2—554

SCIENTIFIC LIBRARY

UNITED STATES PATENT OFFICE

CASE ________ SHELF ________

GOVERNMENT PRINTING OFFICE 11—8625

FEB 4 - 1928

TF
701
.T75

THE

The Street Railway Journal.

SCIENTIFIC LIBRARY PATENT OFFICE

INDEX TO VOLUME XXIII.

January to June, 1904.

McGraw Publishing Co.,
114 Liberty Street,
New York.

82374

INDEX TO VOLUME XXIII.

(Abbreviations: * Illustrated. *c* Correspondence.)

D

E

F

N

O

P

U

V

W

Y

Z

AUTHORS' INDEX FOR VOLUME XXIII.

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, JANUARY 2, 1904. No. 1.

Published Every Saturday by the
McGRAW PUBLISHING COMPANY

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York,"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Canada and Mexico......................$4.00 per annum
Single copies, first issue of each month, 25 cents; other issues, 10 cents.

To all Countries outside of the United States, Canada and Mexico.... $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.
Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

The Prospects for 1904

The advent of 1904 promises to be accompanied by most important developments in the electric transportation business of the country. He would be rash, indeed, who should make any very definite or positive predictions in any branch of the electrical industry. Nevertheless, it is possible to specify certain directions in which changes are indicated, and, based upon these current signs, we believe it safe to say that the coming year promises to be as momentous and to usher in as important an era in electric railway development as either 1884 or 1894.

It is somewhat curious that each of the two decades which have passed since the introduction of commercial electric railroading is closely identified with a particular form of electric development. The first consisted in the substitution of electric for animal power on the urban and shorter suburban lines throughout the country. This may be considered to have commenced practically in 1884 with the Van Depoele trolley railway at the Toronto Exposition, although the merits of the new motive power were not realized until four years or five years later. This era, that of the transformation of city railways, practically closed in 1893, as by that year nearly all of the city systems in the United States had been electrically equipped, outside of two or three, as New York and Chicago, which, owing to local conditions, were not able to introduce electric power, and, in fact, have not yet entirely done so.

The second step in the development of the electric railway industry of the country consisted of the extensions of these same lines to and through nearby cities and towns on routes over which the horse car had never run, thus forming the interurban lines which are now so widely ramified through so many portions of the country, particularly in the Middle West. The commercial development of this class of road was made possible only by the introduction, about ten years ago, of the polyphase system of power distribution with the use of sub-stations and rotary converters, and the pioneer roads of this class built in 1894 and 1895 have served as patterns upon which practically all the other interurban lines have been constructed. This class of road has been most successful, when built with due regard to probable business, and there is no reason for believing that other roads following practically the same lines of construction will not be successfully promoted and prove financially profitable for many years to come. Nevertheless, we believe that this class of road will be considered as especially typifying the decade which has just passed.

Every indication points to the fact that the coming decade will be characterized by a distinct change in electric railway methods. Two factors will contribute materially toward this result. One is the perfection during the past year of the steam turbine, with the advantages which it offers for cheaper power production. The other is the entrance into the field of the single-phase motor, with the possibilities which it offers for cheap power distribution. Should this motor prove as successful as its advocates claim, it will remove what is now the most serious impediment to long-distance traction. These two factors also promise to exercise a large influence on the development of heavy high-speed railroads in the neighborhood of our large cities, where there are dense traffic conditions, and may effect a change in motive power, upon some portion at least, of the suburban branches of our existing steam railroad lines. The contracts for electrical equipment already awarded by the New York Central Railroad and Pennsylvania Railroad, in connection with their terminal plans in New York City, were in a sense obligatory, as local conditions would not permit the use of steam power. Nevertheless, the employment of electricity for such service will, undoubtedly, demonstrate its advantages over steam for rapid suburban transportation, and will hasten the time of its adoption on other lines which have short average runs and high traffic densisty. Under these circumstances it does not seem unreasonable to assert, at the beginning of 1904, that we are on the threshold of a wider adoption of electric power for traction purposes than has yet been seen, and that the approaching decade will exceed any of the others in the extent to which electricity will be used for the transportation of passengers and freight.

Arnold System of Single-Phase Motor Railway

We are enabled to present this week some particulars regarding the Arnold system of single-phase motor railway, together with a résumé of the inventor's work in developing it. Unfortunately, the equipments, embodying the latest improvements and intended for commercial service, as well as for further experimental investigation, were destroyed by fire last month. Mr. Arnold, however, possesses records of the results already accomplished, and he has kindly furnished us drawings

and photographs, which, together with his data upon the construction details, give a very fair idea of the lines which he has been following and what he has thus far accomplished.

It has been commonly known for several years that Mr. Arnold has been at work upon this problem, and at the Great Barrington meeting of the American Institute of Electrical Engineers he gave an inkling of the manner in which he sought a solution, but particulars were withheld at that time owing largely to the fact that the inventor was not entirely satisfied with the results then attained, and because patents were pending. His article, published on another page this week, presents for the first time in his own words the story of the progress of the work upon which he has been engaged so assiduously. It is an important problem, and Mr. Arnold's solution is not only a most interesting one, but is in striking contrast to those offered by other workers along the same line. The publication of the plans submitted will certainly stimulate interest in the subject at this time, not only on account of the novelty of the means suggested but also because of the standing of Mr. Arnold in the engineering field and his persistent advocacy of alternating current for railway work for many years. The promise of the inventor that he will embody a detailed account of his work in a paper to the American Institute of Electrical Engineers ensures another able contribution to the subject of single-phase motors for traction work, which we will await before attempting to discuss the comparative merits of the Arnold system with others.

In the Clutches of the Union

The experience of a unionized street railway company in a large Eastern city should serve as a warning to managers of other properties who are desirous of operating their roads to advantage and maintaining discipline among the employees. The company had never opposed the organization of the men; in fact, the policy of the management was rather favorable to getting the employees together in benevolent and other assosiations, intended for their improvement and advancement, and with the view of establishing a closer relationship between them and the officers, which, it was hoped, would result in maintaining confidence in the company. The actual outcome of these philanthropic measures, however, was not along the lines planned, as the meetings of the men afforded an opportunity for agitators to urge the claims of the union, and it was not long before the men had been won over by the labor leaders. Since that time the management has been constantly harassed, and to-day the system is completely dominated by organized labor. Every department is included, and the property is in the strictest sense a "union road."

The city referred to is a manufacturing center of considerable importance, and during the last year there have been strikes among operators in several industries. As is customary, and quite natural, union men generally, whether affected or not, lent their assistance to the strikers. Under ordinary circumstances it would seem that street car men would be limited to extending their moral support, but in this case they have been actively engaged in assisting the strikers. They were enabled to do this because of peculiar local conditions. A majority of the large manufacturing companies affected are on the lines of street railway, and for the accommodation of these houses a rule was made by the company to permit the motormen to stop half-way between street crossings to take on and discharge passengers having business in these establishments. Shortly after the strike was declared the conductors ignored "half-way" signals, either to permit patrons to alight or board the cars. When explanation was demanded it was learned that the street railway employees had decided to disregard this rule, as the non-union men employed to take the places of the strikers in the factories made it a point to ride between their homes and work, thus practically evading the "pickets," as the latter could not intercept them readily between the car and shop when the cars stopped at "half-way" points. Some of these blocks are very long, and when the non-union men are obliged to get off at street crossings they afford an excellent opportunity for practicing the tactics employed by Sam Parks' notorious entertainment committee.

Another instance of union methods is illustrated in their attitude toward certain suburban and interurban lines entering cities over tracks of local companies. Most of these companies do not employ union men as conductors and motormen, although some of them do, and, consequently, in several cities the local union has demanded that union conductors and motormen meet these cars at the city limits and assume charge of them in their course through the city until they again reach the city line, thus keeping two crews on each car. These men are designated pilots, and the principal object in placing them upon the cars is to exercise the power which the union happens to possess at this time, and to bleed the local operating company as effectually as possible.

Another, and probably the worst exhibition of union tyranny, is exemplified in a controversy involving a large interurban electric company. This road was built for interurban service only, and, although it touches several cities and villages, it does no local business whatever. It carries freight and passengers exactly after the manner of steam roads, and has provided facilities for developing traffic of this kind to the exclusion of such patronage as supports what are strictly termed "street railways." When the question of unionizing the road came up two associations appeared as claimants for the support of these employees; one being the organization of steam railway employees engaged in similar service as that of the road in question, while the other was made up of street railway employees. The men joined the former, and as a result the latter organization boycotted the road, thus most effectively dispelling the illusion that labor unions are primarily for the good of the men and not for the aggrandizement and profit of labor leaders. The spectacle is somewhat similar to that presented by the organizations in New York which were under the especial care of Sam Parks: but it would seem that the lesson must be repeatedly impressed upon those engaged in street railway operation, and held up to their view constantly, to emphasize the importance of the subject and secure their attention at the first sign of organization. The cases here cited are only a few of many examples that are constantly coming before our notice, and which show how recklessly the power vested in labor leaders by their unions is used. Theoretically the labor union is all right; practically it is a menace to the community.

Chicago Union Traction Situation

Although the history of the franchise controversy in Chicago has been related in detail from time to time in these columns, and scarcely a week has passed that some new developments have not been announced, a general summary of the situation to date may be of value to those who have not followed the details closely. It is our purpose at this time to take up more particularly the Chicago Union Traction situation, which is radically different from that of the Chicago City Railway

Company, as the latter company has a franchise extension ordinance drawn up and under consideration.

To go back to the origin of the present franchise controversy, it is claimed by the city of Chicago that the franchises on certain important streets expired July 30, 1903. Several years before that date the City Council and other officials of the city of Chicago began to consider the matter of franchise renewals. Chicago has been a center of interest on that account ever since. As to whether the franchises really did expire on the date mentioned, nobody knows. That date was the one specified in extension ordinances granted twenty years ago. Those extension ordinances, however, were admittedly granted as a temporary make-shift to postpone the settlement of the controversy over the so-called ninety-nine-year act for twenty years. The company claims that under an act passed in 1865 franchises then held were extended ninety-nine years. The city claims that they were not. Until the matter is passed upon by the Supreme Court of the United States no one can know what the real rights of the companies are.

Previous to the beginning of the year which is just passed, the local transportation committee of the Chicago City Council had been preparing itself to take up intelligently the question of franchise extension ordinances, both by personal investigation and study of the whole question by members of the committee and by securing an expert report on the Chicago transportation problem from Bion J. Arnold. This local transportation committee is composed of Chicago business men who are unusually well informed on this subject by virtue of conscientious work which they have done to acquaint themselves with the various aspects of this important problem. As a consequence, these gentlemen are not inclined to listen, on the one hand, to extravagant statements of street railway values, or, on the other hand, to impractical ideas on immediate municipal ownership. While, naturally, they are inclined to drive as good a bargain for their city as possible they are far from belonging to the radical and rabid class that clamor for immediate confiscation of street railway property and its operation by the city.

Early in the present year, after the publication of the Arnold report, the committee announced its readiness to take up with the companies negotiations looking to an extension of the franchises. It was generally hoped at that time that a compromise might be reached between the city and the companies whereby the companies would waive any rights which they might have under the ninety-nine-year act, and the city would, in extending the franchises, make allowance for this by granting more liberal terms than if the franchises expired without question in 1903. Several meetings, open to the public, were held in January and February of last year, between attorneys for the Chicago Union Traction Company, the Chicago City Railway Company and the local transportation committee. The Chicago City Railway Company, being a simple corporation without underlying companies and even without any outstanding bonds or leased properties, was in a position to say definitely what rights it would waive and what kind of a trade it would make with the city. The representatives of the Chicago Union Traction Company, on the other hand, were by no means in as simple a position. The Chicago Union Traction Company is a leasing company, which operates properties owned by a pyramid of underlying companies. What the representatives of the Chicago Union Traction Company might be willing to do in the way of waiving rights was one thing; what the stockholders and bondholders might insist upon was quite another. This uncertainty as to the powers of the Chicago Union Traction Company's representatives proved a stumbling block almost at the first session, and these negotiations with the local transportation committee came to naught so far as that company was concerned. The Chicago City Railway Company, being free to act without hindrance from underlying security holders, continued negotiations with a sub-committee of the local transportation committee, and agreed to waive its rights under the ninety-nine-year act in exchange for a blanket extension ordinance of twenty years' life. This ordinance is now undergoing a series of public hearings before the local transportation committee, at which the views of various citizens and organizations can be expressed to the committee.

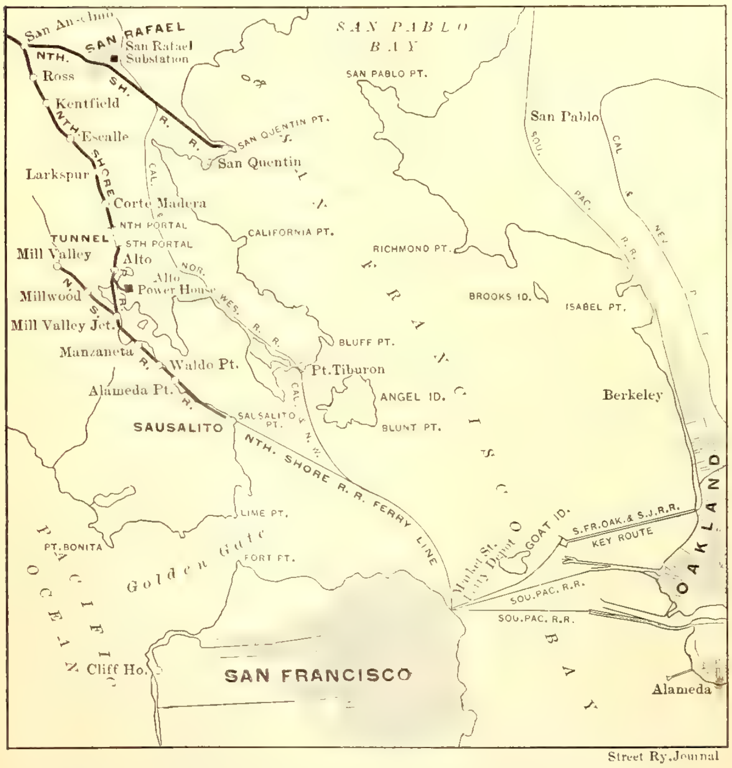
Chicago Union Traction matters, however, took an entirely different turn. The company went into receivers' hands last July, and since then has been in charge of the court. The receivership is generally looked upon as a protective measure to curb any possible radical action on the part of the city. Judge Peter S. Grosscup, under whose care this property has been during the receivership, is an eminent jurist, noted for the attention he has given to matters pertaining to trusts and large corporations. He has shown by his actions during the receivership that he intends to protect fully any rights which security holders may have and to give the public the best service possible under the circumstances. He has made several moves in the direction of attempting to secure a business-like compromise with the city which will protect the interests of all concerned, but in this has been unsuccessful. Failing in this, he has directed the receivers to attempt to secure from the city permits to make extensive improvements, with the understanding that the city should in no way weaken its legal status in the claim that the ninety-nine-year act is invalid, and that the franchises expired last July. Although there is desperate need of improvements the legal officers of the city have not seen fit to allow any permits for work of this kind to be issued, for fear that such permits might be an admission on the part of the city that the company had rights under the ninety-nine-year act, and also for fear that if such improvements were made a settlement of the franchise controversy might be delayed. There is no indication now that any settlement will be reached between the Chicago Union Traction Company and the city until the rights of the company under the ninety-nine-year act shall have been passed upon by the United States Supreme Court.

The rights of the companies under this act will be argued this month before Judge Grosscup. Eminent attorneys have been retained by both sides. It is a practical certainty that whatever the outcome the case will be appealed to the United States Supreme Court and a hearing may be secured next October. This is about the earliest action that could be taken. So far as the Chicago Union Traction Company is concerned, therefore, the franchise controversy is in a very uncertain and unsatisfactory state. There is, of course, the possibility that the courts will decide the ninety-nine-year act to be valid, in which case money could quickly be raised for improvements. If, on the other hand, the franchises expired last July, the company has remaining franchises only on the less important streets for a few years to come. While it would be impossible to operate a comprehensive street railway system under the franchises which would be left, it would also be impossible for the city or any other company to operate a satisfactory system by using only the streets upon which the franchises had expired. The company will not, therefore, be any more helpless than the city in such an event, but there would, of course, have to be some kind of a compromise in which it is but reasonable to assume that the city would drive as hard a bargain as it could.

ELECTRICAL EQUIPMENT OF THE NORTH SHORE RAILROAD FROM SAN FRANCISCO TO SAN RAFAEL—I

On its suburban division, between San Francisco and San Rafael, Cal., the North Shore Railroad Company has recently introduced a system of electric third-rail traction which is marked by many interesting engineering features. The North Shore Railroad, up to the last few months, operated a narrow-gage steam railroad and ferry system between San Francisco and Cazadero, a distance of 87 miles, with branches to Mill Valley and San Rafael, the railroad proper starting at Sausalito, on San Francisco Bay, 6 miles north of San Francisco, and running in a northerly and northwesterly direction to the upper terminus. Throughout its entire length the road traverses an interesting country, and, on the southern end, between Sausalito and San Rafael, it passes through a section that is especially attractive. Many suburban homes have been built at several

FERRY DEPOT IN SAN FRANCISCO AND STREET RAILWAY LINES LEADING TO IT



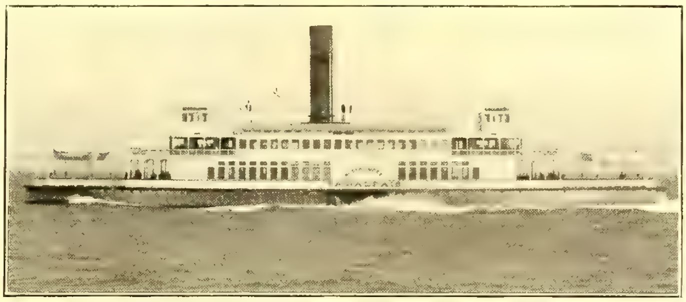
MAP OF NORTH SHORE RAILWAY ELECTRIC INTERURBAN SYSTEM

DOUBLE BOW-KNOT ON MILL VALLEY & MT. TAMALPAIS SCENIC RAILWAY, SAN FRANCISCO BAY IN THE DISTANCE

points along this line, and as the mild California climate makes a suburban home attractive the year round, the result has been the establishment of several towns or communities of permanent residents whose business interests require them to be in the city every day. In building up these towns the suburban train service of the North Shore Railroad to Mill Valley, San Rafael and intervening points has been an important factor.

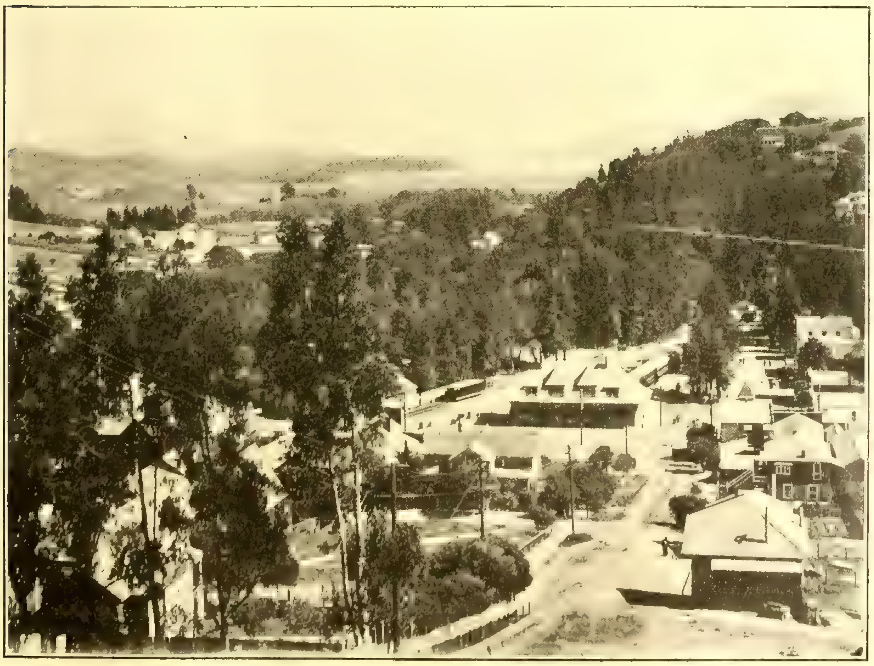
The importance of this line has been very generally recognized by steam railway men, especially those familiar with the California situation. It has been known, too, that the Southern Pacific and the Santa Fe have been figuring upon getting control of this property, and now it is announced, semi-officially, that arrangements have been made by which the Santa Fe is to acquire complete possession of the property, offering a very generous price for the stock, so as to ensure not only a majority but practically, at least, complete ownership. It is said that the North Shore shareholders will receive $100 a share for their stock. This will mean a handsome profit over and above the $10 a share assessment recently collected by the company on its outstanding stock from all stockholders who bought into the company at the time John Martin and his associates assumed control of the property, nearly two years ago, and brought the North Shore Railway Company into existence. The details of the deal, so far made public, provide for the placing of all outstanding stock in escrow, payment to be made to the depositing stockholders when all their stock has been delivered. As a guarantee of good faith on the part of the Santa Fe, the brokers who represent the company have, it is said, deposited with the escrow holders the sum of $1,200,000, equal to $20 a share for each of the 60,000 outstanding shares, with the understanding that this money deposited will be forfeited if the Santa Fe fails to complete payment for the stock placed in escrow. To meet the requirements of the Santa Fe's purposes, the main line of the North Shore will have to be straightened in places and converted into a standard-gage road.

SAUSALITO TERMINAL YARDS, DEPOT, THIRD-RAIL HOOD PROTECTION, CARS AND FLEET OF FERRY STEAMERS



ONE OF THE FERRY BOATS PLYING BETWEEN SAN FRANCISCO AND SAUSALITO IN NORTH SHORE SYSTEM

About two years ago, John Martin, of San Francisco, to whom the electrical interests of California owe much of their pioneer development and present successful condition, secured control of the North Shore Railroad, with a party of capitalists, and decided to rebuild the suburban division and put on an electric train service which would be of the most modern type, and which would best meet the needs of the traffic. The reconstruction work, which has now practically been completed, consisted in rebuilding the entire roadway between Sausalito and San Rafael, putting in double track for practically the entire distance, installing a third-rail system of train operation, equipping the division with an improved automatic block signal system, building a high-tension power station, and erecting a new ferry depot and slip at Sausalito. The Mill Valley branch of the new system was placed in operation on Aug. 21, and the main line to San Rafael was opened on Oct. 17. This is the first third-rail road to be constructed and put into operation in California,



MILL VALLEY, ELECTRIC TRAIN AT DEPOT AND POWER HOUSE AT LEFT

and the second west of the Mississippi River, and it is a significant fact that the reconstruction work was done without interrupting the old schedule of steam trains.

ROUTE

The San Francisco terminus of the line is at Ferry Building, at the foot of Market Street. Between this point and Sausalito

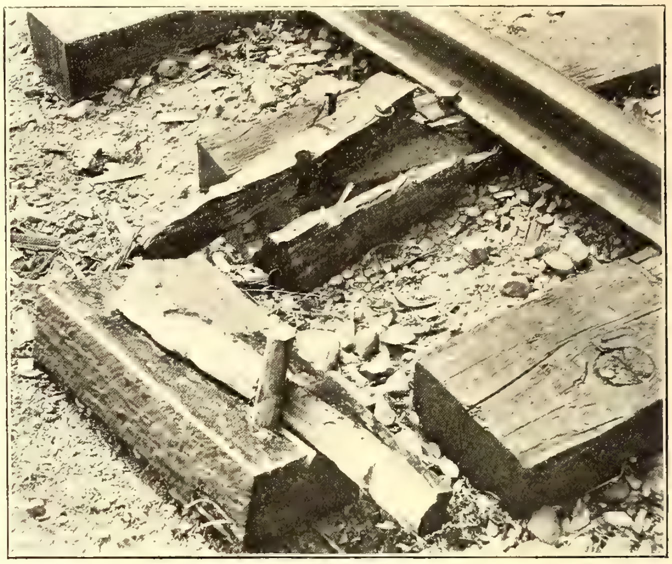
APPROACH TO SOUTH PORTAL, WHERE ALUMINUM FEEDERS ARE CARRIED OVER HILL, AND DOUBLE TRACK RUNS INTO SINGLE TRACK

is operated a splendid ferry system, the ride across the bay affording an interesting view of the harbor, with Angel Island and Alcatraz Island, with their military stations, and of the Golden Gate. At Sausalito, a town of 3000 population, the

DOUBLE-TRACK PLATFORM AT STATION

passenger passes through a new ferry building, in which are located the offices of the operating officials, to covered platforms, where the electric trains are in waiting. A general view of the depot and Sausalito yards and the company's fleet of ferry steamers is shown on page 5. The route from Sausalito, as may be noticed from the map on page 1076, skirts Richardson's Bay and passes through the picturesque and thriving towns of Corte Madera, Kentfield, Ross and San Anselmo, and terminates at San Rafael, a residence and resort city of about 8000 people. The line extends to San Quentin, where one of the State penitentiaries is located, but this extension is not in operation at present. The narrow-gage main line to Cazadero leaves the suburban electric line at San Anselmo.

The Mill Valley line, 2 miles in length, branches off at Mill



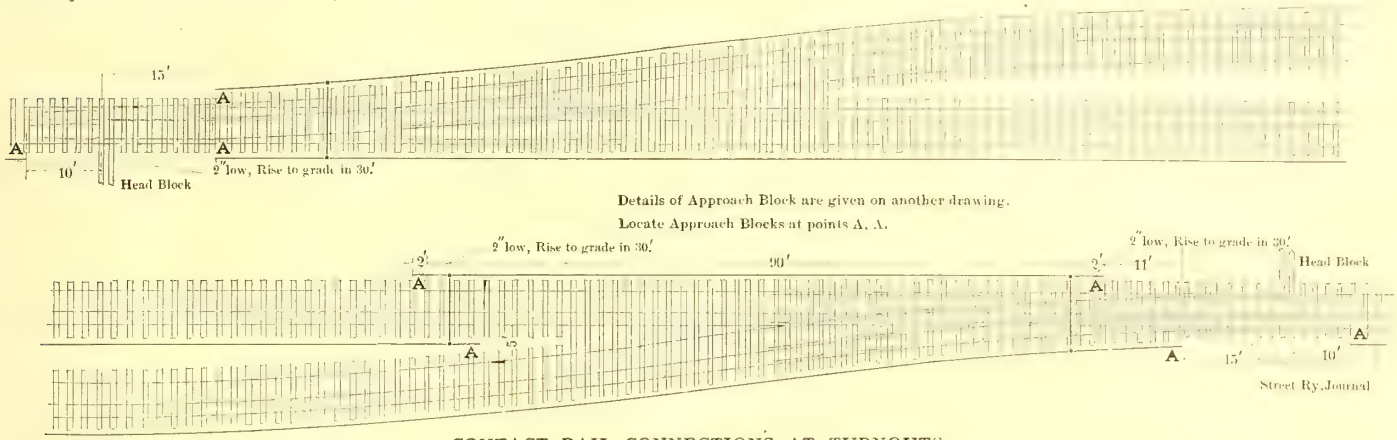
SINGLE-TRACK CONTACT-RAIL INSULATOR. TIE SPLIT OFF, BUT BLOCK AND TREE-NAIL UNINJURED

Valley Junction. Mill Valley, familiarly termed "The Little Switzerland" in the guide books, is the lower terminus of the broad-gage scenic steam railway that runs to the summit of Mt. Tamalpais, one of the most popular resorts in the vicinity

SINGLE-TRACK CONSTRUCTION, FENCED IN THROUGH STREETS IN SAN RAFAEL

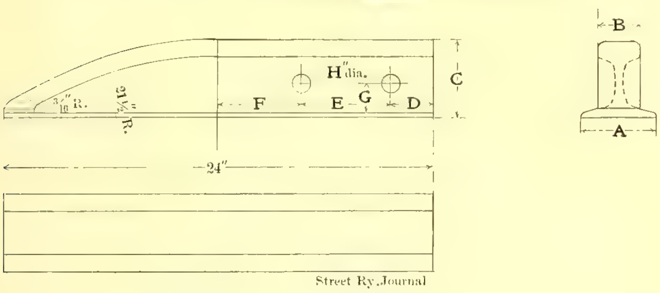
of San Francisco. The mountain is only 2592 ft. high, but on clear days its summit affords an excellent panoramic view of San Francisco Bay, the bay cities and the Pacific Ocean. Every mountain scenic railroad lays claim to some distinctive feature of construction, and the Mill Valley & Mt. Tamalpais Scenic Railway, in accordance with this fashion, is known as "the crookedest railroad in the world." This will be readily ap-

preciated after a glance at the view presented herewith. The road has an average grade of about 5 per cent, and in its 8 1-5 miles it has 277 curves, at one point the track paralleling itself five times, and being called the "Double Bow Knot." The Mt. Tamalpais railroad is owned by a separate corporation, and is operated distinctly from the North Shore, but connections are made at Mill Valley.

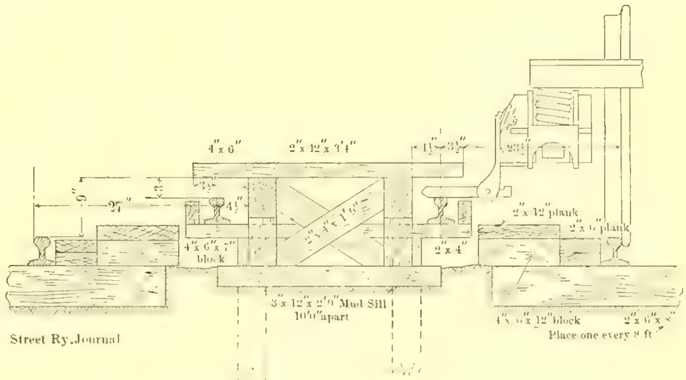


CONTACT RAIL CONNECTIONS AT TURNOUTS

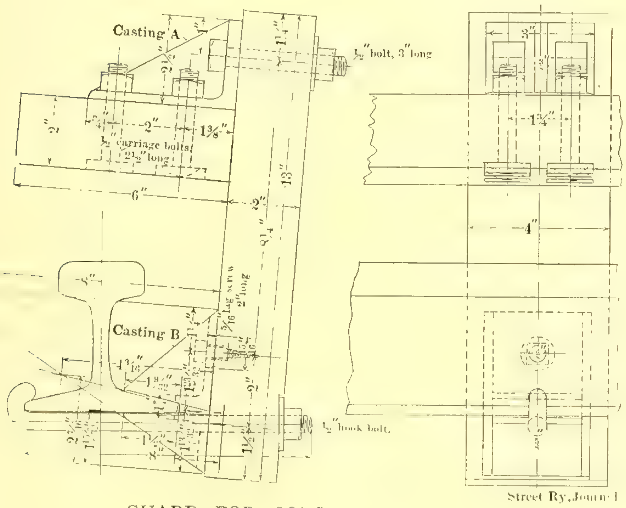
	A	B	C	D	E	F	G	H
BICO STEEL 50 LBS.	3⅞"	2 1/16"	3¾"	3½"	5"	3½"	1¾"	1"
MOSS BAY ST. 50 LBS.	3 15/16"	2 1/32"	3 15/16"	2½"	5"	4½"	1¾"	1"
BARROW STEEL 56 LBS.	4"	2 3/16"	4 3/16"	3¾"	5"	3¼"	2"	1"
AMERICAN STD. 60 LBS.	4¼"	2⅜"	4¼"	2⅜"	5"	4⅝"	1 115/128"	1"



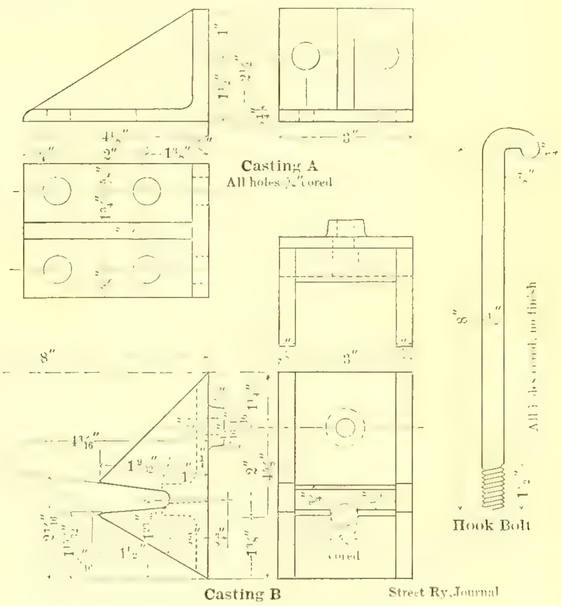
DETAILS OF APPROACH BLOCK



STATION PLATFORM—DOUBLE TRACK



GUARD FOR CONTACT-RAIL



DETAILS OF CONTACT-RAIL GUARD

TRACK CONSTRUCTION

The track of the North Shore Railroad, between Sausalito and San Rafael, is 11.95 miles in length, and the Mill Valley branch is 1.74 miles long, making a total mileage of electrically-operated road of 13.69. With the exception of the line from San Anselmo to San Rafael, the Mill Valley branch and a tunnel between Alto and Corte Madera, the road has a double track. The road is built with 60-lb. A. S. C. E. section 30-ft. rail, laid to standard gage on 8-ft. x 6-in. x 8-in. redwood ties, spaced 2 ft. center to center. To accommodate the narrow-gage steam trains which run from Sausalito to Cazadero, and use the electric line as far as San Anselmo, an additional rail has been laid on the same ties, giving a 3-ft. gage with the outside rail. This steam rail weighs 60 lbs. to the yard, and is also of the A. S. C. E. section. Between Sausalito and Alto the road crosses several salt-water marshes, or lagoons, on substantially built wooden trestles, the remainder of the roadbed being well ballasted with gravel. The track construction throughout conforms to the requirements of the best steam road practice. The maximum grades are of 2.2 per cent and 1.91 per cent, and most of the curves range from 1 deg. to 4 deg., the maximum, 18 degs., being on the single-track line just beyond San Anselmo. The tunnel before mentioned passes through a high hill on a 1 per cent grade, and is 2194 ft. between portals.

CONTACT RAIL

For the third or contact-rail 60-lb. A. S. C. E. section rail is used in 30-ft. lengths on more than half of the line, the rest being 56-lb. rail that formed part of the original narrow-gage track, and was thus used for the contact-rail as a matter of economy. The type of approach block for the ends of the contact-rail is illustrated, with a table of dimensions for the different sections of rail used.

PROTECTED THIRD RAIL IN YARDS AT SAN RAFAEL

In the matter of third-rail insulation and feeders there has been displayed much of Mr. Martin's pioneer policy of adopting a construction to meet existing conditions. In the yards and around the depot at Sausalito reconstructed granite insulators have been used, on account of the extra strength and insulating qualities required on that portion of the road. But on all the rest of the line the third rail has been mounted on wooden insulators, and this cheaper construction has been justified by the continued successful operation of the road in all kinds of weather since it was started. Of course, it must be remembered that it does not snow and that sleet is uncommon in the vicinity of San Francisco, so that third-rail insulation does not have to bother with those conditions of weather that are at times so annoying in Eastern cities. The North Shore construction, however, would probably pass successfully through even an Eastern winter. Leakage measurements, made during the third day of a heavy storm, showed an average loss of 1 amp. per mile.

For single-track construction the contact-rail is mounted on block insulators fastened to the ends of every fifth tie, so as to give the insulators 10-ft centers. The rail is fastened to a 4-in. x 6-in. x 18-in. block, 4½ ins. from its outer end. The block rests on a 2-in. x 6-in. x 21-in. cleat, that is bolted to the end of the tie by means of two ½-in. x 5-in. lag screws. The cleat projects 7½ ins. beyond the end of the tie, and the block 12 ins. A wooden tree-nail is driven through the block, cleat and tie. To prevent the block turning on the pin, wooden strips are nailed on the sides of the cleat and block where they overlap. This arrangement brings the center of the contact-rail 27 ins. outside of the gage line of the track, and the top of the contact-rail 6 ins. above the top of the running rail, these being the standard distances throughout for the contact and gage rails. This type of insulator is illustrated in several of the accompanying track views. It is also used on double track for curves where one track is higher than the other.

For straight double-track construction two types of insulators have been employed. Where the roadbed will permit it the contact-rails are supported on 4-in. x 6-in. pieces laid across between two ties and fastened to the latter by wooden tree-nails. When an earth support is desired, the contact-rails are supported independently from the track by means of 2-in. x 6-in. strips, 3 ft. 6 ins. long, which are tree-nailed to the tops of two 4-in. x 6-in. posts driven into the ground, so as to give the correct elevation to the contact-rail.

In general these are the principal forms of insulators used. The material employed is California redwood, and it is all given a coating of asphaltic paint before being put into service. The insulators are comparatively inexpensive, they do not require extra-length ties, and, as no metal is used in their construction outside of the lag screws and small cleat nails, their insulating qualities are good. That the single-track block insulator is as strong as the tie itself was demonstrated during the construction of the road by a steam locomotive hitting one of the insulators upon which the contact-rail had not yet been mounted. The result is well depicted in the illustration on page 6. The block is shown laying top downward, practically uninjured, while the tie and cleat were split. The tree-nail was uninjured, and this seems to demonstrate that its strength is sufficient for this type of construction. The block was replaced on an adjoining tie and is in use at present.

TRACK CONSTRUCTION AT STATION

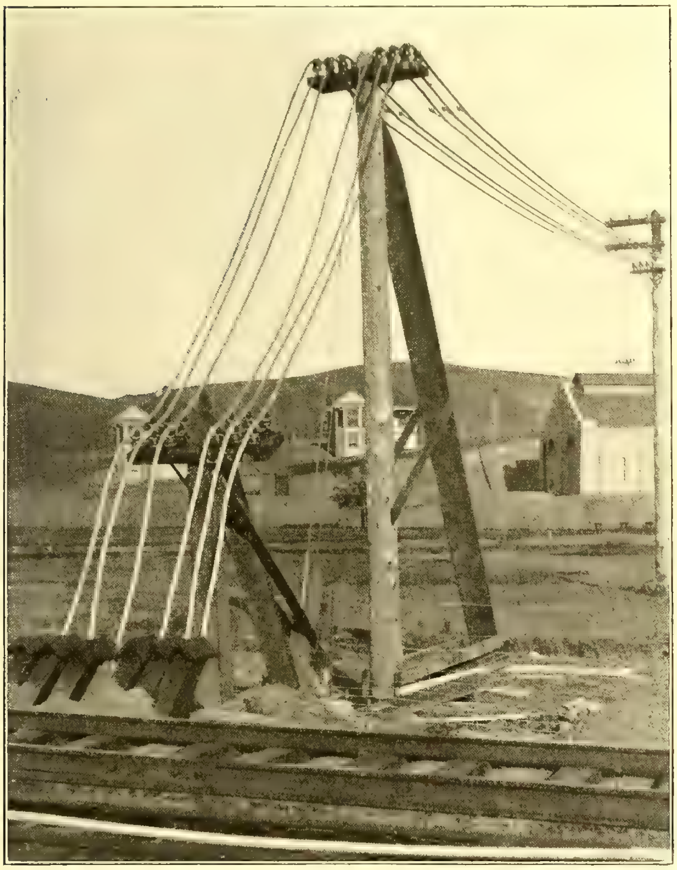
CONTACT-RAIL GUARD

In the Sausalito and San Rafael yards and in one or two other places it was thought advisable to equip the contact-rail with a guard so that the possibility of accidents would be lessened. As the Potter contact-shoe is used on the motor cars it was possible to adopt a hood protection, and the construction features shown were adopted. It consists of a 2-in. x 4-in. x 13-in. post, clamped to the bottom flange of the contact-rail by means of a special casting and hook bolt, and supporting by means of another special casting a 2-in. x 6-in. x 8-ft. plank guard, 2½ ins. above the top of the rail. The bottom casting

is constructed so as to throw the post out at a slight angle. This raises the outer edge of the guard plank about ½ in. above the horizontal and gives greater freedom to the contact-shoe, while still serving all the purposes of a strong and sufficient guard. The drawings show the details of the guard and the special castings used on it. In general it is a modification of the form devised for the Wilkesbarre & Hazelton Electric Railway, which was described in the STREET RAILWAY JOURNAL of March 7, 1903.

STATION PLATFORMS

At station platforms the guarding of the contact-rail is carried still farther, as shown by the detailed drawing and views. The center platform between the tracks is formed of 2-in. x 12-in. x 3-ft. 4-in. planks, nailed to 4-in. x 6-in. stringers, which in turn are supported on 4-in. x 6-in. x 7-in. blocks, that rest on 3-in. x 12-in. x 2-ft. 9-in. mud sills, spaced 10 ft. apart.



CARRYING ALUMINUM FEEDER CABLES FROM POWER HOUSE AND UNDER TRACK TO FEEDER RODS

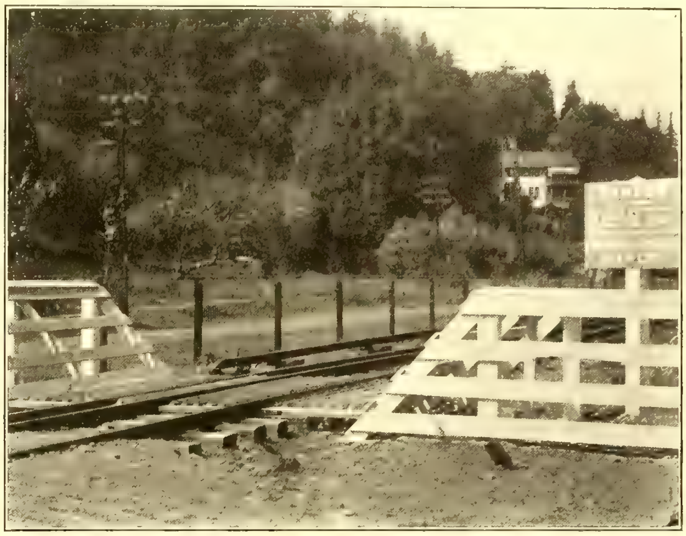
Entirely separate from the platform are the contact-rail insulators, of the post form, the third of these already described being used. Outside of the rails are nailed 2-in. x 4-in. pieces on edge, so the rails are very well protected and no one could possibly come in contact with them unless by deliberately placing a hand under the guard and on the rail. Between the track rail and the insulators are run two planks mounted on blocks, as shown, and with but a 1-in. space between the outside edge of the top plank and the end of the insulator plank. By means of this construction the tracks, with their longitudinal planking, the contact-rail insulators and the center platform are all independent of each other, so that an ordinary accident to any one of the three would not disturb the other two. A half-tone view shows the platform construction at Kentfield.

DANGER SIGNS

At crossings, stations and other exposed points, warning signs have been placed, the wording being a combination of the signs on two Eastern third-rail roads. The signs are made of white letters on a dark blue background, the whole being enameled. One of the signs is shown in one of the views here presented.

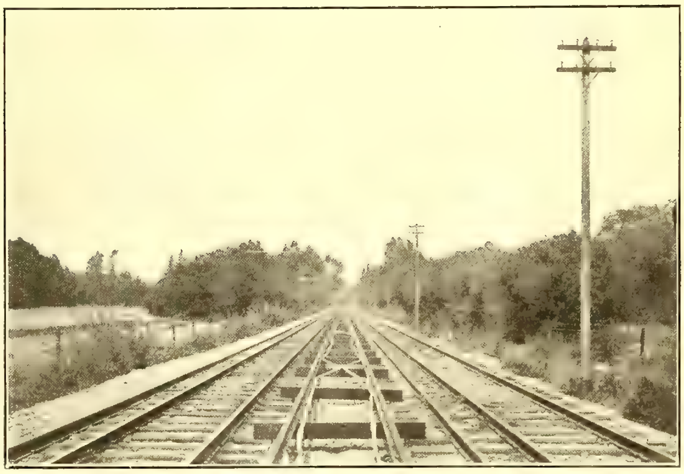
CONTACT-RAIL FEEDERS

In adopting solid, bare aluminum rod for contact-rail feeders, the North Shore Railroad has departed from the practice of Eastern roads, but California engineers are prone to break away from established customs of the East by adopting their



SINGLE-TRACK CONSTRUCTION, WITH CATTLE GUARD AND WARNING SIGN; PRIVATE RIGHT OF WAY FENCED ALONG HIGHWAY

constructions to meet local conditions, and the results in this case, at least, are highly satisfactory. Throughout the whole length of the double track the two contact-rails are fed by two of these aluminum rods. The rods were received in 30-ft. lengths and joined together by 8-in. joints, by an hydraulic press giving a pressure of about 50 tons to the square inch. The illustration on page 10 shows the manner in which the press was used, it being mounted on a wooden truck, which was sup-



ALUMINUM FEEDER RODS, BETWEEN DOUBLE TRACKS, EXPANDED BY HEAT SO THAT THEY TOUCH IN FOREGROUND; THEY ARE CROSSED FARTHER DOWN. SIGNAL POLE LINE AT RIGHT.

ported and moved along on rollers resting on the contact-rail and the outside track rail.

At every other joint in the contact-rail the aluminum feeder rod is tapped in. The top consists of an aluminum casting bored to fit the rod, with a piece of No. 0000 extra flexible copper cast into it, the whole being hydraulically squeezed into the rod. The two ends of the flexible copper are soldered to the ends of the rails at the joint, and the whole covered with asphaltum paint. In this manner every rail is bonded to the aluminum feeder; hence, a defective bond is not considered

serious. The odd joints of the contact-rail between the feeder taps are bonded with Chase-Shawmut bonds, these also being painted with asphaltum paint. The aluminum rod was laid to a temperature gage, loose on the insulators, as may be noticed in the views of the track. About every half mile the feeders are crossed so as to equalize the pressure. During cold weather the feeder rods are comparatively straight, but during warm weather they expand and creep in toward each other, in many cases actually touching, as may be noted in the illustration of this feature, herewith reproduced from a photograph of the line. In this picture the rods come together in the foreground, and at a point a little farther down the track they cross. The rods are only held rigid at the points where they are tapped to the contact-rail, so that in the 60 ft. intervening they are free to move back and forth on the insulators. In some cases it has been noticed that the rods have played back and forth 6 ins. to 8 ins. on the top of the insulators.

GRINDING TRACK RAIL FOR BONDING

HYDRAULIC PRESS MAKING JOINT IN ALUMINUM FEEDER ROD

POURING PITCH INTO OPEN CONDUIT FOR ALUMINUM FEEDER ROD; CLOSED CONDUIT AT LEFT

The aluminum rod used is 1.365 ins. in diameter, and has an area of 1,865,000 circ. mils, which is equivalent to an area of 1,170,000 circ. mils of copper on a basis of the resistance of aluminum being 1.59 times the resistance of copper, with a conductivity of 98 per cent on the Matthiessen scale. The company purchased 19½ miles of the aluminum rod, and it is used for underground feeders as well as for those along the track. At the San Rafael end there are 1700 ft. of the rod mounted on a pole line, connecting the end of the contact-rail with the San Rafael sub-station switchboard. The arrangement of contact-rail connections at turnouts is shown.

The feeder rods are connected with the power house by means of six 1,000,000-circ. mil, 37-strand concentric aluminum cables, supported by glass insulators on a short pole line. The cables pass under one track and are joined to the rods above ground, three cables feeding the north feeder rods and the other three the south rods. The strain of the cables on the end poles is taken up by means of glass strain insulators.

At the tunnel it was thought best to carry the feeders over the hill, and to take through the tunnel the contact-rail only. To make up for the loss in conductivity in the single track, as compared with the double track elsewhere, negative feeders, in the shape of two old 35-lb. iron rails, are run through and are tapped into the track at frequent intervals. By means of switches at each portal the contact-rail can be cut dead for repair work in the tunnel without interfering with traffic in other places.

The positive feeder over the hill consists of three 1,000,000-circ. mil aluminum cables, carried on a separate cross-arm of the company's signal-wire pole line. Herewith is a view at the south portal of the tunnel (the portal itself being hidden by a curve in the road), and shows the contact-rail and track at the diverging point. At the left the two aluminum rods are joined to the three aluminum cables. The center cable is split and connected to both rods so as to equalize the load.

At highway crossings and other portions of the track where it was necessary to discontinue the contact-rail the aluminum

rod feeders are tapped to the rail, near the end, and carried underground in wooden conduits. This conduit or box is made of 1-in. redwood boards, with interior dimensions of 3 3-16 ins. x 3 3-16 ins.—just large enough to hold the General Electric No. 69,010 porcelain rack insulator. These insulators are spaced about 5 ft. apart, and are fastened in the conduit by means of wooden wedges after the rod is laid in them. At the ends the conduit is built at an angle of about 45 degs., and is carried up to the height of the contact-rail. After the cable is laid in this manner the box is closed, and filled from the ends with hot asphaltic pitch of practically the same composition as is used for Edison underground tubing. The construction of the conduit is shown on page 10, that for the feeder on the left being completed, while the right one is ready for the pitch, which is being poured into it. This method of pouring in the pitch for the horizontal portion of the conduit is interesting, as shown. After the box is filled with pitch, small roof-like protections are placed over the ends of the conduit, as shown in the cut, to prevent moisture entering the box.

This form of underground conduit has also been used at points where overhead feeders are tapped in. The construction was done during the dry season, and as every piece of work was finished the same day it was started the chances for moisture getting to the rods were very slight, and so far as known there has been no leakage from any of these conduits.

TRACK RETURN

For track return the single standard-gage rail and the narrow-gage rail are bonded with Brown plastic bonds. The track rail that is common to both standard and narrow-gage trains is used for the block-signal system. A Brown grinding machine was used to polish the rail ends for the bonds. Opposite the power house the return track rails are connected to two return feeders, consisting of the same size aluminum rod as is used for the contact-rail feeders. These return feeders are carried across the salt-water marsh intervening between the station and track in a wooden trough, built about a foot above high-tide mark, and upon entering the station are connected to four 800,000-circ. mil bare copper cables, for connection through a double-pole, double-throw switch to the battery booster or generator negative bus-bar.

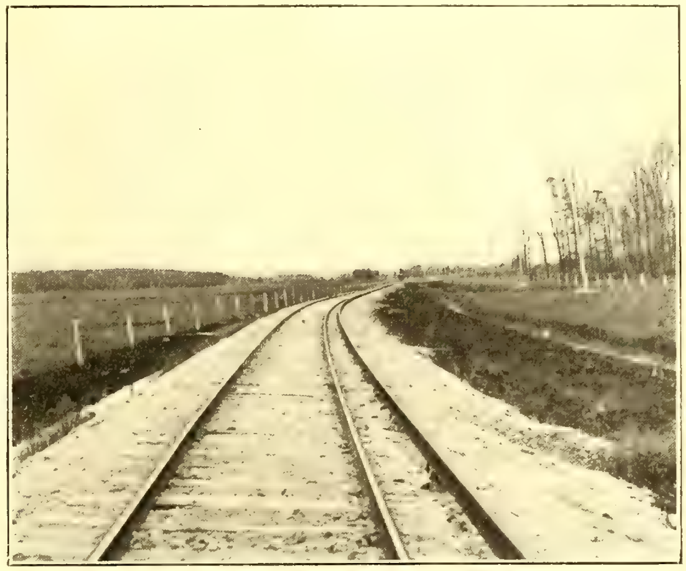
POWER STATION AND SUB-STATIONS

The second installment of this article will be devoted to a description of the main power house and sub-stations, with their equipment and notes upon operation, and as this is a modern plant throughout it may be accepted as an example of engineering practice on the coast. The transmission system, employing 40,000 volts, contains many interesting features, as well as the new signaling apparatus, which will be discussed in detail. A storage battery auxiliary is another feature of the plant. Operating details, and a practical discussion of the conditions prevailing in the vicinity of San Francisco, will be included in the second part of this article, which will be presented next week.

THE JACKSON & BATTLE CREEK RAILWAY

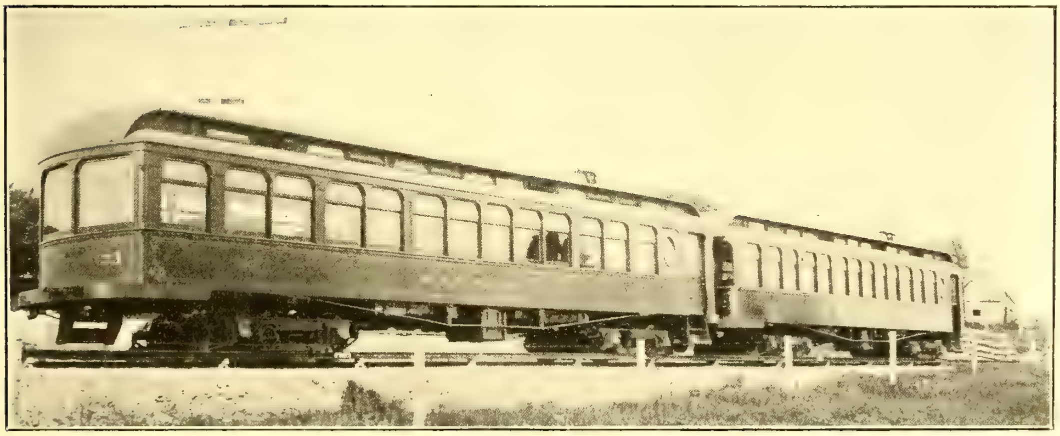
BY W. G. FARGO

This electric line has recently been completed by the Jackson & Battle Creek Traction Company and connects the two important industrial and steam railroad centers of Southern Michigan, the cities of Jackson and Battle Creek.



VIEW OF LINE EAST OF ALBION. THE CURVE SHOWN IS 3 DEGS., WITH 5½ INS. ELEVATION

Both cities are developing rapidly. Jackson is the division headquarters for the Michigan Central Railway. It is also the distributing headquarters of all the large agricultural concerns of the country. Battle Creek is division headquarters for the Chicago & Grand Trunk Railroad, and is a large manufacturing town, with diversified interests. Some of the largest steam engine and threshing machine works and steam pump works, sanitariums and adventist institutions in the country are located here. At Jackson the road connects with the Detroit, Ypsilanti, Ann Arbor & Jackson Electric Railway to Detroit, and at Battle Creek with the line of the Michigan Traction Company to Kalamazoo.



TRAIN OF TWO "LIMITED" CARS ON THE JACKSON & BATTLE CREEK RAILWAY

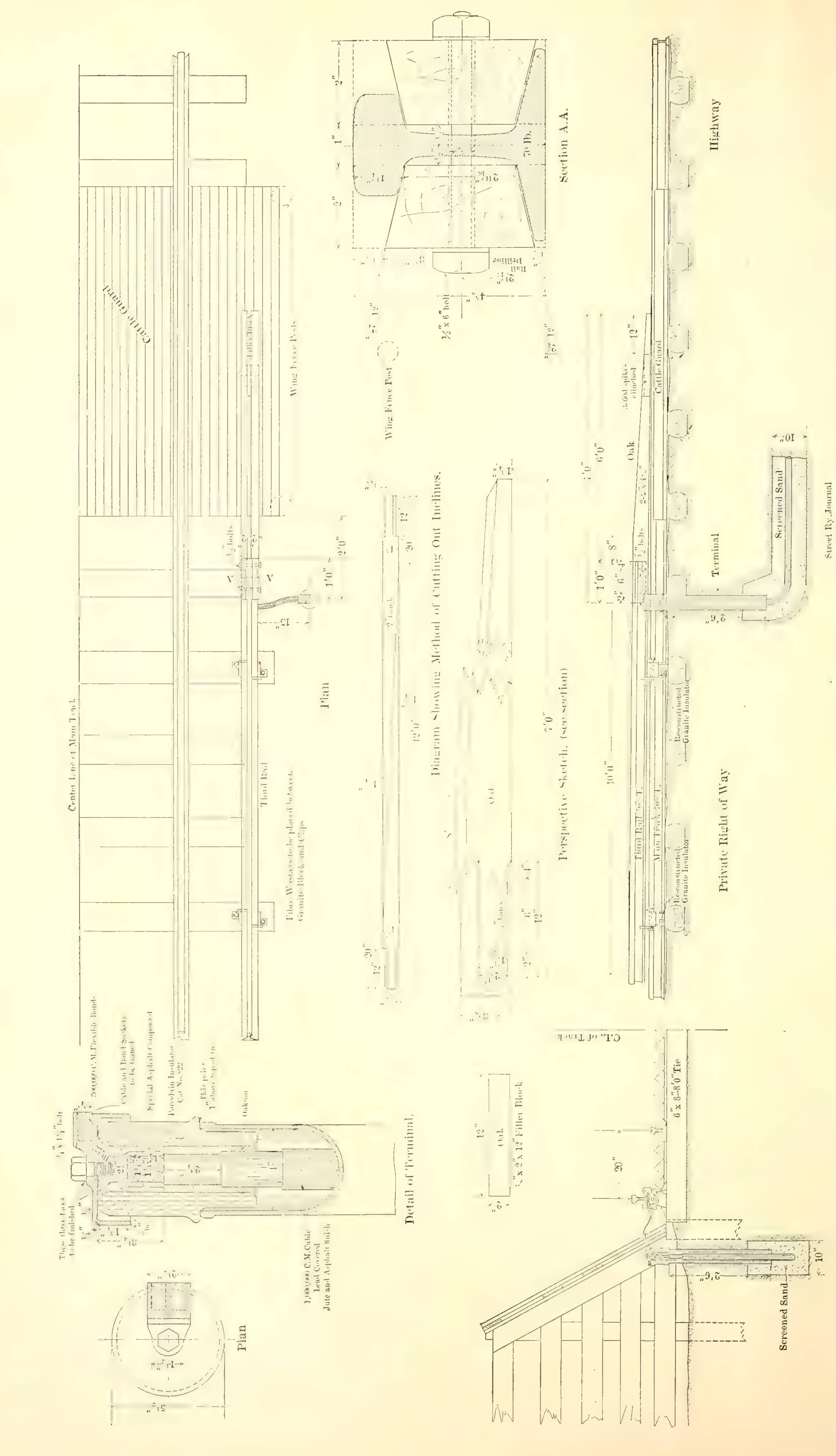
Between the cities of Jackson and Battle Creek, and along the line of the railway, are the cities of Albion and Marshall, the village of Parma and several smaller places. The country traversed is of very productive soil, and constitutes one of Michigan's finest agricultural districts.

The population served by this road is as follows:

Jackson	30,000	
Albion	6,500	
Marshall	6,000	
Battle Creek	30,000	
Parma	1,000	
		73,500
Tributary population aggregates		23,000
Making a population served of		96,500

The distances from Jackson are:

Parma	11	miles
Albion	21	"
Marshall	33	"
Battle Creek	45½	"



PLAN AND SECTIONS OF THIRD-RAIL CONSTRUCTION AND FEEDER TERMINAL, ALSO OF CATTLE-GUARD AT HIGHWAY AND FARM CROSSINGS, JACKSON & BATTLE CREEK TRACTION COMPANY

The road is single track, and is built on private right of way, except through cities and the village of Parma.

The maximum grade is 2 per cent, and the curves are all moderate and elevated for speed of 60 m. p. h.

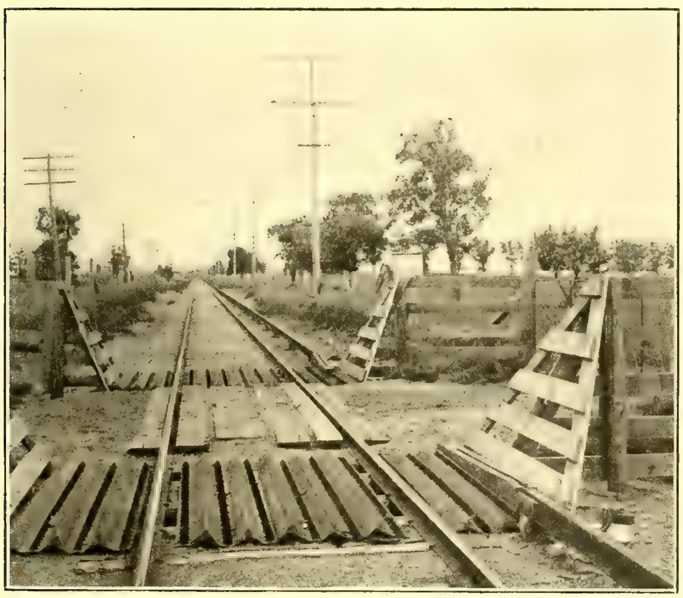
Gravel ballast is used throughout with 6 ins. under the ties, averaging 1800 cu. yds. of ballast to the mile of track.

The Michigan Central, the Lansing division of the Lake Shore & Michigan Southern Railroad, and the Kalamazoo River at Albion, are crossed by viaducts, thus avoiding grade crossings. Deck-plate girders, 75 ft. x 96 ins., constitute the river span; the span over the steam road is a 135-ft. Pratt truss, designed for a live load, equivalent to 3530 lbs. per lineal foot throughout.

TRACK

Track is laid with 30-ft., 70-lb. A. S. C. E. rail, on 3000 6-in. x 8-in. x 8-ft. cedar and oak ties to the mile. Twenty-six inch four-bolt Continuous rail-joints are used, with elastic nuts on the bolts. The joints are supported, and oak ties or tie-plates are used on curves as required.

The turnouts, of about 600 ft. in length, and laid with No. 10 spring rail frogs, and split switches are used at intervals of about 2 miles. All switches have rigid connecting rods and regulation switch lights at night, and are kept locked. The tongue switches on the turnouts located in city streets are operated by ground-throw levers beneath the rails, and provided with a crank rigidly connected to the switch tongue and to a mechanical semaphore located on the curbs.



TRACK, HIGH-TENSION LINE AND CATTLE-GUARD

Each track joint is bonded with two No. 0000 9-in. protected rail-bonds, placed under the joints.

THIRD RAIL

The third-rail is 70-lb. section, in 30-ft. lengths, and of the same composition as track rail. Its head is 6-ins. above that of the traffic rail, and it is supported on reconstructed granite insulators, without iron top or base, every 10 ft. The center line is 20 ins. outside the center of the outside traffic rail, and 21¾ ins. outside the gage line. The joints used on the third rail consist on one side of one plain round edge-bar, 3 ins. x ½ in. x 14 ins., with ⅞-in. round holes and two ¾-in. machine bolts, and on the opposite side an oak block, 1¾ ins. thick, forming a nut lock.

The third rail is bonded with two 300,000-circ. mil foot bonds, applied with hydraulic presses in holes punched in the base of the rail.

The third rail is coupled under crossings with 1,000,000-circ. mil lead-covered and paper-insulated cable. The cable terminals are of the General Electric Company's pattern with porcelain upper insulation.

The third rails have oak inclines or tips, which extend partly over the metal guards, as shown in the full page diagram.

POWER EQUIPMENT

Power is purchased from the Kalamazoo Valley Electric Company, whose three water plants are located a few miles apart on the Kalamazoo River, in Allegan County, 90 miles from Jackson, the eastern terminus of the road, and 45 miles from Battle Creek, the western terminus. This power is furnished to the sub-stations of the Jackson & Battle Creek Traction Company at 40,000 volts, three-phase, 60 cycles. Direct current is fed from the sub-stations into the third rail at five different points, viz., Battle Creek, Marshall, Albion, Parma and Jackson, the sub-stations averaging 11 miles apart.

ELECTRIC FREIGHT CAR IN FRONT OF OFFICE BUILDING AND FREIGHT DEPOT IN JACKSON

In each of the sub-stations are three 225-kw, 40,000-volt-375-volt step-down transformers. These transformers are wound with two separate secondaries, so that two 300-kw rotaries can be run from one bank of transformers in parallel on the direct-current side. The transformer secondaries are provided with taps and switches so that the voltage on the rotary may be varied 50 volts in two steps of 25 volts each. The transformers are water and oil cooled, and were built by the General Electric Company. They are all delta connected on the high-tension side. The oil switches for cutting them out of circuit are located in separate switch houses, located a short distance from the sub-station building.

MARSHALL PASSENGER, FREIGHT AND SUB-STATION

Each station, with the exception of Albion, also contains one

300-kw, 8-pole, 900-revolution General Electric rotary converter. At the Albion sub-station there are two, making six 300-kw rotaries supplying current for the road. The rotaries are started by the use of small induction motors.

TRANSMISSION LINE

The transmission line is composed of three No. 1 stranded aluminum wires mounted on 10½-in. porcelain Locke insulators. The wires are arranged on two cross-arms, two wires at the outer ends of the lower cross-arm and one near the center of the top cross-arm, forming a triangle of about 8 ft. on a side. At each outer end of the top cross-arm is installed a grounded barbed wire for lightning protection, also three banks of General Electric lightning arresters of standard construction. The high-tension line is provided with oil-break switches at five different points in the 90 miles of line whereby it can be cut into sections in case of trouble.

PARMA PASSENGER, FREIGHT AND SUB-STATION

LOCATION OF SUB-STATION

The sub-stations in the cities are located at convenient points for waiting-rooms and freight depots, and the sub-station attendants act as station agents, taking care of the freight and ticket selling. A plan and elevations of the Marshall sub-station are shown in the accompanying diagram.

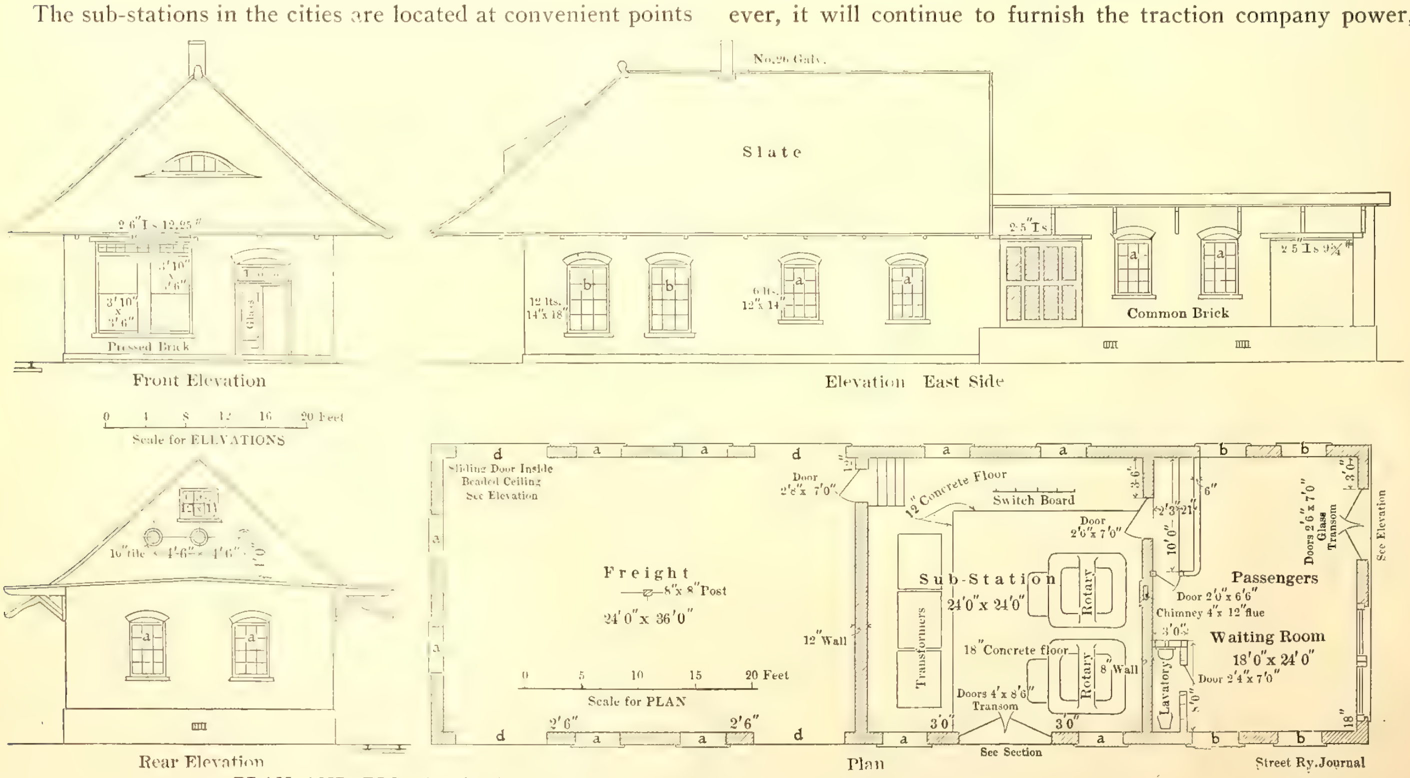
POWER CONTRACT

The contract under which power is purchased from the Kalamazoo Valley Electric Company is rather interesting, and some of its features will be given in detail.

It provides that the railway company shall be furnished with the current which may be necessary or required by it to operate its railway system in a manner satisfactory to it on every day, including Sundays, for at least eighteen continuous hours per day, between such hours as the Jackson & Battle Creek Company may from time to time designate.

The railway company reserves the right to order whatever extra service is needed beyond eighteen hours per day by giving the power company 24 hours notice of its intention. For this power the Jackson & Battle Creek Company agrees to pay at the following rate: For the first 3000 kw-hours per day 1¼ cents per kilowatt-hour, and for all amounts in excess per day 1 cent per kilowatt-hour. The current delivered under this contract is direct current, at approximately 600 volts, and is measured at the direct-current switchboards located in the sub-stations of the Jackson & Battle Creek Traction Company, at Jackson, Mich., Albion, Mich., and Battle Creek, Mich., by standard Thomson wattmeters manufactured by the General Electric Company, or some other meter satisfactory to both parties. The power is paid for monthly.

The contract also provides that the Jackson & Battle Creek Traction Company is not liable for or required to pay the power company for any power when its cars are not operated for some extraordinary cause. The power company agrees that in the event of its being necessary to shut down a portion of its plant or plants by reason of accident, or for any other cause whatsoever, it will continue to furnish the traction company power,



PLAN AND ELEVATIONS OF TYPICAL FREIGHT AND PASSENGER WAITING STATION

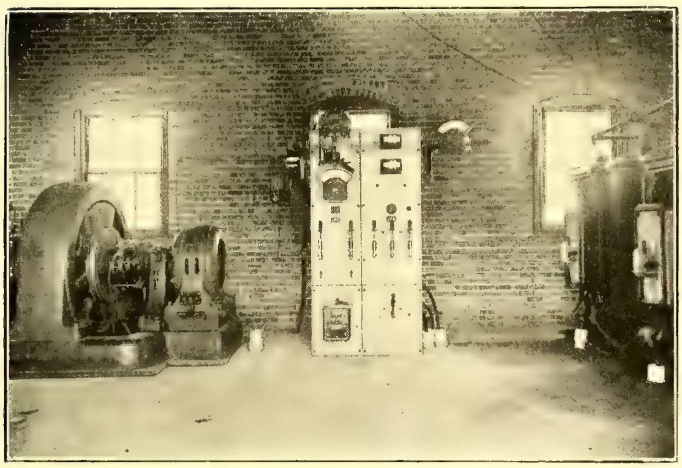
as contemplated in the contract, if it is possible for the company to do so, even if such service should require the use of the entire remaining capacity of its plants, to the exclusion of the light or other power business.

The contract also provides that if the power company shall at any time fail to furnish power contemplated in the contract it shall pay to the traction company all loss the latter may sustain by reason of such default. This loss is to be based upon the amount of gross earnings per day, less the cost of power, which shall be estimated by taking the average of the daily gross earnings less the cost of power for the week next preceding such default.

DESPATCHING SYSTEM

A telephone line for despatching cars, composed of two No. 11 hard-drawn copper wires, transposed every fifth pole, is run along the pole line 7 ft. below the lower transmission arm. Telephone booths are installed at all turn-outs, and telephones are placed in all sub-stations and ticket offices.


INTERIOR OF LIMITED CARS, FRONT AND REAR VIEWS



INTERIOR OF PARMA SUB-STATION

The telephone system is a combined central energy and magneto call. All the telephones in the turn-out booths call the despatcher up by simply taking the receiver off the hook, and when the receiver is on the hook the telephone is entirely cut off. All telephones in sub-stations, ticket offices, etc., are supplied with a regular magneto call, so that they can reach any other telephone on the line. The telephones are equipped with a condenser to neutralize the static effect of the high-tension line.

The principal reason for using this kind of telephone for turn-outs, was to relieve the line from the large number of magneto bells and generators that would be cut in along the line if all the telephones were cut on, as there are over twenty telephones connected with the central switchboard.

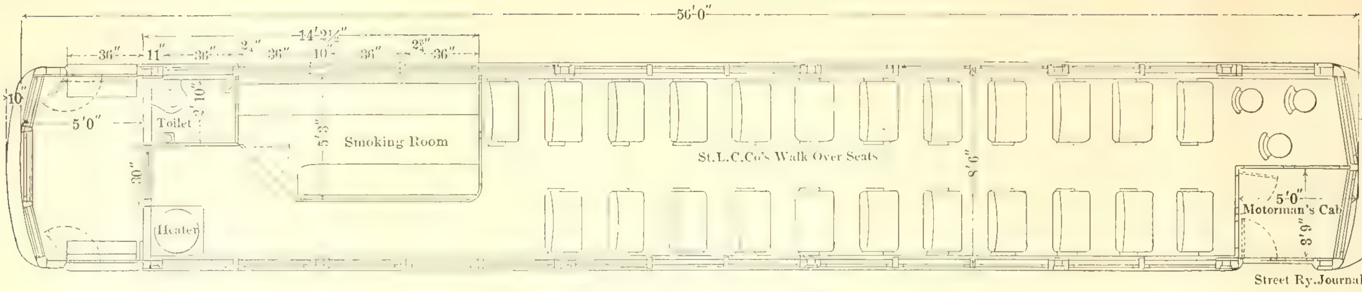
A train despatcher is always on duty, and trains are handled by him according to the standard steam road practice. All trains are run on a printed time-table, and when on time at their regular scheduled meeting places run without special orders. On reaching the terminals, however, the conductors report to the despatcher and get a clearance card from him. Should any train arrive at a meeting point and not find the opposing car there the conductor calls up the despatcher, and receives orders whether to proceed. He is required to write out on a printed blank the order received, making a duplicate carbon copy of it. He then repeats the order, as he has written it, to the despatcher, and upon receiving his O. K. and entering on the blank the time at which the O. K. is received, the conductor hands the motorman the carbon copy and retains the original. Trains, which become late for any cause, are handled by orders from the despatcher from point to point.

On arrival at all stations the conductor of each train registers on a printed blank the time of arrival and departure. This is immediately reported over the telephone to the despatcher by the station agent. The despatcher enters this information upon a regular steam railroad train sheet. At the end of the day this sheet gives full information as to the time of arrival and departure of all trains from all the stations on the line during the day.

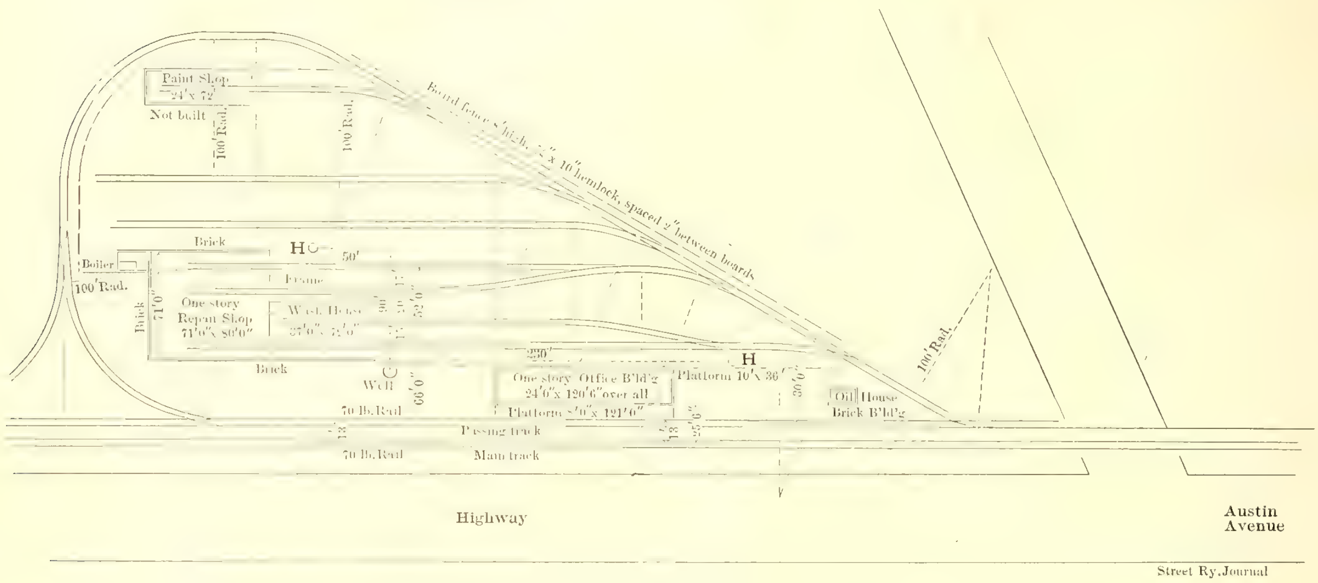
ROLLING STOCK

The company operates both express and local passenger service. The express cars measure 58 ft. 4 ins. over all, and are elaborately fitted up, having smoking and toilet compartments and high-backed, red upholstered seats. They were built by the St. Louis Car Company, and are mounted on Peckham

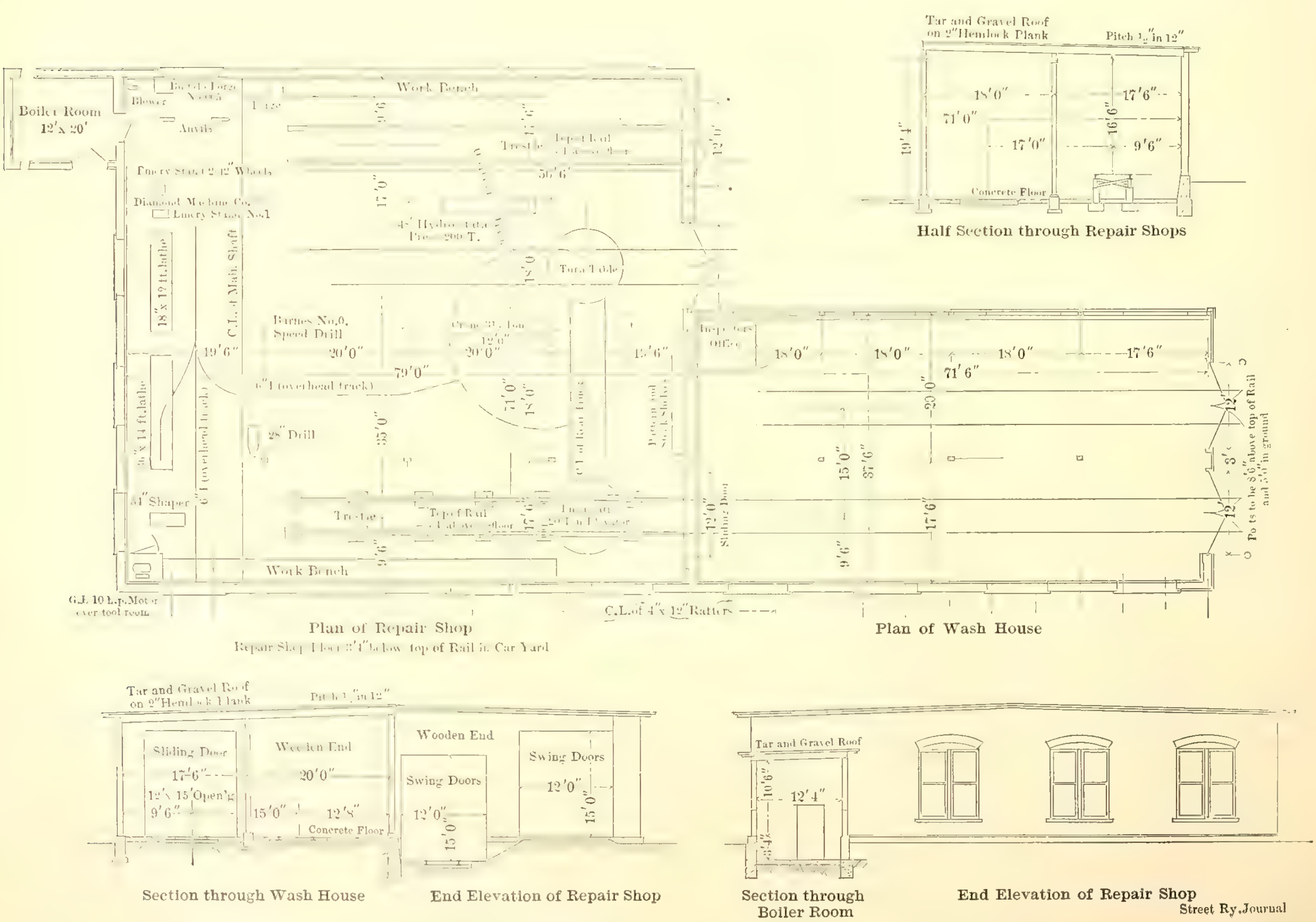
PARMA FREIGHT AND PASSENGER STATION—FREIGHT-TRACK SIDE



PLAN OF "LIMITED" PASSENGER CAR



PLAN OF SHOP AND OFFICE BUILDING



PLAN AND SECTIONS OF REPAIR, SHOWING ARRANGEMENT OF MACHINERY AND TRACKS

extra heavy M. C. B. trucks. The trucks have a 7-ft. wheel base with axles 7 ins. in diameter in wheel and gear seats, and 6 ins. in diameter through the motors. The axle gears are solid, and pressed on by hydraulic pressure ahead of the wheel. Thirty-four-inch steel-tired wheels are used with 3-in. tread and ⅞-in. flange.

The cars are equipped with four General Electric 66, 125-hp motors each, geared to 60 m. p. h., with General Electric type-M control and Christensen motor compressors. The company also has four trail cars of the same length, mounted on light M. C. B. trucks, which are used on busy days behind the limited trains. They are equipped with Van Dorn couplers, and are also fitted with brake cylinders and hose connections, so that their brakes can be operated by the motorman on the head car.

For its local service the company has five 50-ft. combination baggage and passenger cars, built by the G. C. Kuhlman Company, and illustrated on page 774 of the Street Railway Journal for May 23, 1903; also two 50-ft. light freight and express cars. Each of these cars is equipped with four General Electric 57, 50-hp motors, geared to speed of about 40 m. p. h.

TRAIN SERVICE

This road, so far as known, is the first to put into service a regular system of limited and local trains, making alternate trains local and limited through the day. The arrangement has proved very successful, it being found that the part of the traffic is between cities and the proportion which comes from the country districts is amply served by the local cars. The practice, heretofore, has been to subject the most profitable part of the business, namely, the interurban traffic, to the annoyance of the slow schedule of a service which makes every train stop on signal. By cutting out the local stops on every other train a service can be rendered for this class of traffic which is better than the local steam road service.

The limited trains run on an average of 1¾ hours apart, while local trains are sandwiched in between. The limited trains stop only at stations in the principal towns through which they run, while the local trains stop anywhere. The local trains also handle baggage and light express matter.

The 45½-mile run between Jackson and Battle Creek comprises about 37½ miles of private right of way and 8 miles of city streets. The running time is 1 hour and 35 minutes for the limited trains, including delays and interruptions at terminals. This allows 13 minutes for getting out of Battle Creek and 12 minutes for getting into Jackson, which makes the distance between the limits of the two cities covered in 1 hour and 10 minutes, making six regular stops.

FARES

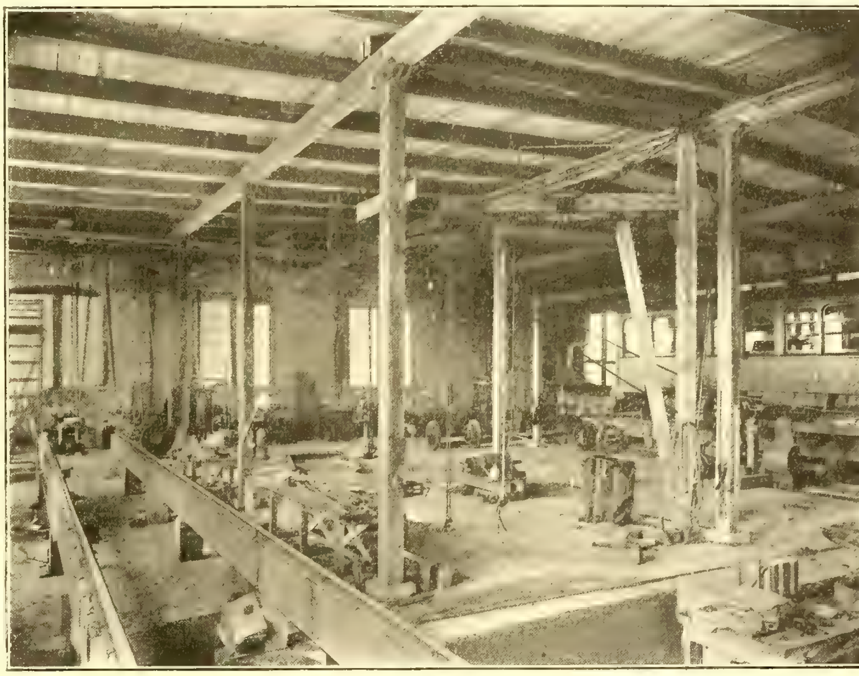
The rate of fare is 1½ cents per mile, with a 5-cent minimum. Five cents is the rate for any ride within the city limits of any city. Baggage is checked between all points on the road for a uniform price of 15 cents per piece, and is carried on all local cars. Round-trip tickets are sold at reduced rates between stations. Experience up to date has shown that fully two-thirds of the business is done by tickets. This takes considerable work off the conductors, and enables them easily to collect their fares and attend to their other duties. Four-hundred-mile mileage books are sold for $5. These books are good for purchaser and members of his family.

Cash fare passengers are given duplex cash fare receipts.

All passengers are registered on Ohmer fare registers, being rung up as "Cash Fare," "Ticket," "Pass," or "Transfer." Transfers are given from the local cars to limited cars at Albion, because the latter pass the local cars going in the same direction at Albion, and any passengers collected from the country by the local running ahead of the limited are transferred at this point to the limited for stations beyond.

The freight business is handled under standard steam railroad classification, rates, way bills, expense bills, etc., and at the same freight rates as competing steam roads. No free cartage is furnished, all freight being delivered to the company at its stations and delivered by them only to their stations. It has been found that owing to the greater convenience and speed of the electric freight service the company gets practically all the business in the territory under even conditions as to charges and delivery, with the steam roads.

Milk is handled by both the freight and combination baggage cars from points along the line into Battle Creek and Jackson in large quantities, without the use of way bills. The milk companies and farmers along the line buy a coupon ticket, which is at the same time a tag, and this ticket calls for the delivery of the can of milk and the return of the empty can.



INTERIOR OF REPAIR SHOP AT ALBION

REPAIR SHOP

The repair shop located at Albion is equipped with lathes, shapers, forges, 200-ton wheel press, overhead I-beam trolley with pneumatic hoists, a jib crane, turn-tables for quickly removing trucks from beneath cars, and all modern conveniences. The cars for inspection are run out upon elevated tracks, the entire floor of the repair shop being sunk 3½ ft. beneath the level of the tracks.

A wash house for washing cars is provided, heated by steam so that the cars can be washed in winter.

A large storage yard for storing extra equipments is provided outside of shops. The tracks are well separated so as to reduce fire risk as much as possible.

OFFICERS

The officers of the company are: President, C. M. Spitzer; vice-president, A. L. Spitzer; treasurer, N. S. Potter; secretary, W. T. Foote; superintendent, E. S. Loomis; passenger and freight agent, J. A. Bucknell. The Messrs. Spitzer are of the firm of Spitzer & Company, bankers of Toledo and New York.

The Lake Shore Electric Railway is now operating, nightly, Cleveland theater cars from as far west as Norwalk, 57 miles, the cars being held until all the theaters are out. The return to Norwalk is made in two hours.

THE STREET RAILWAY SYSTEM OF RICHMOND, VA.

The street railway system of Richmond, Va., as is well-known to readers of the STREET RAILWAY JOURNAL, now represents a consolidation of interests into which a good deal of new life has been infused in the last year or two, and for which a continued, gradual growth seems promised for the immediate future. The unification of management, which occurred early in 1901, with the formation of the Virginia Passenger & Power Company, has, as is the rule with the association together of competing railways, resulted in a better distribution of lines throughout the city and an equable and more satisfactory service to the public. Changes in routes and the extension of lines have, of course, been attended with the usual political obstructions, but the rearrangement has gone steadily on. The geographical location of the city as the center of some of the notable engagements of the civil war, as well as on ground associated with the early settlers, gives the property the special advantage of attracting the tourist; and two important suburban and one interurban line, passing near points of historic interest, have already stimulated a considerable traffic on this account, and attention is now being given to the possibilities of extending additional branches for this travel as well as for that of the suburbanite and the picnicker. There are, for the last class, a considerable number of parks, both in the city and at outlying points, most of them attractive for their natural beauty, but others for their amusement places. It will be seen that the Richmond system is a combination of urban, interurban and suburban properties, possessing a comprehensive city and country park business.

LEE MONUMENT

From an engineering standpoint, the property is of unusual interest, chiefly as to the power plants which serve it. One of these is the combination steam and water-power plant on the James River, besides which are two water-power plants in process of development near Petersburg, on the Appomattox River. The James River plant was begun a few years ago by the Virginia Electric Railway & Development Company, with an initial installation of 4000 hp in both water-wheels and steam engines. As the flow of the James River is a fluctuating one throughout the year, and as the company instituting the plant had to furnish an uninterrupted supply of power, the steam adjunct was a necessity. Lately the plant has been enlarged to have a capacity of 10,000 hp in the steam plant as well as the hydraulic equipment, as use can now be made of the full power at all times. The Appomattox plant is still in process of construction, and any extended reference at this time must be deferred. Suffice it to say that water rights, land and a navigation canal are owned for 50 miles on the river, and a present development of 10,000 hp is being made. It is the intention to install additional alternating-current machinery in the Twelfth Street station, to utilize the power derived from both sources. Plans for this development have been drawn up, and are being carried out under the direction of L. B. Stillwell, consulting engineer of the company. Of the railway work, the standard track construction is shown in one of the accompanying illustrations. Mention should also be made of the fact that a number of large bridges were required, some over the rivers and others to span vales in the hilly section on which Richmond and its suburbs were founded.

The company owns and operates all the street railway lines in the cities of Richmond, of Manchester, which is across the river from Richmond, and of Petersburg, which is 21 miles south. The total mileage is 116.8 miles of single track, divided as follows: In Richmond and its suburbs, 71.7; in Manchester and its suburbs, 10.3; in Petersburg and its suburbs, including the Richmond and Petersburg interurban road, 35.8 miles. Twenty-six different routes are operated in the three cities. A general map of the railway lines is reproduced on an accompanying page. Of the total mileage, 70 miles in Richmond and Manchester were, prior to the organization of the present company, the property of the Richmond Passenger &

VIEW OF JAMES RIVER, SHOWING PORTION OF MAIN DAM AND LOWER DAM FOR MANCHESTER SUPPLY, VIRGINIA PASSENGER & POWER COMPANY, RICHMOND

Power Company. This company owned an electric light and power plant, driven by steam, on Brown's Island, near the water-power plant. Twenty miles of track in Richmond belonged to the Richmond Traction Company. Twenty-one miles are represented in the interurban line, then the property of the Richmond & Petersburg Railway Company, and 15 miles, with an electric light and power plant in Petersburg, were operated by the South Side Railway & Development Company.

TRACK CONSTRUCTION

As shown in the cross-section of the track construction, the rails are ordinarily of the grooved girder type, on ties which rest on 6 ins. of concrete foundation. The ties are 8 ft. long and 7 ins. in depth. A city ordinance requires the company to pave the street between the tracks and 2 ft. outside of them, and the paving is of spalls obtained from adjacent granite quarries. They cost from 95 cents to 1.00 per square yard, and make a very satisfactory paving, of the appearance of staggered belgian block. The cribs are also filled with concrete, and the webs of the rails, this to prevent the escape of current and consequently to avoid any electrolysis. The rails are 95-lb. and 98-lb. girders. In Manchester and Petersburg 90-lb. girder rails, and in the latter some 70-lb. T-Shanghai rails are used. On the suburban and interurban lines T-rails, 60 lbs. and 80 lbs. in weight, are used. Instead of concrete the suburban lines are laid on stone and gravel ballast. Considerable attention is paid to obtain good bonding.

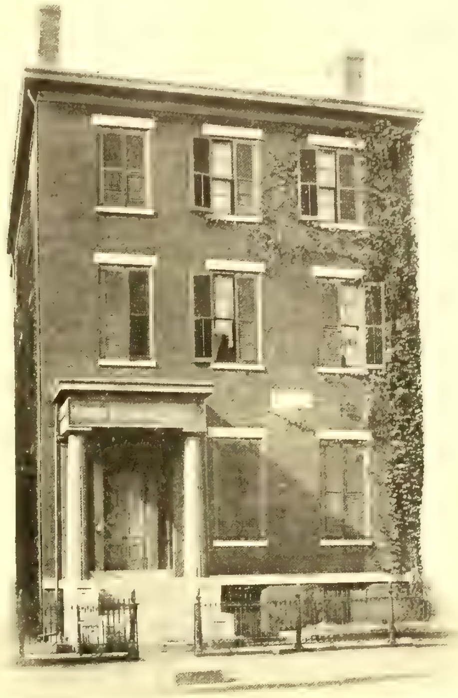
The company has contracts with the only two railway bridges over the James River to operate its cars between Richmond and Manchester. One of these, Mayo's Bridge, at the foot of Fourteenth Street, is a bow-string girder bridge, 1800 ft. long; the other is the Free Bridge, a triangular truss something over 2000 ft. in length. In addition, it owns two steel viaducts over the Bacon Quarter Branch, the northern corporation line of the city, one 1900 ft. and the other 1200 ft. in length. It has many fine structures on its suburban and interurban lines, notably the Appomattox Bridge at Petersburg.

CAR EQUIPMENT

As to the car equipment of the company, there are, owing to the consolidation of different roads, a miscellaneous collection of cars. Altogether there are 268 cars besides a 15-ton Brill electric locomotive. Two hundred and thirty-one of the cars are employed on the Richmond divisions, twenty-nine on the Petersburg division, and the remaining eight cars are trailers.

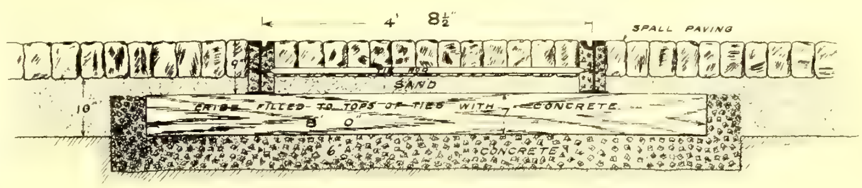
EXTERIOR OF JAMES RIVER POWER COMPANY

In open cars there are 124 all told, in closed cars 126, and ten of the combination type. The company has not a full truck equipment, having, for example, 153 single trucks and twenty-two double trucks. A city ordinance lays down a definite period of the year by months during which closed cars must be operated, and as a result often times closed cars are run when the



VIRGINIA HISTORICAL SOCIETY BUILDING AND HOME OF GEN. R. E. LEE, 1861-1865

weather is uncomfortably warm. In changing from one class of service to the other, the trucks and motor equipments have largely to be transferred. Of the Richmond cars, the greater



CROSS SECTION OF STANDARD CITY TRACK

number are nine-bench and ten-bench cars, thirty-five of the former built by the American Car Company and forty-seven of the latter by Jackson & Sharp. The greater number of closed cars have 20-ft. bodies and single trucks, and a comparatively recent addition to the equipment is comprised of 21-ft. body Brill cars.

The company has leased from the Virginia Passenger Car Trust Association twenty-two semi-convertible cars, built by the St. Louis Car Company, and these are expected to give the most satisfaction, and if so, are to become the standard. These will be 31 ft. long in the body and 41 ft. over all. They are to be equipped with four General Electric 67-motors and the Christensen air brake. They will have panel sides, with channels on the side sills, flanges projecting outward as a buffer for wagons. Most of the present motor equipment is of the General Electric 67-type and the controllers of the K-10 pattern. Of the single trucks, seventy-nine are Brill and seventy-two Peckham. The closed cars for the Petersburg division are 19-ft. body, Jackson & Sharp. In addition to the afore-mentioned cars, the company has also a miscellaneous equipment as follows: One party car, two sweepers, one sprinkler, five flat cars and one box car.

POWER PLANT

The James River combination steam and water-power plant was begun in 1898, when the Virginia Electrical Railway & Development Company purchased the water rights of the flouring mill on the James River on Johnson's Island. This com-

pany planned for an ultimate development of 10,000 hp. The plant was constructed and apparatus installed for 4000 hp, and the design and construction of the hydraulic portion of the work, including the power house, was in charge of Reuben Shirreffs, M. A. S. C. E., as chief engineer. J. H. Apsey was superintendent for Winston & Company, of Chicago, contractors on the dam, canal and power house foundations. The steam and electrical features were designed by Edward J. Willis, M. A. S. M. E., who resigned in the spring of 1900, and was succeeded by J. P. Pope. Sargent & Lundy, of Chicago, were consulting engineers on the steam plant. Since the consolidation of the company William C. Whitner has been retained as chief engineer of the water-power developments of the Virginia Passenger & Power Company, and under his supervision the power house has been extended, additional units installed, some changes made in the canal and intakes and a new type of dam designed for the portion of the original work that had not yet been completed.

INTERIOR OF JAMES RIVER PLANT, SHOWING COMBINED STEAM AND HYDRAULIC INSTALLATION

The city of Richmond is situated at the head of tidewater, about 100 miles from the mouth of the James River. In the last 3 miles above navigation the fall of the river is 84 ft., and within 9 miles 112 ft. The James River plant is designed for a head of 25 ft., and assuming a combined efficiency of the wheels and generators of 75 per cent, Mr. Whitner has prepared the following schedule of power: For five months, 8846 hp; for six months, 6242 hp; for eight months, 4012 hp; for nine months, 2982 hp; for eleven and one-half months, 1065 hp; minimum, 639 hp. This summary shows the necessity, if it is desired to supply 10,000 hp continually from its plant, for the steam engine adjunct. It shows that if 9000 hp is the demand, for example, the engines would not have to be operated at all practically for five months, that for one month they would have to supply 2758 hp, for two months they would have to supply 4988 hp, and so on. For fifteen days they would have to meet practically the entire demand. Of course, it must be remembered that these results are based on the minimum flow, which is not ncessarily an annual occurrence.

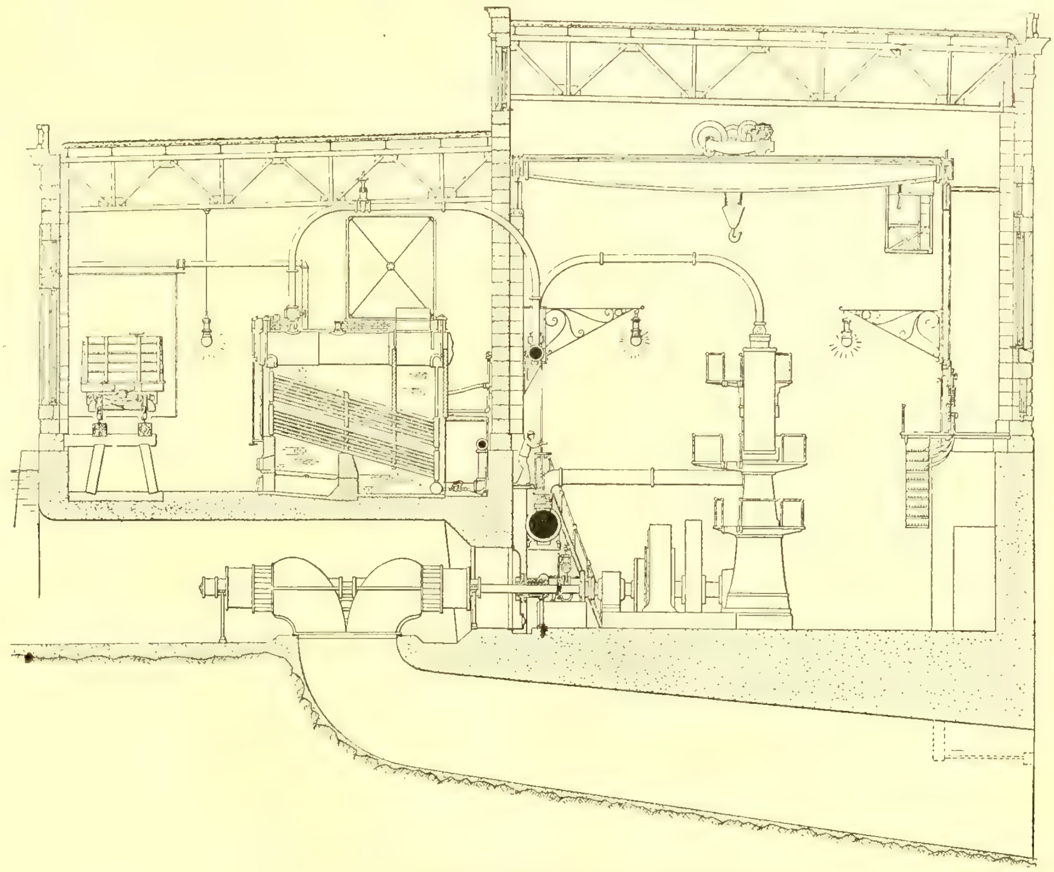
The dam extends straight across the river at the upper end of Brown's Island. The head gate house, which controls the entrance of water to the power canal, is a continuation of the dam extending from the island to the east bank, to a point on the property of the Tredegar Iron Works. In a contract with that company the level of the water in the pond above the dam was fixed at an elevation of 44.75, and this level is maintained by flash boards.

The dam is a concrete masonry structure over 1700 ft. long, inclusive of a guard wall at the upper end of the channel. The average height of the crest is only 5 ft. above the solid granite bed of the river on which the dam is built. That a head of 26 ft. or 27 ft. is realized with a dam of this height is indicative of the rapid fall in the river between the dam and the power house. The maximum height of the dam is about 8 ft. A higher one would probably have been constructed except for the reasons mentioned, and the probability that serious damage might come to property above the dam at times of extreme freshets. At intervals of 40 ft. concrete piers, 4 ft. wide, were built along the top of the dam, 10½ ft. above the crest of the dam, to support the structure for moving the flash boards. Their height was taken to bring them above the highest freshet levels, and to them are hinged the timber gates or flash boards. When resting on the dam proper they maintain the desired level in the pond. They are constructed of heavy pine timber in planking, and are faced with cotton duck heavily coated with North Carolina tar as a preventive of leakage.

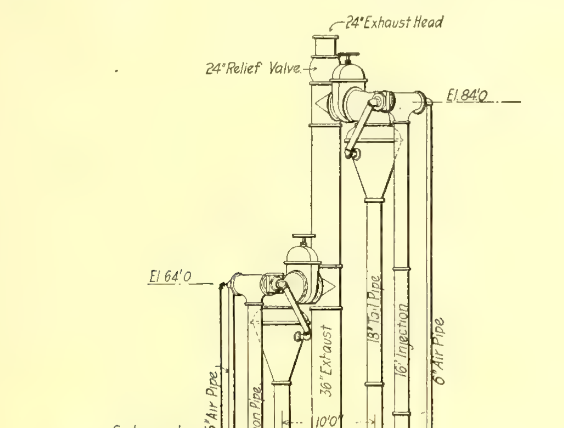
The power house is built on bedrock, and, on account of the great weight of the machinery installed, on the one hand, and the considerable upward pressure of water in extreme freshets, which reach a level of 20 ft. above the boiler room floor, on the other, the foundations have been made unusually massive. The water-wheels, which are of the horizontal type, are mounted in pairs, one pair submerged in each wheel chamber. The wheel chambers are arched overhead, and support the boiler room for the steam plant. The tail water from the turbines reaches the tail-race through a comparatively long draft-tube, and across the draft-tubes is located the generator room. The shaft from the water-wheels extends into this and is directly attached to the electric machine, and on the other side of the generator is the steam engine, placed also in line for direct connection when necessary. Under the engine room the entire space excavated is solidly filled with concrete, for except the draft tubes, which are circular in section, 10½ ft. in diameter at the outlet of the wheels, enlarging to 14 ft. at the river wall, the extensive use of concrete masonry is noticeable, as not only the dam, the canal masonry and power house foundations are constructed of it, but the walls and roof of the first portion of the station, the switchboard gallery floor, and even the outer shell of the chimney are concrete. Portland cement was used for the most part, except in places where

weight only was required, and there natural cement was used. It was stated that the stone from the excavations was unsuitable for stone masonry, and the use of concrete in constructing the building and chimney made architectural effects possible at a comparatively low cost. The foundation work was built in forms, and the shaft of the chimney was constructed in the same way. The walls of the superstructure, however, were built of blocks of concrete, previously molded in boxes and laid up in the walls like stone ashlar. This part of the station was built large enough for four units of 1000 hp each. The extension is designed for six additional 1000-hp units, so that the capacity will be 10,000 hp.

Six pairs of the water-wheels are of the Victor cylinder-gate type, built by the Stillwell-Bierce & Smith-Vaile Company. Each is 51 ins. in diameter, and the pair guaranteed to develop 1200 hp under a 25-ft. head. The seventh pair of wheels thus far installed consists of Hercules turbines, built by the Holyoke Machine Company. The shaft from each pair extends in the usual way to the engine room through an opening in the partition wall. Each generator is a continuous-current machine of 700-kw capacity, built by the General Electric Company. The engines are steeple tandem-compound Allis engines. They are arranged to run condensing or non-condensing, and are rated at 750 hp, and at best economy are capable of delivering 1500 hp. The water-wheels are controlled by Lombard governors. The steam engine cylinders are 18 ins. and 36 ins. in diameter, with a 42-in. stroke, and they are equipped with the Reynolds valve gear and ball governors. A bolted flange coupling effects the connection between the turbines and the generators. The engine fly-wheel, which weighs 80,000 lbs., is mounted between the generator bearings and runs with the generator, whether driven by the turbine or engine. The engines are disconnected by uncoupling the connecting rods from the crank pins. To change from the water to the steam plant, bolts are removed from the couplings and the connecting rod is connected to the crank-pin. To change from steam to water the operation is, of course, reversed. It is stated that the change requires about 45 minutes. The reason that the engines have a most economical rating at the comparatively low power is that the engines are depended on to operate alone, but for a small portion of the year. They are intended principally to supplement the wheels in time of low water, and to maintain proper speed in the turbines at high water.



CROSS SECTION OF JAMES RIVER POWER PLANT



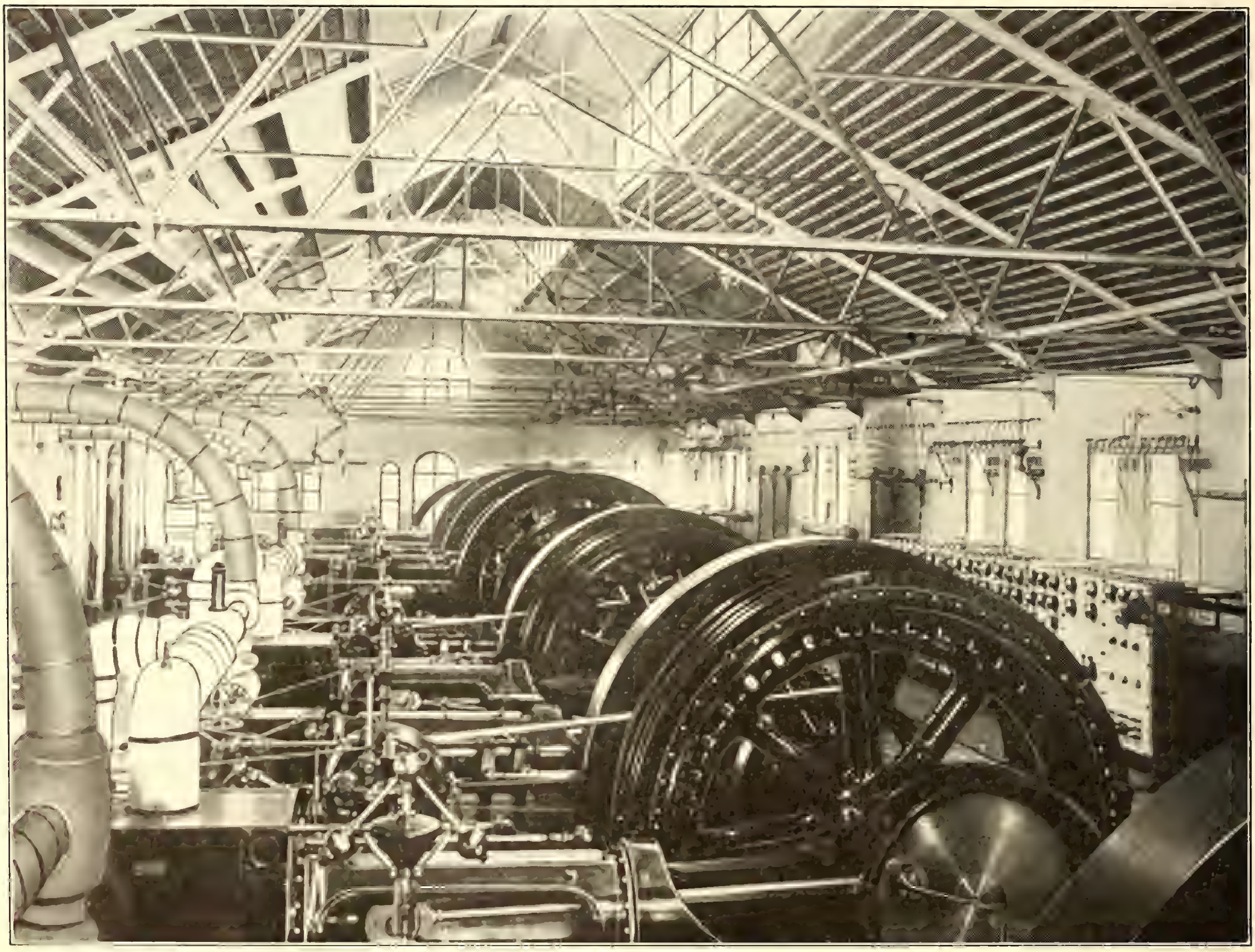
CONDENSERS AND SUCTION PIT

The condensing plant presents an interesting combination of two Worthington elevated injector condensers, set at different levels. The lower one is operated normally under the head existing between the canal and the river. The second condenser is provided with an electrically-driven centrifugal pump, which has a capacity of 1600 gals. per minute, to meet the conditions of high water when the natural head may prove insufficient. The condenser plant has a rated capacity of 6000 hp. It is provided with a double-acting Worthington dry vacuum pump, 10 ins. x 18 ins. x 18 ins. in size.

The boiler installation consists of four 1000-hp batteries of Babcock & Wilcox water-tube boilers, each having 252 tubes, 4 ins. in diameter and 18 ft. long, and three steam drums, 3½ ft. in diameter and 20 ft. 4 ins. long. They are rated at 500 hp each, on the basis of 10 sq. ft. of heating surface per horse-power, and 0.2 sq. ft. of grate surface per horse-power, so that the ratio of grate area to heating surface is 1 to 50. The ultimate steam capacity of the plant is 4000 hp.

It will be noted from the cross-section drawing of the station that coal is delivered in the railroad cars pushed on a trestle in the boiler room. The coal is readily dumped immediately in

front of the boilers, and there is storage capacity for about 120 tons. Semi-bituminous coal is used, and as labor is cheap and the boilers are not operated continuously, they are hand fired. The chimney is 11 ft. in diameter and 175 ft. high above the boiler grates. Feed-water is drawn from the canal, but there is also a connection with the city mains, so that in times of excessive turbidity in the canal the boilers may be kept free from scale-forming water. There are two feed pumps of the Knowles duplex type, 6 ins. x 10 ins. x 12 ins. in dimension. The water is discharged by the pumps through a Berryman feed-water heater, 36 ins. in diameter, provided with the usual by-passes for both the exhaust steam and the feed-water. The only steam passing through the heater is that from the dry vacuum and the feed pumps.



INTERIOR OF AUXILIARY STEAM PLANT ON BROWN'S ISLAND

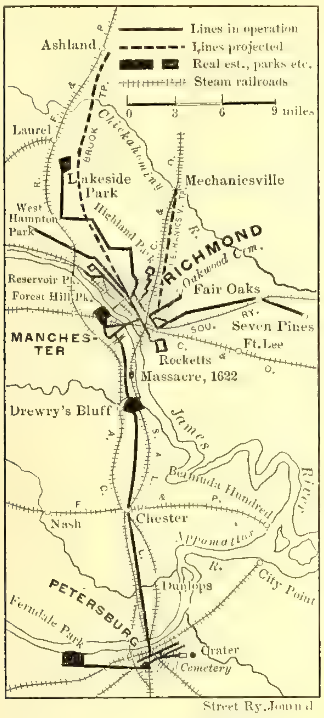
The steam pressure is 150 lbs. per square inch, and extra heavy wrought-iron flanged pipe was installed for all the steam mains. The Chapman valves are employed, and the high-pressure mains and pipes are drained into the boilers by means of the Holly system. The steam header is 14 ins. in diameter and the exhaust header 36 ins.

In addition to the machinery described, there are two drainage pumps on the engine room floor, with a combined capacity of 600 gals. per minute, furnished to handle any water which may percolate through the masonry during freshets. A 25-ton traveling crane, built by the Whiting Foundry Equipment Company, spans the engine room.

Being an independent company when the work was instituted, a variety of service was arranged for. The switchboards, which are situated on a gallery running around the engine room, are quite extensive. Direct current is supplied for railway work and for light and power, and for the latter there are two high and two low bus-bars and one common neutral bus on the lighting panels, the Edison system of distribution being employed. Alternating current is also furnished, and besides the generator and exciter panels the switchboard has ten railway feeder panels, ten Edison system panels, and two alternating-current panels. The unusual feature is presented of a water-power station situated almost at the center of its load, two-thirds of it being located within a radius of 1½ miles. On this account the three-wire system of distribution was adopted, 235 volts for light and 470 volts for power, reserving the alternating system for service outside this zone. The voltage for this service is 2300 at the station, with transformation to 115 volts for local distribution. The railway current is, of course, delivered at 550 volts. The current is distributed both through underground conduits and overhead feeders. In the former the conductors are rubber-covered lead enclosed feeders, furnished by the John A. Roebling's Sons Company. The electric controlling apparatus is of standard General Electric make.

The main steam plant of the company is one built some years ago on Brown's Island, a short distance above the combination steam and water power plant. It contains five 386-hp Babcock & Wilcox boilers, one 250-hp Babcock & Wilcox boiler, and one 170-hp Campbell & Zell boiler. They are all equipped with the Roney stoker. The generating equipment comprises both direct-current and alternating-current units. There is one General Electric railway machine, of 300-kw capacity, direct connected to a Wetherill tandem compound-condensing engine, and three General Electric 500-kw generators, also driven by direct-connected Wetherill tandem com-

pound engines. The alternating equipment comprises three Stanley two-phase 500-kw machines, giving 2400 volts at 60 cylcles, and direct-connected to Allis cross-compound condens-

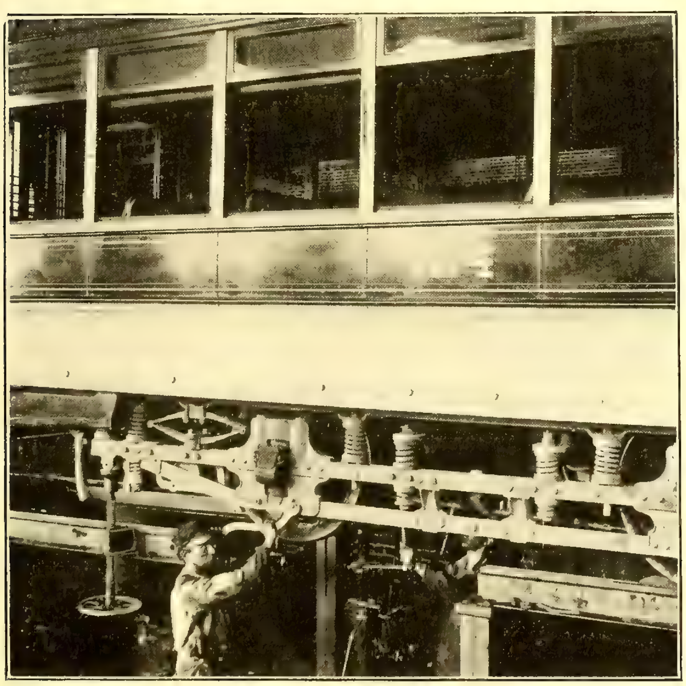


MAP OF SYSTEM

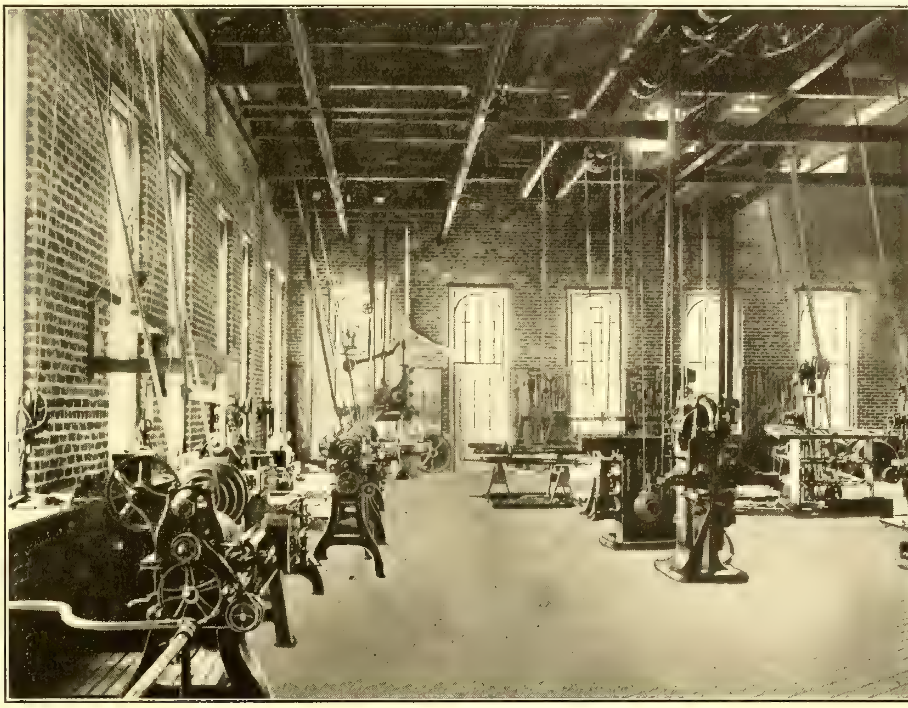
ing engines. For these there are three 30-kw Northern exciters.

REPAIRS SHOP AND CAR HOUSES

The main repair shops and car houses are located near West End Park. The repair shop is a brick building, 85 ft. x 160 ft. in size, with a steel truss roof and a pine flooring, laid diagonally. It has a good size machine shop, an armature repair de-


SCREW JACK FOR RAISING TRUCK

partment, a large store room and an office. The machine shop, of which a view is given, has an equipment of machines including a Putnam boring mill, a Schaffer boring mill, a Gould & Eberhart shaper, an Oesterlein milling machine, Reed lathes and a Snyder drill press. The shops and store room extend along one side of the building, and on the other is the erecting floor with through tracks. This contains the usual working pit, and a special feature in this connection is a device for lifting one end of a car for the removal of wheels. A screw jack


VIEW IN REPAIR SHOP

is fixed to each rail and one end of the truck is lifted in that way. The adjacent section of a rail is removable, and the weight of the car can thus be taken from the wheels and axle. A view of the device is given in an accompanying illustration. The machine shop is driven by two Crocker-Wheeler motors supported at a high point overhead and driving a jack shaft, to which the main line of shafting, supported from the roof trusses, is belted. An overhead tracking system, built by Pawling & Harnischfeger, is employed in the machine shop, and includes two short-span hand-power traveling cranes, one over the erecting pit and the other over the lathes. The building is lighted artificially by arc lamps, and the windows are protected on the outside by small-mesh galvanized wire screens.

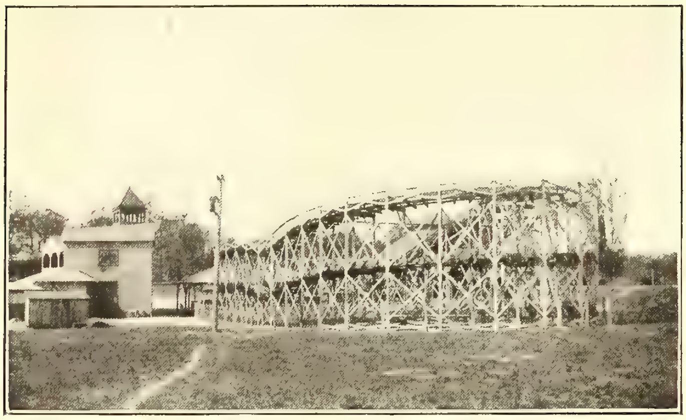
The paint shop is a detached building, 85 ft. x 80 ft. in size, and between it and the repair shop is a transfer table. This shop, like the repair shop, is well lighted from windows, but it has no monitor in the roof like the main shop. A wood floor extends over the entire area, including the space between rails, and the building is heated by steam pipes laid on the floor, ten 1-in. pipes sides by side, between the rails. This building is also lighted chiefly by arc lamps. The doors throughout are of the Kinnear rolling type. Some distance from these buildings is the car house, which is an unusually large structure, and a detached oil house has been provided.

PARKS

Of the parks, the most conspicuous is the West End, or Reservoir Park. This has been laid out immediately below the reservoir of the city water system, and is the chief amusement center which the railway possesses. A large lake for boating has been made there and a large complement of amusement institutions have been erected at one end. At one side of the lake stands a large grove, and encircling the lake and crossing through the grounds is a system of gravel roads with concrete curbs and gutters. The lake has banks of white sand and gravel at the water's edge and large rocks above, more or less hidden with growing grass. Accompanying photographs show some of the attractions of the resort. There is a large casino, a switchback, roller-coaster, an aquarama, caroussel, a raths-

keller and the usual collection of ice cream, soda-water and candy booths. In addition to these one of the features of the park is a natatorium, which has an unusually large concrete tank. The park is within easy riding distance of the center of the city and has proved very popular.

Altogether the city owns 384 acres of park land, and West



SWITCHBACK, WEST END PARK

End Park comprises about 300 acres. At the east end of the city the most important city park is Chimborazo. Outside of the city are some very large parks, notably Forest Hill Park at Manchester, Highland Park immediately north of Richmond, and Lakeside Park. Near Petersburg there is Ferndale Park, and on the line to Petersburg historical places like Drewry's Bluff and the site of the Battle of the Crater. The natural beauty of Forest Hill Park may be shown by reference to an accompanying reproduction of a photograph. Of the routes passing battle fields, the most important are the Petersburg interurban line and an 8-mile road to Seven Pines. Mechanicsville is also to be joined to the Richmond system by an extension along the Mechanicsville turnpike.

ADMINISTRATION

It will probably be remembered that early this year control of the Virginia Passenger & Power Company was obtained by

VIEW IN WEST END PARK

Frank Jay Gould, of New York. The officers of the company are now as follows: F. Sitterding, of Richmond, president; Mr. Gould, first vice-president; Augustus Wright, of Petersburg, second vice-president; Guy Phillips, of New York, secretary and treasurer, and William Northrop, of Richmond, assistant secretary and treasurer. In addition to the officers the following are also directors: Messrs. Edwin Gould, A. H. Calef and Alfred Skitt, of New York, and J. D. Patton, of Richmond. S. W. Huff is general manager, and C. B. Buchanan general superintendent. William C. Whitner is chief engineer of the water-power development, and Calvin White-

VIEW IN FOREST HILL PARK

ley, Jr., is chief engineer of the railway department. George H. Whitfield is mechanical and electrical engineer.

THE RECENT STRIKE

An account of the Richmond system would not be complete without a reference to the recent strike that has already been commented on in these columns. It will be of interest to record the issue that was drawn and the result of the contest. The strike was notable in that the union started out with an absolutely solid front and wound up thoroughly disorganized and disrupted. The men had been granted arbitration the spring previous, under which wages were materially advanced, and, not willing to abide by this, even for a year, the union within ten months demanded a 30 per cent increase in wages, recognition of the union, arbitration of all questions that might arise between the company and its employees, and the usual clauses that accompany extreme union demands. The general

NATATORIUM, WEST END PARK

manager, Mr. Huff, with the approval of Mr. Gould, made a conciliatory but positive refusal of these demands, stating the case to the public at the same time. The union then asked for arbitration; the company declined to arbitrate, and, after this, refused to discuss the issue any further with the union, its international organizer or the local people that interested themselves in its behalf. Efforts were made to reach Mr. Gould

and his New York advisers in regard to the matter, but without avail.

On the strike being declared, the company served notice on its former employees that those not returning to work within three days would no longer be regarded as employees of the company, and new men employed would be rated according to the date of their employment—and this has been strictly adhered to. The union sympathizers tried in every way to draw the company into further discussion of the matters at issue. The company declined to take any notice of this, but proceeded to operate its road with new men, importing experienced men from all sections of the country and instructing inexperienced men who came in from the surrounding country; at the same time the company employed 200 picked men to assist in breaking the strike.

The operation of cars was characterized by the usual violence attending street railway strikes, with an unusual amount of shooting from ambush. The police protection was inadequate, both in the city and county, and, before the military was called for, it was necessary for the company to place special guards armed with shot guns on its cars; the assaults on the cars became so numerous and violent that these guards were finally forced to fire a volley into a mob, six persons being wounded. Shortly after this incident, the militia was called out, remaining on duty a little over a month. The withdrawal of the militia was followed by the usual outburst of violence, but the company again placed armed guards on the cars and had its track in exposed places patrolled by men armed with shot guns. This outburst of violence was not of long duration, nor did it prove very serious. Three cars were dynamited without serious injury to passengers.

Every effort was made to induce the company to concede some minor point which would enable the union to call the fight off and save itself, but, from the time the strike was declared, the company absolutely ignored the union and its representatives, and operated its property according to its own ideas of the best methods of operation. Wages and hours were changed to conform largely to the former policy of the company, and the seniority of the men was fixed according to the date of their employment. A great many of the strikers renounced the union and applied for work, but only those were selected who were considered entirely desirable, and they were placed on the list according to the date of their employment.

After the strike had lasted sixty-nine days the union finally declared the strike off and disbanded. Of the 650 men who went out on strike only about 150 have been reinstated, and in most cases they are running extra. Travel has some time since become normal; in fact, showing the usual increase over last year, and, although the fight has necessarily been expensive, it is generally conceded that the value of the Richmond properties will be very much enhanced by having settled this issue early in the history of its new ownership. The result is regarded as an absolute defeat for the union, and as going a long way toward established street railways in their right to operate their own property, and street railway owners are much indebted to Mr. Gould for the firm stand he has taken in the handling of the Richmond properties.

"Golden Rule" Jones, Mayor of Toledo, Ohio, recently journeyed from that city to Chicago that he might appear in public and admonish the citizens of the windy city to go to the City Hall and protest against the awarding of street railway franchises. With the modesty that is characteristic of the man he assured the Chicagoans that he was very reluctant to appear before them, and that, above all, he did not want to appear in the characteristic of a patent-pill peddler. Assuming the role of the prophet he predicted that Chicago's next centennial would see people using street cars as they now use sidewalks.

THE ELECTRIC RAILWAY ON ITS OWN RIGHT OF WAY

BY EDWARD P. BURCH

The one principal feature of the heavy electric railroad which distinguishes it from the trolley system on the city streets and from the suburban or cross-country interurbans on the county roads or other public highways, is the use of a private right of way.

First class electric railroads are now being incorporated under the general railroad laws of the States. A corporation so organized is empowered to take and appropriate private property for a right of way over, through, under and across any land needed for the construction, maintenance and operation of the road, and may do so by instituting condemnation proceedings against owners or tenants and the payment of damages assessed, to the parties entitled to the same.

A private right of way is a valuable asset for a first-class short or long interurban railway. It is often a necessity in order: (1) to secure and retain business, and (2) to reduce the cost of handling a given volume of business. These are the all-important operating consideration, from a commercial and engineering standpoint, in railroading.

Out in the country the fixed charges against the net earnings of a railroad for interest on the cost of a right of way 60 ft. wide are small. But in the larger cities the real estate may cost $100,000 a mile, and thus may be a large portion of the total cost of the road. However, part of this increased cost will be offset by absence of the delays, uncertainties and expenses due to obtaining a franchise on city streets for twenty-five years or thirty years; by the lower cost of paving, bridges and drainage, and by the absence of an increased length of track for a loop around one or more city blocks, etc.

The right of way in the city will secure and retain passenger business, because the higher schedule speed saves in the passenger's time. One particularly disagreeable phase of present "interurban electrics" is the trailing behind the slow city trolley cars and coal wagons, the blockades and the municipal speed restrictions. This private right of way in the city will, in addition, meet the competition of steam roads for the business in the far outlying districts hitherto belonging exclusively to the steam roads. Conversely, the steam roads, having converted their power to electric traction, as a matter of increased earnings, economy of power and comfort to passengers, will be in a position to obtain for themselves the suburban and interurban business now being lost, and also to hold the business against all competition by electric railroads not on a private right of way.

The high speed will secure business, on the time-honored principle that "facilities create traffic." In fact, running time is now more important than frequent service in heavy electric railroading. The suburbs of our cities are determined and measured on a time basis instead of by distance.

One will not live, say, 3 miles from the center of the city and reach home in 20 minutes by the trolley car on the city streets, when he may live 12 miles from the center of the city and reach his lake or country home in, say, 30 minutes by using the hourly service of the heavy electric railway on a private right of way. The great cities will spread far from the present limits, and suburban towns will be built up rapidly enough, as has been demonstrated, so soon as the railroads provide proper transportation facilities.

The private right of way allows freight, express, mail and baggage to be handled. With the terminal station easy of access, located well in the heart of the city, provision may be made for a waiting room, catering to the comfort of passengers. There is great objection to freight traffic and to passenger trains of even two cars on the city streets. High-speed interurban service on city streets is wrong, because it is dangerous.

From an operating standpoint, the expense of handling a given traffic will be less for the railway on a private right of way. Expenditures will be less for maintenance of track, bridges, drainage and for tie renewals. There will be no paving to maintain. The city loop being cut out, the line is shorter and the cost of track, overhead construction, conduits and cables may be less.

Maintenance of equipment will decrease, because, in whole or part, one can use steam road standards and also avoid the restrictions of girder rails, paving, light switch work, short radius curves, etc., which now increase the operating expenses per ton mile and per passenger. There will be no restriction on the weight, width and length of cars.

In conducting transportation the increased schedule speed on a private right of way will decrease that largest of all operating expenses, trainmen's wages, per car mile and per car hour, and particularly so for two-car and three-car trains. The greater safety on a private right of way will not only make the service more reliable but will decrease the accident and legal expenses. A private right of way, as generally selected, avoids the grades of the city streets and the abnormal power demands for these grades, thus bettering the load factor of the generating equipment and its economy of operation. There will be a saving of power due to the absence of grades and to the decreased traction on the cleaner rail. The power required for a two-car or three-car train is but 70 per cent to 60 per cent of the power of a single car per ton moved; thus, the cost of fuel or water-power is decreased.

The private right of way will increase business and will make other reductions in operating expense in particular cases, but the above is an outline for our general consideration of the subject.

The private right of way has already been recognized as advantageous by electric railways. This is shown by the fact that out of the 24,000 miles of track in the United States, there are now 4000 miles on a private right of way owned or leased by the operating companies.

The writer is of the opinion that the time has now come when

TABLE SHOWING STATISTICS OF FIFTY-SEVEN RAILWAYS OPERATED ON PRIVATE RIGHT OF WAY

List A.—Electric Railways	Location of Terminals	Single Track Mileage: Total	On a Private Right of Way	Between Terminals
Aurora, Elgin & Chicago Railway	Aurora and Elgin to Chicago, Ill	88	80	35
Chicago, Milwaukee Electric Railway	Evanston to Waukegan, Ill	49	36	26
Indiana Union Traction Company	Indianapolis to Marion, etc., Indiana	243	161	57
Indiana Union Traction Company	Indianapolis to Kokomo, etc., Indiana			53
Indianapolis & Cincinnati Traction Company	Indianapolis to Rushville, Ind	40	34	38
Indianapolis & Northwest Traction Company	Indianapolis to Lebanon, Ind	64	60	38
Lake Shore Electric Railway	Toledo to Cleveland, Ohio	160	75	119
Toledo, Bowling Green & Southern	Toledo to Finlay, Ohio	41	30	40
Toledo & Indiana Railway	Toledo to Bryan, Ohio	55	55	55
Toledo & Western Railway	Toledo to Adrian and Pioneer, Ohio	78	72	58
Western Ohio Railway Company	Lima to Celina and Minster, Ohio	78	64	55
Cleveland & Southwestern Traction Company	Cleveland & Norwalk, Ohio	130	90	57
Cleveland & Southwestern Traction Company	Cleveland to Wooster, Ohio			60
Eastern Ohio Traction Company	Cleveland to Levittsville, Ohio	117	90	56
Eastern Ohio Traction Company	Cleveland to Chardon, Ohio			34
Columbus, Delaware & Marion Railway	Columbus to Marion, Ohio	55	50	47
Columbus, London & Springfield Railway	Columbus to Springfield, Ohio	73	38	49
Dayton, Springfield & Urbana Railway	Dayton to Springfield and Urbana, Ohio	54	42	42
Dayton & Northern Traction Company	Dayton to Greenville, Ohio	40	34	40
Interurban Railway & Terminal Company	Cincinnati to Lebanon and New Richmond, Ohio	101	73	40
Detroit United Railway	Detroit to Pontiac, Mich	381	94	34
Detroit United Railway	Detroit to Flint, Mich			68
Detroit United Railway	Detroit to Farmington, Mich			28
Detroit, Port Huron & Shore Line	Detroit to Port Huron, Mich	107	49	73
Detroit, Ypsilanti, Ann Arbor & Jackson Railway	Detroit to Jackson, Mich	91	38	76
Lansing, St. John & St. Louis Railway	Lansing to St. John, Mich	38	36	36
Grand Rapids, Holland & Lake Michigan	Grand Rapids to Holland, Mich	69	39	40
Grand Rapids, Grand Haven & Michigan	Grand Rapids to Muskegon, Mich	46	35	40
Utica & Mohawk Valley Railway	Rome to Little Falls, N. Y	114	90	42
Hudson Valley Railway Company	Albany to Warrensburg, N. Y	128	88	65
Albany & Hudson Railroad	Albany to Hudson, N. Y	42	40	40
International Railway Company	Buffalo to Lockport and Alcott, N. Y	223	34	40
United Railway Company	Baltimore and suburbs, Maryland	365	165	..
Birmingham Railway & Power Company	Birmingham to Bessemer and Pratt County, Ala	110	61	..
Pacific Electric Railway Company	Los Angeles to Pasadena and L. B., Cal	88	56	..
St. Louis Transit Company	St. Louis and suburbs, Missouri	361	41	..
Northern Texas Traction Company	Dallas to Fort Worth, Tex	62	42	35
Lackawanna & Wyoming Valley	Wilkesbarre to Scranton, Pa	45	45	22
Wilkesbarre & Hazelton Railroad Company	Wilkesbarre to Hazelton, Pa	28	24	28
Seattle & Tacoma Interurban Railway	Seattle to Tacoma, Wash	40	33	36
List B.—Steam Railways	**Location of Division**			
New York, New Haven & Hartford Railroad	Providence, Warren and Bristol Branch, R. I	44	44	34
New York, New Haven & Hartford Railroad	Stamford and New Canaan Branch, Conn	9	9	8
New York, New Haven & Hartford Railroad	Nantasket Beach Division, Mass	40	40	20
New York, New Haven & Hartford Railroad	Hartford, Bristol and Plainville, Conn	26	26	20
Colorado Springs & Cripple Creek District Railway	Cripple Creek to Vistor, Col	12	10	10
Cincinnati, Georgetown & Portsmouth	Cincinnati to Georgetown, Ohio	49	49	47
Peoria & Pekin Terminal Railway	Peoria to Pekin, Ill	9	9	9
Los Angeles & Redondo Railway Company	Los Angeles to Rodondo, Cal	23	23	23
Baltimore & Ohio Railway Company	Baltimore tunnel and vicinity, Maryland	9	9	6
Boston & Maine Railroad Company	Concord and Manchester Division, N. H	17	17	17
Cincinnati, Hamilton & Dayton Railroad Company	Findlay-Delphos Branch, Ohio	20	20	20
Dayton, Lebanon & Cincinnati Railroad Company	Lebanon to Cincinnati, Ohio	26	26	25
Chicago, Burlington & Quincy Railway	Deadwood and Lead City Branch, S. D	4	4	4
Fonda, Johnstown & Gloversville Railway	Gloversville to Schenectady, N. Y	124	72	33
Canadian Pacific Railway	Ottawa, Hull and Alymer Division, Quebec	26	20	20

one way of sizing up an interurban or suburban railway, which caters to through passenger and freight traffic, is to note what proportion of the road is on a private right of way. It is admitted that there are not ten heavy electric railways in the country which use a private right of way from one end of the line to the other. This article is an argument for a complete right of way. The future will show that the best heavy electric railroads will not use city streets.

The accompanying table gives some of the first-class electric and steam railways using electricity for motive power on a private right of way. The data was compiled from the June 30, 1902, United States Census Report, and from recent articles in the Street Railway Journal and other sources. It does not include a large number of roads built during the summer of 1903, which are not yet in operation. The data is approximate, yet is the best obtainable from the above sources and is free from any intentional exaggeration.

BRAKES AND SAND

BY EDWARD C. BOYNTON

Attention has recently been called to the necessity of an emergency brake on heavy interurban cars, to be used only in case of danger. That such a necessity exists is well known, and it is becoming more apparent every year.

It is perhaps safe to say that about nine-tenths of the heavy double-truck cars recently built, and now building, are equipped with some kind of a power brake, usually worked by compressed air, in addition to the hand brake. The latter is retained, and rightly, too, for use when some part of the air brake mechanism becomes disabled. But if, as is generally the case, the braking power of the air brake is properly proportioned to the weight of the car, which means that all of the power possible is supplied to the brake without locking the wheels, no advantage can be obtained by utilizing the hand brake, as the additional power would only skid the wheels. This is true whether the hand brake is connected to the regular air brake rigging, as is usually the case, or to a separate rigging with an independent set of brake-shoes. The ordinary hand brake, then, is not an emergency brake except when used upon failure of the air brake.

A brake consisting of one or more drums on the axles, with power applied to straps on their circumference, or a pair of discs, one of which is keyed to the axle and are brought into contact with heavy pressure, or combined with a magnetic effect, as in the ordinary electric brake, are not true emergency brakes, for their additional power is conveyed directly to the wheels and would skid them.

It is evident, then, that emergency brakes, those which give additional stopping power to the car, cannot be applied directly to the wheels, but must be applied to the track. Exclusive of the track brake, then, the stopping power of a car is limited by the amount of power required to skid the wheels, however applied.

The reversing of motors is probably more common than it used to be, for the reason that motors of the present time are much better able to stand the strain, and injury to them is rare. This is partly accounted for by the almost general use of circuit breakers on modern cars.

It is not uncommon that the brakes on a car become disabled, and the motorman finishes a trip, making all stops, by careful reversing. With most of the ordinary controllers the time necessary to change from full speed ahead to a notch or two in reverse is not over two seconds.

It has been demonstrated by careful experiments that a shorter stop can be made by the proper application of a good power brake than by reversing the motors on the same car. This was long ago proved by experiments with steam locomotives equipped with good driver and tank brakes, and most steam roads have issued orders not to reverse a locomotive under any circumstances if the air brakes are in good order.

It is well known that after a powerful application of the brake is made a retardation is felt; then if the wheels skid, the car shoots ahead as if the braking power had been suddenly diminished. If the wheels are allowed to continue skidding until the car comes to a stop, the distance required will be considerably greater than if the brake had less power and the wheels had not locked. The difference has been explained by the theory that skidding is simply a sliding friction between the wheel and the rail, whereas, when the wheels roll over the rails the infinitesimal irregularities in the wheel fit into those in the rail, somewhat in the same way that two gears mesh into each other.

Clean, dry sand, when properly applied, forms probably the best real emergency brake known to-day, especially on a slippery rail.

The one thing in the equipment of a heavy interurban car which seems to have failed to keep pace with the other many improvements is the arrangement for sanding the track. There are many difficulties to be overcome before a perfect sander can be designed.

A large number of so-called improvements have been made in the sand-box on the car, consisting of a variety of knives, choppers and slides, for cutting up the lumps, stirring the sand and allowing the proper amount to escape from the box when the levers are operated by the motorman. These may all be improvements, but the inventors stopped there, seeming to care little whether the sand reached its proper destination—on top of the rail just ahead of the wheels.

On a single-truck car the straight vertical sand pipe, about 2½ ins. inside diameter of rubber hose or spring wire on the right side of the car only, answers the purpose fairly well, when the pipe is aimed at the rail. Then some of the sand may stay on top of the rail until the wheel reaches it, if the rush of air does not blow it all away.

To put the same arrangement on a heavy double-truck car, as is usually done, is almost useless. Some attempts have been made to turn the sand pipe back nearer the truck, so that on a calm day, when the car is running slowly, a little sand will lodge on the rail if the car is on a tangent, but if the car is on a curve the sand is generously distributed anywhere, from the middle of the roadbed to the drainage ditch at the side.

Pneumatic sanders are a move in the right direction, and they will, no doubt, be improved in the future. Many cars have been and are being equipped with them. They are very successful on steam locomotives, because conditions are entirely different. The sand is kept warm and dry on top of the boiler, and the driving wheels are on a rigid base and do not swing, as does pivoted truck, so the sand pipe does not have to follow the truck.

The point to be desired is, if the sand-box is on the car the nozzle of the sand pipe should be attached to the truck and swing with it in such a way that it is always able to deposit the sand on the rail just ahead of the wheels. Various attempts have been made to do this, both with gravity and pneumatic sanders, but with indifferent success. It seems to necessitate a flexible hose connection between carbody and truck. When this is tried with a gravity sander, the length of the hose connection is so great that the sand will not run, and when used with air pressure the hose often becomes choked with sand.

On a certain interurban road in New England an arrangement is in use which seems to be the best yet devised. Attached to the front frame of the truck are two elongated hoppers, one on each side, from the bottom of which projects the sand pipes. These are held in the proper position by suitable clamps. The hoppers are about 18 ins. long and 4 ins. or

5 ins. wide, the longer dimension being across the track. Ordinary gravity sanders are used, located inside the car, the discharge pipes of which lead down into the hoppers on the truck, but do not touch them. It is easily seen that it is possible to get the sand on the rail with this arrangement whatever the position of the truck.

The best plan would seem to be, if it has not already been put into use, to use the truck hopper as above, supplemented by pneumatic sanders discharging into them.

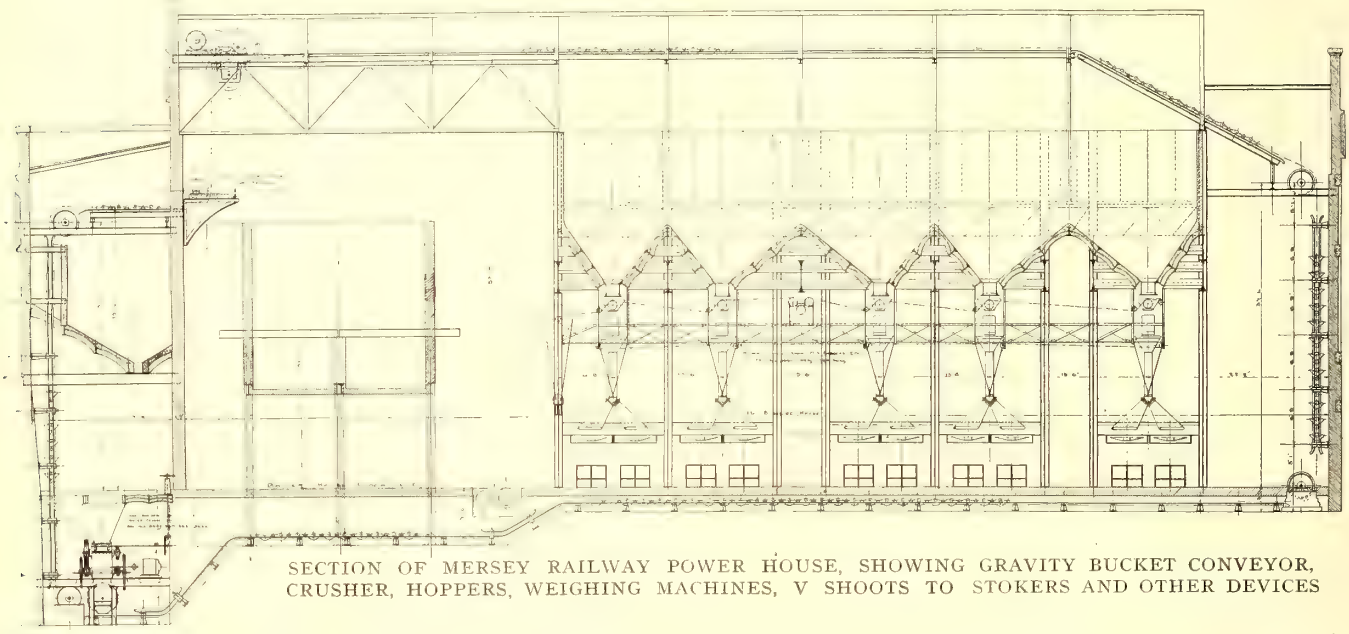
CONVEYORS IN MODERN BRITISH POWER HOUSES

BY ARCH. J. S. B. LITTLE

The province of this article is to show how improved methods of transporting materials in large power houses have increased the productive power of a given period with a reduction in human toil. Several British installations, designed and erected by the New Conveyor Company, Ltd., of Smethwick, Birmingham, England, will be described, as it is with these that the writer is personally familiar.

One of the largest power houses is located in Central London, and has for its object the supplying of electricity to the surrounding district. The coal is brought into the yard in railway trucks of 10 tons capacity, and is of the quality known as washed nuts. It is so carried that the railway car can be emptied in a few minutes by dropping the doors. From this point the machinery comes into play. A hopper capable of holding one truck load is placed with the top level with the rails, and on the fuel being dumped therein, an attendant operates a valve, which on once being fixed acts as a constant regulator to the conveyor, so long as there is no variation in the class of coal. A subtruded filler is found next to the valve, and being of unusual pattern, merits description. It consists of two plates about 3-ft. diameter, mounted on a 3-in. shaft, receiving motion from the conveyor chains, and having bolted to the peripheries a number of division plates of angular section, which close the spaces between the buckets but leave openings to feed them. When parts are assembled the filler looks like a drum, 3 ft. in diameter, with a number of funnels equidistant on the periphery, and there is a hole about 18 ins. in diameter in one of the side plates through which coal is introduced by a spout. Egress is possible only at one funnel at a time, under which and along with it moves a bucket, and the drum being rotated at a suitable prearranged speed the succeeding funnel commences to deliver into the following bucket, as soon as the filled one passes away, by which time the funnel coming away from this bucket has ceased to discharge coal. By means of this simple contrivance the buckets are filled regularly and equally without spilling, and, needless to say, should the conveyor for any reason come to a stand, the run of coal to buckets is suspended.

The conveyor itself, as the foregoing description indicates, is that known as the gravity or swingable bucket type, for which double chains are employed as the means of transport. These chains are kept parallel at a required distance to allow buckets with a capacity of 100 lbs. to freely swing on pins placed 2-ft. pitch, the space between buckets being partly filled by the cross-stay just referred to. Each chain has double links, formed of flat Siemens-Martin steel bars, having tube distance pieces for the chain pins at 12-in. pitch, these being shouldered down at each end, so that the outside links are not jammed against the inner ones when the pins are riveted over. These pins are also reduced at ends, so that the riveting makes them solid with the outside links, while the bushes or distance pieces are tight in the inner ones, thus ensuring a broad wearing surface for the joint pins. To make the friction as low as possible, rollers are introduced into each link, and an improvement has been affected by running these on pins in the body of the link instead of as formerly putting them on the joint pins. That is, a new pin or roller can be put in without uncoupling the chains. These roller pins are made to project into the space between the two chains to carry the buckets. The shoulder on one side and a split cotter behind a washer on the other holds the pin in position. The eye of the roller is recessed to allow for efficient lubrication, the space being filled with absorbent packing. The oil is introduced through a hole drilled at an angle, and the inside edge is ¼ in. nearer the center than the bottom of recess, so that in whatever position the roller stops the oil cannot run out of the hole. Before closing the description of the chains it is necessary to add that further pins are put in with head and cotter at respective ends, and are solely used as driving pins for the chain wheel which drives the filler drum. They are covered with tubes, these being plain on ends and allowed to revolve freely, to ensure long life and little friction. Next in importance to the chains are the buckets. The style used in America comprises two 3-16-in. steel side plates flanged to take the 3-16-in. bottom plate, and having riveted to the sides two cast-iron ribs made to act as bearers and tippers. In England several variations occur in the design and material. On the Newport plant they are cast in one piece and annealed, and on each side malleable cast-iron brackets are secured with counter-sunk bolts, and at the lower end is a roller working on a pin. This roller is used for tipping the buckets. When it is stated that these buckets and brackets cost about double the



SECTION OF MERSEY RAILWAY POWER HOUSE, SHOWING GRAVITY BUCKET CONVEYOR, CRUSHER, HOPPERS, WEIGHING MACHINES, V SHOOTS TO STOKERS AND OTHER DEVICES

riveted ones, it will be conceded that engineers should pause before specifying the former. On the plant at present being described a combination of the two has been found acceptable by the engineer and to the contractors. Here there are two stamped steel sides and a steel-bottom plate. On each side plate are brackets having two bosses, one to take the swivel pins in chain and the other to take the pin to carry the tipping rollers. On the Central Electric station job there are three conveyors, two being designed to feed the coal to bunkers and take ashes from boilers and one for coal alone

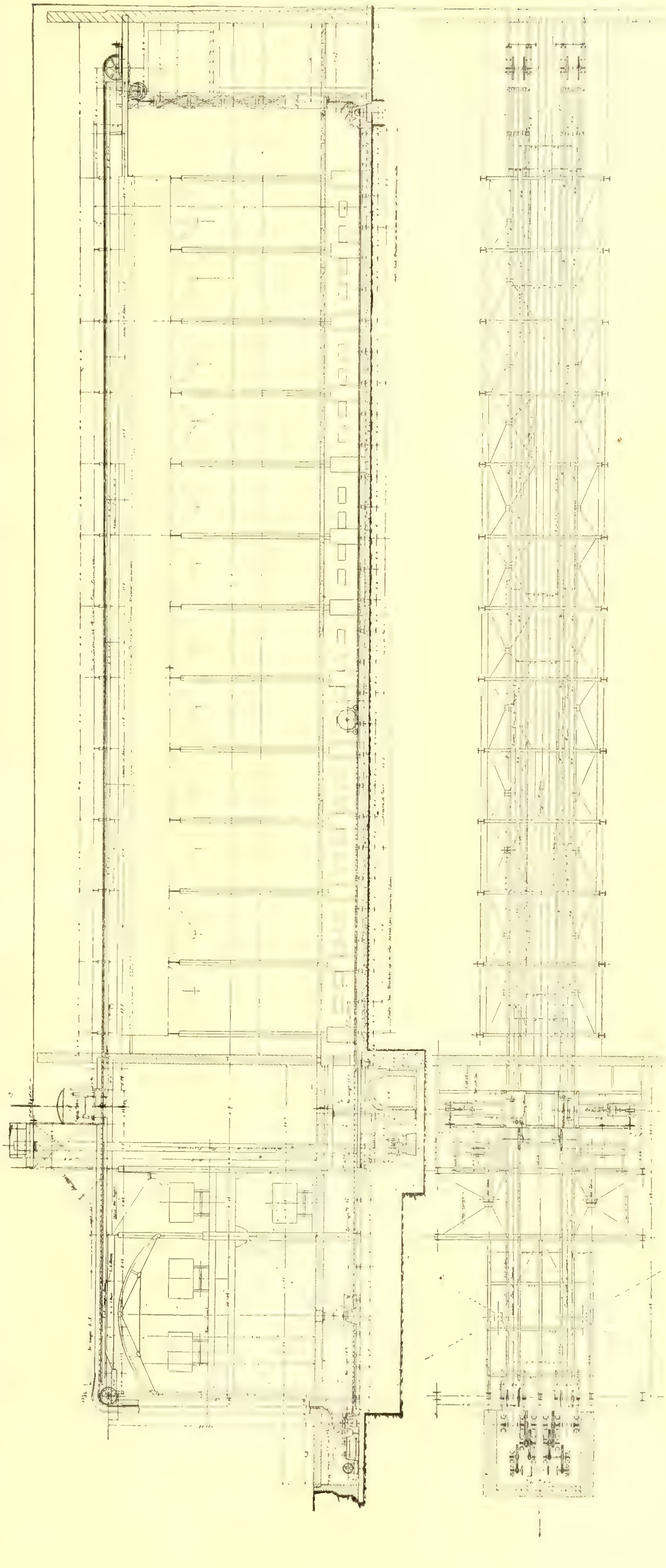
The run of the conveyor is as follows: Starting from the hopper under trucks the conveyor passes under the subtruded filler, clear of the siding, and then rises up the side of the ash tank and over the same to the boiler house wall. At this point is placed a continuous automatic weighing and recording machine. The horizontal top-run of the coal conveyor above the firing floor level can deposit its coal to a number of points so as to completely and automatically fill the bunkers, which are situated over the boilers. At the end of the boiler house the conveyor run descends below the firing floor, under which it passes to allow ashes from boilers to be dumped through grill openings and down chutes which direct the refuse by way of a traveling filling drum into the buckets, which, thereupon, transport it along to the end of the house, down and under the coal filler (which, of course, is raised out of the way when this is being done), and, finally, as before mentioned, the conveyor returns over the hopper outside the building in which the ashes are located until a quantity is stored sufficient to fill several trucks. The driving mechanism is operated by a dust-proof electric motor, furnished with three sets of cut-steel gear-wheels.

Perhaps one of the most interesting power houses in England is that in Birkenhead, in which the power is generated for operating the electric cars on the Mersey Railway. It is designed to work with hardly any labor, and very little attention, everything being on the most up-to-date lines, as the following brief description will show.

The boilers are of the Stirling type, nine in number, and built on the ground floor. Each furnace is fitted with Roney stokers—which were first tried in England at this station. The grate is inclined, and the moving bars gradually conduct the fuel to the rear of the combustion chamber, where it falls in its residual state into an ash pit. From the ash pit it is raked to the conveyor run, to which it passes through grill openings down directing funnels.

An interesting problem arose on this plant owing to the extremely hard nature of the ground, which consists of solid rock, and this meant a new form of gravity bucket conveyors to do away with a traveling filler.

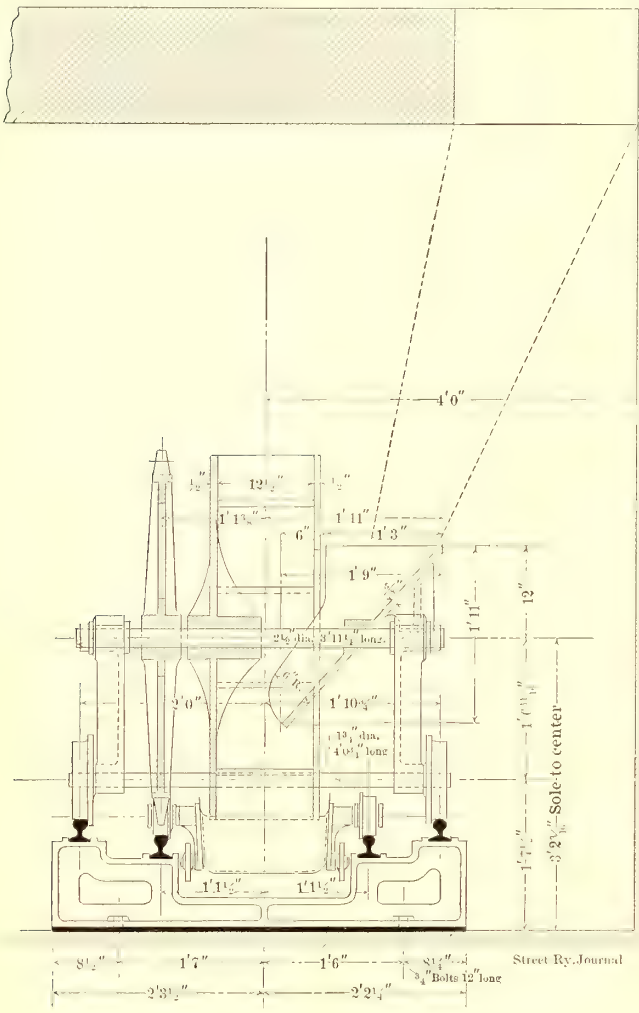
In this installation the coal siding is above the firing floor, and is situated at one end of the boiler house, between the ash hopper and the coal bin, the trucks thus being shunted to a point which is on a center line equidistant from



GENERAL ARRANGEMENT OF GRAVITY BUCKET CONVEYORS FOR MANCHESTER CORPORATION

the two rows of boilers, this line representing the run of the conveyor. Under the railroad is a hopper and chute, capable of containing two truck loads of coal and directing the same to an auxiliary hopper, which has its top level with the firing floor, making it easily accessible to the chargeman.

Commenting on this arrangement of double and distinct auxiliary storage hoppers, it may be well to draw attention to the principal advantage, which lies in the accuracy with which large loads of coal can be quickly discharged, temporarily stored and fed to the conveyor, the intervening chute between the two rendering each distinct and positive, for, if the first hopper jams through arching of wet coal, the fault at once becomes apparent, and, while it is easily rectified, the second hopper holds



CROSS SECTION OF PORTABLE FILLER

a sufficient supply to keep the traveling buckets fed. This point should not be overlooked, as it enables the engineer to reduce the size of his traveling and most expensive portion of the plant, if he can rely upon it being continuously and regularly fed.

From the second hopper, that is, the one under firing floor, the coal, regulated by a door, passes through a crusher, driven by a 7-hp motor, equipped with positive gearing, which reduces the fuel to a size suitable for the stokers, that is, small enough to pass through a 2-in. diameter ring. From the crusher the coal descends further through a revolving filler, which feeds the buckets without spilling. Unfortunately, owing to the fact that sometimes large coal must be used, the crusher had to be put in, and this caused the cutting of the large pit shown, which was no easy matter.

Referring to the buckets, it will be remembered that in connection with the ash trench it was advisable to have the latter as shallow as possible on account of the difficulty in working the ground. To help in this it was decided to do away with the usual traveling filler, so, of course, special buckets had to be designed which would allow of ashes being fed direct to the same without a revolving filler. The buckets are built with only ⅛-in. clearance between the edges and the cross-bars between the chains, and to help in this desire to avoid spilling, special chutes with contracted side plates were made to fit close down on to the buckets, which are thus prevented from swinging more than ½ in. when passing under grill openings. The coal handling part of the plant is similar to the one previously described. The somewhat difficult nature of the run can best be observed from the illustration.

The second plant illustrated is that furnished by the New Conveyor Company, Ltd., for the Manchester Corporation. This conveyor handles both coal and ashes, and is furnished with weighing machines, traveling fillers, etc.

THE DEVELOPMENT OF RAILROAD BRAKING*

BY R. A. PARKE

Probably the earliest form of power brake was that, provided for emergency use only, upon passenger cars, known as the Creamer brake. It consisted of a spiral spring, enclosed in a drum upon the brake staff at one end of the car, and so provided with ratchet wheels and pawls that the spring might be wound up in an opposite direction to that of the brake staff for applying the brakes; and, when subsequently released by a pawl, the brake staff was caused to turn and apply the brakes. The pawl for releasing the spring was so connected by a cord with the ordinary bell cord running throughout the train, that pulling the bell cord in the direction to signal the engineer by the gong did not affect the apparatus; but when the bell cord was pulled in the opposite direction from any point on the train the pawls were operated upon all of the drums toward the rear, and the brakes upon the corresponding cars were applied. This emergency apparatus, while, of course, thus partially available at any point on the train, was more particularly effective when operated by the engineer himself. When the necessity arose the engineer, by reaching up and pulling upon the bell cord, could cause the prompt application of the brakes upon all of the cars of the train.

To just what extent the Creamer brake apparatus was actually used, and in what measure it may have served to avoid disaster, it would be very difficult at the present day to ascertain, but the passenger equipment of the New York Central Railroad was for many years provided with this emergency apparatus. Indeed, it was not until after the straight-air brake had been superseded by the automatic, and the latter had become generally recognized as the accepted standard brake for passenger train service, that the Creamer brake was supplanted on the New York Central Railroad by its more satisfactory rival. Whether this form of emergency brake device became generally applied to the passenger equipment of any other railroad than the New York Central, the writer is unable to state.

Other forms of power brake, beside the ultimately accepted standard air brake, were various forms of friction and other buffer-operated brakes, in addition to steam, hydraulic, electric and vacuum brakes, which came into more or less experimental and regular use.

The friction brakes generally consisted of a drum, operated by friction contact with one of the wheels or axles, or a pulley upon the axle, by which it wound up a chain, so connected with the brake gear that the brakes were thereby applied. The friction drum was generally brought into contact with the revolving part, by which it was operated, through the inward thrust of the draw-bar, and was subsequently released by the draw-bar movement in the opposite direction. In one instance the frictional contact was made and broken by means of an electric current,

* Abstract of paper read at the meeting of the New England Street Railway Club, Boston, Dec. 17

so that it was, in one sense, an electric brake. Brakes of this kind were variously tried, more especially in the New England States; but they were subject to the general objections, that the force with which the brakes were applied could not be varied to suit different requirements, and the chain having become wound upon the drum so as to apply the brakes, the revolving part, which actuated the drum, operated to wear spots upon the frictional surface of the drum, which, after a time, interfered with the proper application of the brakes.

Other forms of brake apparatus were also operated by the in-thrust of the car coupler. In one or two cases brakes of this type, generally called "momentum" brakes, attained some prominence and obtained considerable favor. It was not until the series of brake trials, established under the authority of the Master Car Builders' Association, at Burlington, Ia., in 1886, that this type of brake was demonstrated to be hopelessly unsuited for general freight service. In an attempt to operate a train of fifty freight cars down a moderate grade at a uniform speed, the initial application of the brakes having been caused by a moderate application of the driver brake upon the locomotive, the force with which the brakes were applied increased from the front toward the rear of the train, by the increased force with which successive cars pushed forward upon the increasingly retarded portion of train ahead. The increased retarding force upon the cars toward the rear of the train resulted in stretching out the rear portion of the train and releasing the brakes. Thereupon, the successive application of the brakes was repeated, with increasing force from the forward toward the rear end, and so on, these alternate operations resulting in the successive occurrences of severe shocks at the rear end of the train in one direction when the train closed up, and in the other direction as the train became fully stretched out. These shocks were so great as to condemn brakes of the momentum type for general use upon long trains.

Steam and hydraulic brakes have never attained more than experimental consideration for general use upon trains. The chief objection to such brakes has been the complication from the use of fluid, effected by temperature. Steam-driver brakes upon locomotives were, at one time, very extensively used, the simplicity of the apparatus and freedom from the objection to the use of steam upon long trains giving this form of locomotive brake considerable favor. Though the use of steam locomotove brakes has declined in recent years, it has been more because of the general introduction of air brakes, and of the desirability of uniformity of operation of all the brakes upon the train, than because of any unsatisfactory features of the use of a steam brake upon a locomotive.

Vacuum brakes have come into quite extensive use, more particularly upon European and South American roads. In this country one form of vacuum brake was, at one time, in considerable favor. The apparatus consisted principally of an ejector, operated by steam upon the locomotive, by which the air was discharged from a line of train pipe extending throughout the train and communicating with collapsible cylinders, or with vessels covered with a collapsible diaphragm. The air being withdrawn from the receptacles under the cars, the movement of the collapsible parts was utilized to apply the brake-shoes to the wheels. The simplicity of the apparatus was greatly in its favor, and the chief objection was the limited operative pressure—that of the atmosphere—which could be utilized for braking purposes. Large areas were required for exposure to such a moderate pressure in order to secure a suitable braking force upon vehicles of considerable weight, and it thus occurred that this form of power brake was confined chiefly to narrow-gage surface roads and to the comparatively light equipment of elevated roads.

In England, an automatic form of vacuum brake, by which the brakes were automatically applied to all sections of the train when accidentally parted, received considerable favor, and is still employed upon some English roads. The general movement toward the adoption of compressed air as the most satisfactory medium of operation of power brakes has, however, been accomplished by a gradual decline in the use of the vacuum brake, so that, in this country, at least, it has almost entirely disappeared from general service.

Besides the form of electric brake to which reference has already been made, the friction brake electrically operated, electric brakes have been only experimentally employed in general railroad service, and only in combination with compressed air. That is, just as the brake already referred to was really a friction brake operated by electricity, so the other forms have been compressed-air brakes operated by means of an electric current. The difficulty of maintaining thorough insulation of an electric current, which must be provided with detachable couplings between cars, has been a most serious obstacle to the practical application of any system of brakes requiring the employment of such a current upon trains of cars in regular service; and the satisfactory development of the compressed-air brake, into a form which satisfactorily fulfilled all the requirements of both freight and passenger train service, at a time when the forms of electrically-operated brakes were in but the experimental stage, discouraged any effort to introduce electric brakes into general service in the face of so serious an objection.

In the case of a service in which cars are operated singly, such as that of street railways, other forms of electric brake have received more attention, and this kind of service will be referred to again hereafter.

The peculiar advantages of compressed air as a medium for the transmission of power, together with its comparative freedom from objectionable characteristics, has quite naturally resulted in the ultimate selection of compressed air as the operative agent for power brakes upon railroad trains. The first form in which compressed air was so utilized is that now known as the "straight-air" brake, invented by George Westinghouse about the year 1869. It consisted of an air compressor, operated by steam, upon the locomotive, a reservoir upon the locomotive for storing a supply of compressed air, a line of pipe extending throughout the length of the train, with flexible hose and couplings between the vehicles (now customarily called the "train pipe"), and a brake cylinder upon each car, in which operated a piston, the stem of which was so connected with the brake beams by means of a system of levers and rods that the outward movement of the piston caused the brake-shoes to be applied to the wheels. The train pipe connected the reservoir upon the locomotive with the brake cylinders under the cars (the latter being connected with the train pipe by a short branch pipe), and was provided with an operating valve, located at a convenient point in the locomotive cab, for manipulation of the brakes by the engineer. To apply the brakes the engineer turned the handle of his operating valve into a position which admitted the stored air of the reservoir into the train pipe and brake cylinders; and, to release the brakes, the handle of the valve was turned into another position, in which communication between the reservoir and the train pipe was interrupted, and the air in the train pipe and brake cylinders was discharged into the atmosphere.

As the length of passenger trains increased with the development of traffic, the time occupied in transmitting the necessary volume of compressed air from the reservoir upon the engine to all the brake cylinders of the train, and also the time required to subsequently discharge all the air from the brake cylinders into the atmosphere, through the single discharge port of the engineer's valve upon the locomotive, became matters of serious disadvantage. In addition, also, accidental parting of the trains, through derangement of the car-coupling apparatus or rupture of the coupling hose, or any portion of the apparatus by which the compressed air escaped, prevented the

proper application of the brakes, and as this left the rear, at least, of the parted train without control, and as the rupture of the coupling hose or other part of the apparatus was most likely to occur under the greatest pressure—when the maximum effect of the brakes was most desired—serious accidents resulted.

About the year 1876, the defects of the straight-air brake were removed by the original inventor, Mr. Westinghouse, in the introduction of the "automatic" air brake. The apparatus of the automatic air brake included that of the earlier straight-air brake, with the addition upon each vehicle of a reservoir of sufficient capacity to operate the brake upon that vehicle, which became known as the "auxiliary reservoir," and a valve device, called the "triple valve," placed at the junction of the branch pipe from the train pipe with two other pipes, one connected with the auxiliary reservoir and the other with the brake cylinder. The triple valve is the characteristic feature of the automatic brake, and a most ingenious, though comparatively simple mechanism, which operated through variation of air pressure in the train pipe to supply the auxiliary reservoir with compressed air from the train pipe, to charge it for operating the brakes, and to discharge air from the auxiliary reservoir into the brake cylinder to apply the brakes. Release of the brakes, by discharging the air from the brake cylinder into the atmosphere, was effected by the triple valve in the same operation which provided communication from the train pipe to the auxiliary reservoir to charge the latter with air pressure.

The manipulation of the engineer's operating valve was exactly the reverse in the operation of the automatic brake from that required for the straight-air brake. In the automatic brake the maximum air pressure was always present in the train pipe and the auxiliary reservoir when the train was in motion and the brakes in operative readiness. Reduction of the air pressure in the train pipe by the discharge of a portion of the air at the engineer's valve, or in any other manner, caused the triple valve upon each car to close communication between the train pipe and the auxiliary reservoir, and to apply the brakes, by causing air to flow from the auxiliary reservoirs into the brake cylinders. It was this characteristic which caused it to be called the "automatic" air brake. Parting of the train, or any accident to the apparatus, by which air was discharged from the train pipe, caused the brakes to be automatically applied throughout all parts of the train, bringing the train to a stop and requiring such repair or remedy of any defective part, that the air pressure might be restored in the train pipe to release the brakes before the train could proceed. This brake became almost universally employed upon passenger trains in this country, and was also used to a large extent in Europe.

It was not until about the year 1885 that the conditions of general freight traffic appeared to require consideration of the regular use of a power brake in freight train service. Upon the comparatively short freight trains, operated upon the heavy grades of certain roads in mountainous districts, the automatic air brake had been very satisfactorily employed, as had, also, to some extent, even the preceding straight-air brake; but the general employment of a power brake for all classes of freight train service had not, previous to this time, received serious consideration. A committee was at that time appointed by the Master Car Builders' Association of American railroads to experiment with the various forms of power brake that might be presented upon freight trains. This committee conducted the now celebrated Burlington brake trials, upon trains of fifty cars each, at Burlington, Ia., in the years 1886 and 1887. These experiments included trials of practically all the different systems of power brakes that had been invented at that time, and to the surprise of the committee, and, doubtless, to the disappointment of all the inventors, the earlier series of experiments, in 1886, resulted only in the condemnation of every form of power brake submitted to the committee for trial.

The failure of the automatic air brake was due solely to the time required to cause an operative reduction of the air pressure in the train pipe sufficient to operate the triple valves upon the cars at the rear end of the train, by discharging the train pipe air through the engineer's valve upon the locomotive. Efficient and satisfactory as had been the automatic air brake, upon even the longest passenger train, the time required to cause the brake-shoes to be applied to the wheels of the fiftieth car was about 19 seconds after the brake-shoes had been applied to the wheels of the first car. The very material retardation of the forward part of the train, by the application of the brakes so long in advance of their application upon the rear cars, resulted in destructive blows and shocks as the unimpeded rear cars successively plunged forward into the stopping cars ahead.

Again, George Westinghouse provided the solution of this apparently insurmountable obstacle as to the unaided operation of compressed air to apply the brakes throughout the train. By a modification of the triple valve of the automatic brake, in the addition of another valve, each triple valve operated as an additional train-pipe vent valve, whereby the train-pipe air was discharged, and its pressure lowered at each car instead of at the locomotive alone, and the brake-shoes were thereby applied to the wheels of the fiftieth car in but about 2½ seconds after their application to the wheels of the first car.

The quick-action brake is, therefore, practically the old automatic brake, which operates with entire satisfaction for all ordinary brake service upon even the longest trains, together with an added emergency brake, which, when necessity demands it, applies the brakes almost instantaneously throughout the entire train with a force considerably greater than could be satisfactorily employed in the ordinary everyday brake service. The quick-action air brake has become the standard for freight service, and is now in operation upon practically all freight trains in this country.

A further development of the air brake is one which provides an efficiency superior to that of the quick-action brake for use upon high-speed passenger trains. In the course of a series of experiments, conducted in England by Captain Douglas Galton, in behalf of the Institution of Mechanical Engineers, with apparatus constructed and operated by Mr. Westinghouse in 1876, the static friction between the wheel and the rail, by which the wheel is caused to rotate, was found to be practically the same at all speeds. But the dynamic friction of the brake-shoes upon the rotating wheels was found to vary inversely with the speed, being materially less with the same pressure upon the wheels at high speeds than at low speeds. Such a condition as this, by which the force which causes the wheels to rotate is the same at high speeds as at low, while the retarding force, caused by the friction of the brake-shoes, is less at high speeds, established the importance of employing a greater pressure of the brake-shoes upon the wheels at high speeds to compensate for the inferior coefficient of friction. The apparent difficulty of regulating the brake-cylinder pressure so that one suitable for high speed should become reduced before the speed of the train became sufficiently reduced to cause sliding of the wheels thereby, resulted in no practical utilization of this principle until years afterwards, when the conditions of fast passenger service in this country appeared to demand greater brake efficiency than that afforded by the quick-action brake. About the year 1891 the "high-speed" brake was introduced into service upon high-speed passenger trains, and has since become applied to a large number of trains of that class. It consists merely of the quick-action air brake, with the addition of an automatic brake-cylinder reducing valve, by means of which the air pressure is not permitted to exceed the ordinary limit in service application of the brake, but which permits a considerably higher brake-cylinder pressure to occur in the beginning of an emergency application, and automatically reduces that pressure to a safe limit when the speed of the train has become materially reduced.

Thus far, reference has been made only to brakes for steam railroad service. Power brakes for use in street railway service never received serious consideration until the employment of something more efficient than animal power for locomotion. With the advent of cable propulsion upon the South Side street railroads in Chicago, a friction brake was introduced, consisting of a drum, operated by contact with a friction wheel upon an axle, under control, through a lever, by the gripman, which wound up a chain and thereby applied the brakes. By means of levers and chain connections the drum upon the motor car was thus utilized to apply the brakes, also upon one or even two trailing cars. This form of brake operated quite satisfactorily for a number of years.

Later, several attempts were made to introduce a form of air brake in street railway service. A compressor was usually operated by power derived from the axle, and the apparatus consisted, farther, of a storage reservoir, a brake cylinder and an operating valve, placed within reach of the gripman or motorman, in a line of pipe leading from the reservoir to the brake cylinder. This apparatus was substantially the old straight-air brake, and differed essentially from that form of brake as formerly used in steam railroad service only in the air compressor being axle-driven instead of steam driven. Since that time a very notable change has taken place in the conditions, almost everywhere existing, in the operation of street railways. Several different air-brake systems have been introduced into street railway service with various degrees of success, and two or three forms of electric brake have also been introduced into electric railway service. In general, the air-brake apparatus has been of the straight-air type, differing only in the details of the apparatus, and requires no special mention.

The forms of electric brake have generally utilized, for a large measure of the retarding force, the back torque of the car motors, resulting from instituting a short circuit through them and causing them to operate as generators. In addition, in one case, a disc is placed upon the axle and brought into frictional contact by magnetic means with another disc operating as a brake shoe. Such forms of electric brake have been capable of securing a high retarding power, and would, doubtless, have received much more extensive approval if it were not for the evil heating effects of the use to which the motors were subjected. It is generally the case that the motors in street railway service are loaded well up toward their full capacity, and subjecting them to the additional heating effects of reversal, for braking purposes, has been frequently found to result in burning out the armatures and otherwise damaging the apparatus.

One form of electric brake combines such unique and interesting features and attains such an extraordinary efficiency that it deserves special mention. This form is the so-called "electromagnetic" brake, which combines the ordinary wheel brake with a system of track brake-shoes, and, incidentally, also, provides for heating the car when desired. Briefly, the operation of braking consists of the generation of but a moderate current by the motors operating as generators, which energizes an electromagnetic track brake-shoe, and thereby draws it down into frictional contact with the rails. The frictional retarding force of the track brake-shoe is communicated, as the source of power, to a system of brake shoes upon the wheels, so that the vehicle is subjected to the three retarding influences—of the wheel brake-shoes, the track brake-shoes and the back torque of the motors. The adjustment of the brake apparatus is such that the required retardation is secured with but a moderate current through the electromagnets of the track brake-shoes, and the requirement of the motors as generators is so moderate that the back torque amounts to little, if any, more than is required to overcome the rotative energy of the armatures. Thus, the chief objection to the forms of electric brake which rely, to a large extent, upon the back torque of the motors, has but little, if any, force in this case.

The employment of track brake-shoes with this apparatus justifies a brief consideration of that means of frictional resistance to the movement of a vehicle. Track brake-shoes have, from time to time, been suggested, and, to some extent, experimentally employed in times past. The frictional resistance of track brake-shoes to the motion of the car, necessarily involves corresponding pressure of the shoes upon the rails, and this pressure can, in ordinary cases, be supplied only from or by the car itself. In whatever degree the car is caused to press downward with its weight upon the track brake-shoes, the pressure or weight ordinarily supported by the wheels is correspondingly reduced. Thus, any combination of track brake-shoes with wheel brakes acquires the retarding efficiency of the track brake only at the expense of correspondingly reduced efficiency of the wheel brake. But the case is even worse than it would appear from that statement, for the static friction of the wheels upon the rails is always greater than the dynamic friction of the brake-shoes upon either the wheels or the rails, and as the adhesion or static friction of the wheels upon the rails is the measure of the possible retarding friction of the wheel brakes, loss in the combined efficiency of the two systems of brakes inevitably results, where the inferior dynamic friction of the track brake-shoes is acquired by the necessary reduction of the static friction of the wheel upon the rails, through transfer of a portion of the weight of the vehicle from the wheels to the track brake-shoes. The track brake has, therefore, never been brought into regular practical service except in certain special cases, in which a track brake system has been independently applied, as an emergency apparatus, to be used only in the event of failure of the wheel-brake system.

In the electromagnetic brake, however, the friction-producing force with which the track brake-shoes press upon the rails is not acquired by transfer of weight from the wheels, but is obtained by means of an electromagnet, through which the brake-shoes are caused to descend in opposition to the resilience of the springs which support these shoes; and, thereby, the weight or pressure of the car upon the wheels is actually increased instead of being reduced. It thus occurs that, at least, the full efficiency of the ordinary wheel brake is realizable in this brake system, and the retardation effected by the track brake-shoe system is an added means, whereby the stopping efficiency of the electromagnetic brake exceeds that of any brake apparatus hitherto projected.

There are incidental features of the electromagnetic brake which deserve mention. While the danger of sliding the wheels may readily be restricted to less than that of the ordinary wheel-brake system, and with a still superior retarding effect of the system, as a whole, it will be observed that if the wheels should, from any cause, begin to slide upon the rails the current-generating motors will also cease to revolve and generate current, so that the brakes will be promptly released until the wheels begin again to rotate, and injurious wheel sliding is thus a practical impossibility.

An interesting feature of the electric brake, in which the operating current is supplied by the car motors, is the decline of the current, and, thereby, the decline of the brake-shoe pressure as the speed declines, in which respect the conditions approach those of the "high-speed" air brake.

It is, of course, a necessary consequence that when the wheels have ceased to rotate in coming to a stop, the current from the motors which initiates the brake resistance also ceases. If the car stops upon a grade of any importance it may be necessary to apply the hand brake to prevent the car from starting. It is believed that this is a desirable feature, rather than otherwise, because the occasional use of the hand-brake will serve to maintain familiarity with its use, and prevent that loss of presence of mind and of efficient action that has, more than once, resulted in disaster in steam railroad service, when, through some neglect, the air brakes have not been under the control of the engineer and he has whistled for hand brakes.

If occasional use of the hand-brake were necessary in steam railroad operation it is believed that it would prove an advantage of no little importance in the long run.

CORRESPONDENCE

GEARLESS MOTORS ON THE NEW YORK CENTRAL

London, Dec. 15, 1903.

Editors Street Railway Journal:

In your issue of Nov. 28 you state that gearless motors are to be used in the New York Central Railway conversion. This statement will, I believe, come as a surprise to many readers, both in America and abroad, and especially to those who have in mind the recent experience of the Central London Railway. The original locomotives for this road were equipped with gearless motors, and so severe was the pounding on the rail-joints produced by the large non-spring-borne loads, that the company soon after adopted geared-motor locomotives, and finally multiple-unit trains, eventually scrapping the entire locomotive equipment, costing £70,000 but a short two years previously. The resulting benefits were immediate, to both permanent way and rolling stock. With gearless motors, not only the armatures but the field magnets must be rigidly supported, and if to this be added the increased size and weight of the direct-driving motor, due to its considerably reduced speed for a given size of driver, the resultant non-spring-borne load becomes very large.

On the Central London Railway, with an eight-wheeled locomotive of 800 hp, and a 200-hp motor on each pair of the wheels, the springless load was about seven English tons (7.8 American tons) per pair of 42-in. wheels. One shudders to think of the amount on the 2200-hp locomotives proposed.

Unless some method of concentric spring suspension and drive, similar to that proposed by Ganz & Company for their District Railway scheme, be adopted, it is but reasonable to predict future troubles; troubles, not only with the permanent way and rolling stock, resulting in increased maintenance charges and decreased life, but possible and even probable litigation arising from vibration, caused to abutting property, with its attending settlements.

G. Rosenbusch, A. M. I. C. E.

SERIES-PARALLEL CONTROL WITH FOUR MOTOR EQUIPMENTS

Milwaukee, Dec. 17, 1903.

Editors Street Railway Journal:

I would like to inquire what practical objections there are to arranging the control of four motor equipments so that when the car is first started the four motors will be in series. It seems to me it would be very desirable on fast interurban cars if the motors could be run all four in series on the first points, later throwing two in series and two in multiple, and finally throwing all four in multiple, instead of the present common arrangement which starts the car with motors two in series and two in multiple. This would do away with the necessity of running on resistance points when passing through cities as is now necessary with high-speed interurban cars. For example, an interurban car geared to 40 m. p. h, 50 m. p. h. or 60 m. p. h. will run 20 m. p. h., 25 m. p. h. or 30 m. p. h. at the slowest speed point at which it can be run with resistance out, which is entirely too high for city streets. Furthermore, accelerating a heavy car of this kind up to speeds permissible in city streets, with motors two in series and two in multiple, calls for practically double the amount of current that would be required with the motors four in series. Frequently heavy interurban cars are a serious drain on a small power house supplying a city system. In some cases a separate trolley wire has been provided for the use of the interurban cars, mainly on this account. I am aware, of course, that a platform controller which would provide for starting the motors four in series and running them four in multiple at full speed would require a large number of contact rings and would probably be very cumbersome, but I do not see why this practice could not be introduced with advantage with the train control systems that are coming into use for the control of heavy interurban cars. There may be some objections to this plan which are not apparent, and I would like to see an expression of opinion from operating and manufacturing companies as to its feasibility.

Richard C. James.

POINTS ON CONTROLLER HANDLING

544 La Salle Avenue, Chicago, Dec. 17, 1903.

Editors Street Railway Journal:

Regarding the recent discussion that has been going on in the columns of the Street Railway Journal on the value of reversal as an emergency stop, it seems to me that reversing is only of value when a car is going at a slow rate of speed, say below 8 m. p. h. At speeds higher than this there is great liability that the sudden rush of current would blow the fuse or open the circuit breaker of the car, and dependence might better be placed on the brakes. Personally, I am a believer in track brakes for emergency stops, and hope some day to see this form of brake put where it is available for general use by street railway companies. I think that in the minds of a great many motormen there is a misconception as to the value of reversal, due to an idea in the minds of the non-technical public that reversal is always the proper thing in an emergency. This idea is, of course, a relic of old steam railroad days, before air brakes came into use, when about the only thing a locomotive engineer could do to aid in stopping his train was to reverse.

I have heard of a number of cases where complaint has been made about "the fireworks on the front platform," due to the arcing and burning of controllers. It is noticeable that the cars which have the most trouble in this respect are on roads operating four-motor equipments under long double-truck cars, without the use of air brakes. The motormen on such cars have more than the ordinary temptation to "plug the motors," when they are obliged to make a quick stop, because this plugging is accomplished so easily on a four-motor equipment, by simply throwing off current and pulling the reverse handle. Of course this is terribly hard on the motors, but would not injure the controller, and we would not hear of the "fireworks on the front platform" were it not that the reversing switch is again thrown before the motors come to a stand-still, and since the reversing drum has no magnetic blow-out, a very destructive arc is the result. Cars heavy enough to carry four-motor equipment ought to be equipped with air brakes; although their absence is not a justification for the abuse of the controllers and motors by motormen.

The saving possible on some roads by properly instructing the motormen and seeing that they carry out instructions is little realized. I found on some properties of which I have had the management in the past, that some very peculiar ideas and misconceptions were prevalent among motormen, and that by calling their attention to these matters in a firm but kind way, together with proper supervision and inspection and noting the condition of motor equipment as turned in by various motormen, an astonishing saving in fuel and maximum load can be made. I have in mind one road in particular where 30 per cent reduction in fuel bill was made by this and by improvements in the return circuit. The maximum load was running in the neighborhood of 60 amps. per car operated on a forty-car road. This maximum was reduced nearly 50 per cent, which, of course, made a material reduction in the amount of generating machinery operated at the power house. C. E. Flynn.

CONDUCTORS' SAFES

The question of handling conductors' remittances in the most convenient and satisfactory manner has engaged the serious attention of nearly every street railway manager, and has been discussed at the annual meeting of the Street Railway Accountants' Association for several years. As to the advantages and disadvantages of the receiver system and the bag system, many experts are strongly in favor of the bag system. In commenting on the discussion on this subject at the last Accountants' meeting, one of the leading members, formerly auditor and now general manager of one of the largest street railway systems in this country, stated that his company had saved $12,000 a year by adopting the bag system. Much time is saved by the bag system, because, with the receiver system in use the conductors are obliged to wait in line to deposit their money, and have it checked off by a clerk. Besides this, the money must be handled twice under the receiver system before it reaches the main office. Where the bag system is used the conductor simply seals his package and deposits it in a safe. The money is transferred from the safe to the main office, and counted and checked there according to the conductors' reports, the money being handled but once. The bag system is more popular with the men, as little trouble is experienced with "overs" and "shorts," and no time is lost in depositing the money.

For street railway companies who have adopted the bag system, the Morris-Ireland Safe Company, of Boston, Mass., has perfected and has been for some time selling a very convenient safe. These safes have a device attached to the top which enables conductors to deposit the fares without unlocking the safe or having access to other deposits previously made. The money is put into small bags, tied up in any manner approved by the management of the road, and deposited in the safe. The handle is lifted to a vertical position and a receptacle is thus made for receiving the package, but the opening is closed completely by the bottom of the angle-piece attached to the handle. After depositing the package the conductor allows the handle to drop, when the package is deposited in the safe. At no time is the interior of the safe accessible to other employees except those who have the combination of the lock on the main door. The box or receptacle attached to the handle will receive a package 6½ ins. x 5 ins. x 3½ ins., which is naturally much larger than one ordinarily deposited by conductors.

The Morris-Ireland Safe Company has made a specialty of safes for street railway purposes and has developed the device described above after much experience as to the requirements. It is made according to the most approved designs, with angle-iron front and back, inside bolt work, malleable hinge and everything else that makes a first-class safe. This type is made in three sizes, 36 ins., 44 ins. and 50 ins. high, outside measurements, from which selection can be made to meet the requirements of different roads. It is already used on a large number of street railways, among which may be mentioned the Metropolitan Street Railway, of New York; the Boston Elevated, the Detroit United Railway, the New Orleans Street Railway, the Worcester Consolidated Street Railway, the Cleveland Electric Railway Company, the Los Angeles Traction Company, the Sidney & Glace Bay Railway, of Sidney, C. B., Westinghouse, Church, Kerr & Company, Utica & Mohawk Valley Railway, Galveston City Railway Company, Beaumont Traction Company and many others.

NEW DOUBLE-DECK CAR

The accompanying illustration represents an electric tramway car with an upper saloon, designed by H. L. White, manager of the Great Grimsby Street Tramways, England. The roof, instead of being of the "collapsible" type, as at Liverpool, Bradford and Hull, is a permanent structure, such as has been adopted at Sheffield and Huddersfield. Mr. White has adopted the fixed roof because he believes that it possesses many advantages over the semi-open one. Whilst the passenger is sure of protection from rain and wind in bad weather, the large drop windows afford all the ventilation that is required in summer.

The adoption of the monitor type of roof has permitted a height of 6 ft. 6 ins. along the gangway, without making the car appear too top-heavy, and it also allows the sides of the saloon being kept as low as possible, viz., 5 ft. 6 ins. The sashes in the bulkheads are stationary. The large side windows are weighted and work easily, being held in position by strong gravity catches. The screen round the aperture of the canopy is 3 ft. 6 ins. high, and effectually protects the passenger from any draft coming up the staircase. A cover made to fit over the staircase aperture was found not to be required. The saloon top has been painted white, relieved by dark lines, and the roof painted with electro-galvanizing paint.

DOUBLE-DECK CAR FOR GREAT GRIMSBY STREET TRAMWAYS

The upper and lower decks are provided with cross-seats, the seating capacity being twenty-eight inside and thirty-five outside. The windows of the lower saloon are arranged to open, and the doorway is built as near the edge of the platform as possible, with the object of inducing the passengers to alight by the portion of the step nearest the body of the car, thus leaving a clear space on the platform for the egress of the passengers descending from the roof by the portion of the step furthest away from the body of the car.

The car body is mounted on a four-wheel truck, the wheel base being 6 ft. The diameter of the axles is 4 ins., and the steel-tired wheels are 31¾ ins. in diameter and have a deep flange. The two motors are rated at 30 hp each, and are operated from either end by controllers.

J. C. Morris, Commissioner of Railroads and Telegraphs for Ohio, is advocating legislation to give him jurisdiction over bridges and trestles used by interurban roads. He thinks that the laws governing grade crossings should apply equally to steam and electric railway crossings, and suggests that the Legislature define steam, electric, trolley and interurban roads, that legislation may be intelligently carried out.

THE HOLLAND SLEEPING CAR

The STREET RAILWAY JOURNAL of Aug. 15, 1903, contained a complete description and plans of the two sleeping cars which were then under construction for the Holland Palace Car Company in the shops of Harlan & Hollingsworth, Wilmington, Del. One of these cars, the "Theodore," has just been completed and shipped to Indianapolis for active service. The accompanying illustrations can give but a faint idea of the beauty of the first electric sleeping car ever built.

The exterior of the completed car is shown in Fig. 1. The car is mounted on two M. C. B. trucks, of the type shown in Fig. 2, each truck arranged to carry two 150-hp Westinghouse motors. This is, of course, an unusually heavy equipment, but was decided upon so that the most severe requirements could be met without difficulty. If advisable, however, the motors can be omitted from one of the trucks. Fig. 3 is a view of the front of the car, showing the motorman's cab, controlling apparatus, headlight, cow-catcher, etc.

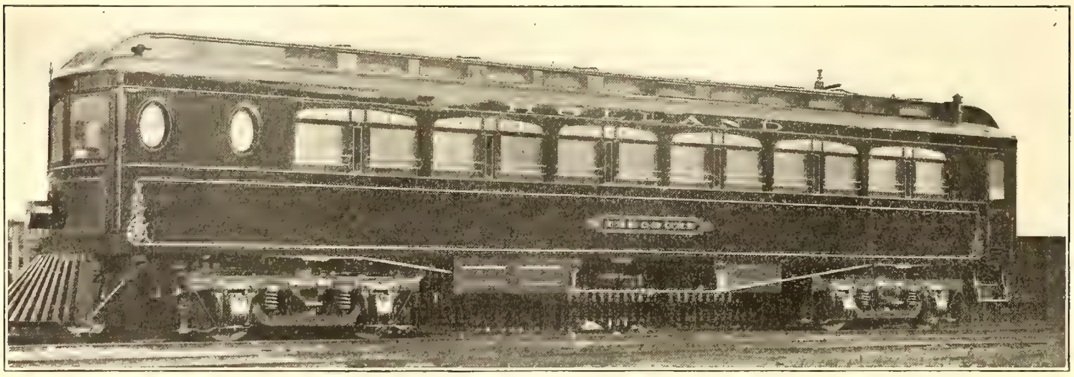


FIG. 1.—FIRST ELECTRIC SLEEPING CAR

When used as an ordinary day parlor car, the interior of this coach appears as in Fig. 4, while in Fig. 5 some of the sleeping compartments are shown closed.

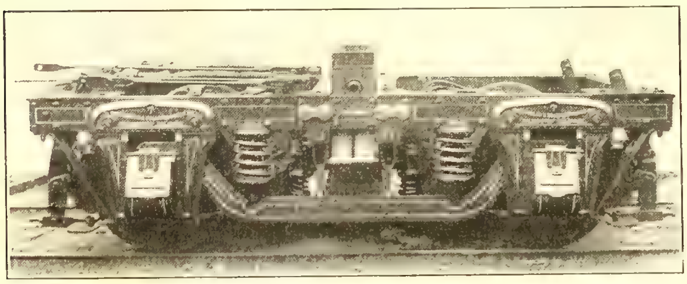


FIG. 2.—TYPE OF TRUCK USED ON SLEEPING CAR

FIG. 3.—VIEW OF CAR FRONT, SHOWING OPERATING CAB, ETC.

FIG. 4.—INTERIOR OF CAR AS IT APPEARS FOR DAY SERVICE

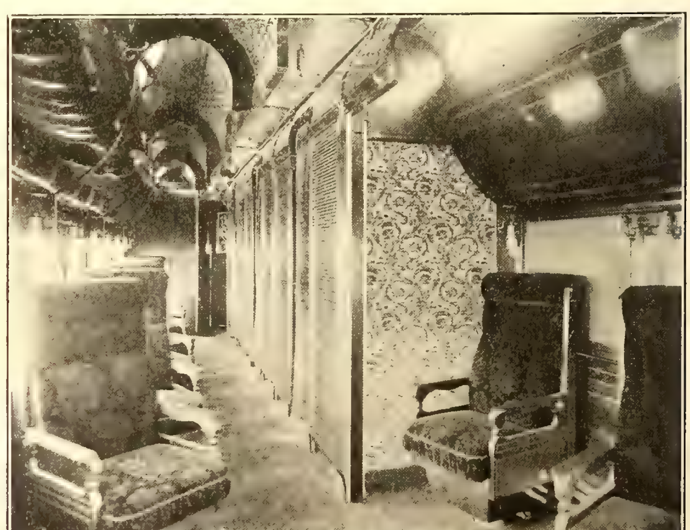


FIG. 5.—VIEW OF CAR INTERIOR, SHOWING SOME OF THE SLEEPING COMPARTMENTS CLOSED

The Holland Palace Car Company, whose headquarters are in Indianapolis, Ind., expects to conduct the sleeping car business along the same lines as the Pullman Company conducts it on steam railroads. It is probable that these cars will first be operated on the long Ohio and Indiana interurban lines.

HIGH-POTENTIAL OIL SWITCHES

The increasing use of high potentials has presented many serious and unusual problems in switching and the protection of the generating apparatus from dangerous overloads. The oil break type, in which the switches and all live metal parts are immersed in oil, is generally conceded to be the best form of switch for handling high voltages, and the most recent development of this type, designed by the Hartman Circuit Breaker Company, of Mansfield, Ohio, is shown.

Fig. 1 is a view of a three-pole, double-break oil switch, designed for installing on the back of the panel, and to be used on circuits up to 11,000 volts. The view shows the switches in the "off" position with one of the switches enclosed in an oil tank. Each pole of the switch is immersed in a separate tank, which is entirely independent of the adjacent ones, and can be readily removed without in any way interfering with the others. The tanks are lined with insulating material which is formed in such a way that there is just sufficient space for the free vertical movement of the switches, and the quantity of oil used is thus reduced to the minimum.

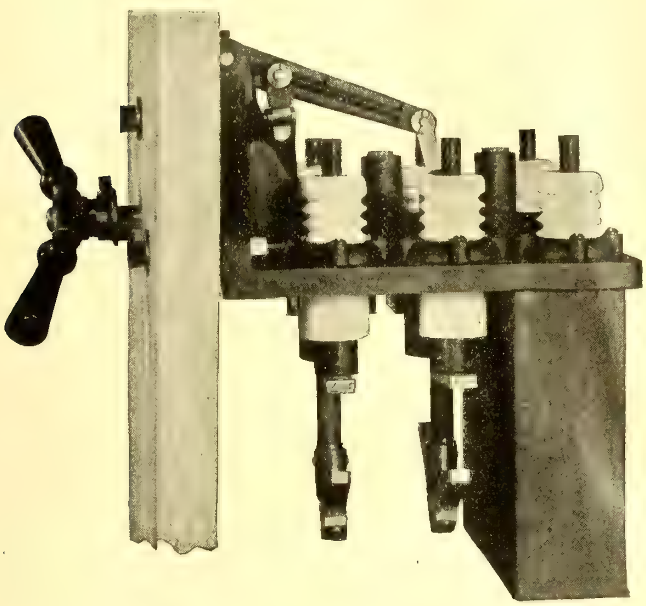


FIG. 1.—THREE-POLE DOUBLE-BREAK OIL SWITCH

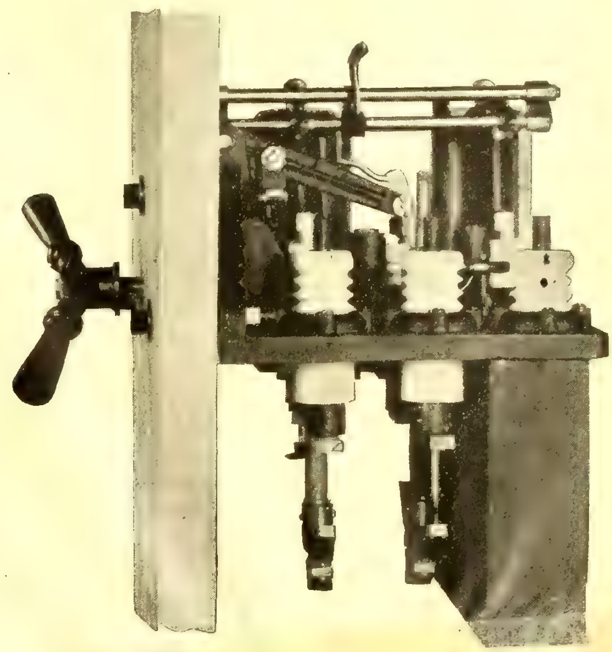


FIG. 2.—THREE-POLE, DOUBLE-BREAK SWITCH, WITH AUTOMATIC OVERLOAD ATTACHMENT

A distinct departure in this oil switch is found in the use of the laminated or brush form of contact, which greatly increases the current-carrying efficiency of the switch and also entirely prevents "freezing" or sticking at critical periods. These contacts are protected by final arcing plates, which, with the corresponding plates on the terminal blocks, are removable and can be readily replaced should they become burnt away in the course of time. The form of contact which is used and the isolation of the switches in separate compartments, gives the switch a very large breaking capacity.

The movable parts of the switch are controlled by means of specially treated wooden rods, which are fastened at their upper ends to a common cross-bar. They are held in normal position by means of a toggle-lock. The switch is opened by giving the handle a slight turn in the direction opposite to that taken in closing. This will cause the toggle to move past the center and the switches will then open free of the controlling handle, thus producing an absolutely quick break.

Fig. 2 shows the automatic overload attachment. There are usually two tripping coils provided for a three-pole breaker, but it can be constructed with a tripping coil in each line. The operation of any one tripping coil will break all lines.

The distinctive feature of this overload attachment lies in the fact that the tripping coils are energized by curre[illegible] high potential circuit, and the use of series transformers [illegible] connection with the circuit breaker is entirely avoided. The tripping coils instead of being located on the front of the panel, as is commonly the case, are mounted by means of special porcelain insulators on the carrying frame itself. They are separated from each other by barriers of insulating material, and the method of insulation throughout is of the highest order. The overload attachment has other distinctive features, one of the most important of which is that it cannot be held closed while an overload exists on any line.

This apparatus is also constructed with remote electrical control, to be installed apart from the switchboard and to be opened and closed from a distance. The operating current may be derived from the exciters, a storage battery or any convenient source of direct-current supply at from 110 volts to 500 volts. The remote control attachment is said to be very reliable and it adds but little to the cost of the installation.

SINGLE TRUCK CARS WITH LARGE SEATING CAPACITY AT GRAND RAPIDS

The Grand Rapids Railway Company is building, under the supervision of W. W. Annable, the master me[illegible], a number of single-truck cars, which are remarkable for their large seating capacity notwithstanding the use of cro[illegible]. These cars are for service on some of the 10 per cent g[illegible] Grand Rapids, and are also noteworthy for having [illegible] the heaviest motor equipment yet placed on a single-truck car. The cars have bodies 23 ft. long and are 28 ft. long over the platforms. They weigh approximately 30,000 lbs., and are equipped with two General Electric 66-motors, which motors are of about 125-hp rated capacity, being the same as are used for the heaviest elevated and interurban service. The seating capacity of the car is forty. Part of the secret of this large seating capacity is in the short distance (27 ins.) between the seat centers, which is made possible by the use of wooden skeleton backs for the seats instead of the usual padded rattan, which takes up about 3 ins. more than the skeleton back. The trucks are being made in the Grand Rapids Railway Company's shops, and have a 9-ft. wheel base. The car frame will be reinforced throughout with pressed steel.

SEMI-CONVERTIBLE CARS FOR THE PUBLIC SERVICE CORPORATION OF NEW JERSEY

Fifty new semi-convertible cars have recently been received by the Public Service Corporation, of New Jersey, from the works of the J. G. Brill Company. These cars are noteworthy from the fact that they are the first of their type to be built with vestibuled Detroit platforms having folding doors. The doors are controlled by an ingenious device which prevents their colliding with the rails which divide the platforms.

The platforms themselves are supported by two pairs of angle-irons, the outside of which are bent out to extend along the side sill, while the upper leg reaches back to the body bolster. A pair of angle-irons is also used at the centers of the platforms, and is intended to receive the force of the blow in case of collision. The bottom framing departs somewhat from the usual practice of the builders with this type of car. Not having room for lower truss rods and requiring extra strength at the ends for the support of the long platforms, 4-in. x ¾-in. irons are bolted to each side of the bolster, and extend 2 ft. 11 ins. inside the side sills in either direction. Besides the usual 12-in. x ⅜-in. plate on the inside of the side sills, to which the bases of the side posts are secured, an upper truss rod is introduced, which is supported on 7-in. iron posts, located over the centers of the bolsters. The side sills are 4 ins. x 8 ins.; end sills, 5¾ ins. x 5⅞ ins., and the crossing, 4½ ins x 5¾ ins. The distance from center to center of king bolts is 20 ft. x 9 ins. The length of the cars over bumpers is 42 ft. 8 ins., and over the corner posts, 30 ft. 8 ins.; from the end panels to the face of bumpers, 6 ft. The width over side sills and panels is 7 ft. 8 ins., and over posts at belt, 7 ft. 11½ ins.; from rail head to car floor (body light), 3 ft. 2⅞ ins.; from rail over trolley platform, 11 ft. 7 ins.; height of first step from the rail, 14 ins., and height of the platform from rail, 2 ft. 3½ ins. The cars are furnished with "walk-over" back seats, and have a total seating capacity of forty-three, one seat being single to allow room for the heater. The interiors are finished in natural cherry, with three-ply curly maple ceilings. Having no wall window pockets the window sills are permitted to be extra low—too low, in fact, to be used as an arm rest by adults, and, therefore, arm rests specially devised by the builders are provided, which are bracketed to the side lining, and do not interfere with the window catches. A single metal runway at the side of each post, and extending into the roof pockets, guides the trunnions at the sash corners, this being the standard practice with this type of car. Four-bar window guards protect the passengers' arms. The middle sash of the vestibule is in one piece, and is arranged to drop into a pocket in the wainscoting, and is provided with stops to prevent injury in case of falling. The cars are mounted on Brill 27-G E-1 trucks, having a 4-ft. wheel base, 4-in. axles and 33-in. wheels. They have solid forged side frames, to which the transoms are secured with double-corner and single-corner brackets, forged out of single billets. The brakes are hung on the outside, and are operated by hand or air. The trucks are equipped with two 40-hp motors per car.

SEMI-CONVERTIBLE CAR WITH DETROIT PLATFORMS FOR THE PUBLIC SERVICE CORPORATION

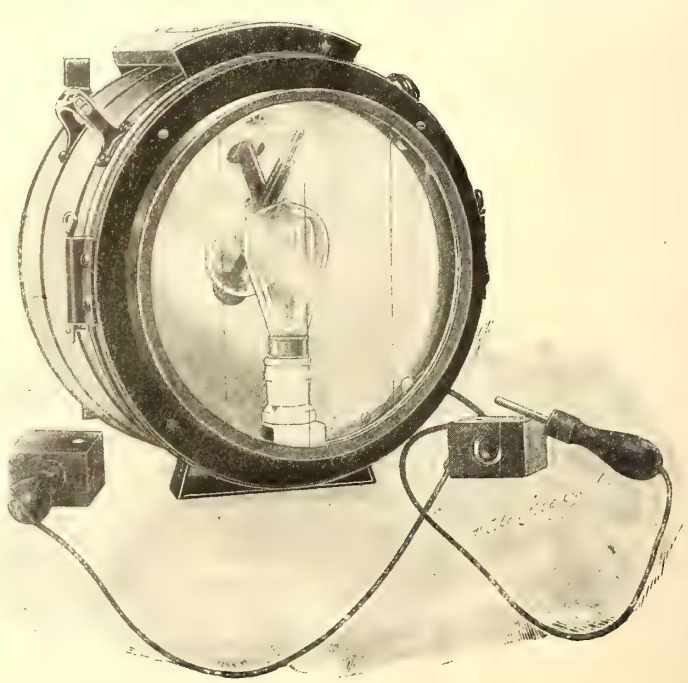
A NEW ARC HEADLIGHT

The accompanying cut shows something entirely new in arc headlights, manufactured by the Crouse-Hinds Company, of Syracuse, N. Y. The carbons are set at an angle of 45 degs., instead of 90 degs., thus exposing all the rays to the reflector to the best advantage, making the light stronger and avoiding the shadow caused by the upper carbon holder in the vertical carbon type lamp.

The drawings of the arc and feeding of the carbon is done automatically by the upper carbon holder, which is a simple arrangement of a floating clutch raised by a powerful magnet. The lower carbon is held firmly by a clutch, and is raised or lowered by a hand wheel, which can be reached through a hole in the case. The adjustment of the carbon controls the position of the arc, which only needs adjustment after burning eight hours to ten hours.

The reflector is made of aluminum, has a diameter of 12 ins., is parabolic in shape, and constantly reflects the light a long distance ahead as well as covering the track near the car.

The incandescent lamp is attached to the inside of the door, thereby utilizing the one reflector for both arc and incandescent light, and not interfering with the arc light. A switch, placed in the vestibule of the car, and operated at the will of the motorman, controls either light. The whole arrangement is very compact and simple.



ARC HEADLIGHT

The Woronoco Street Railway Company, of Westfield, Mass., has plans for numerous improvements at Pequot Park before the opening of next season.

THE ARNOLD ELECTRO-PNEUMATIC RAILWAY SYSTEM AS EMPLOYED ON THE LANSING, ST. JOHNS & ST. LOUIS RAILWAY

BY B. J. ARNOLD

As many of your readers know I have persistently advocated the use of the alternating current directly in the motors for electric railways for several years (see Transactions American Institute of Electrical Engineers' joint meeting with the British Institution of Electrical Engineers, Paris, Aug. 16, 1900; Niagara Falls Convention, Aug. 24, 1901; Great Barrington, Mass., June 19, 1902, and New York, Sept. 26, 1902). By referring to the discussions which took place at these meetings and to the technical papers, it will be found that there were few, if any, other advocates in this country of the alternating current motor for railway work until recently, and that those who supported it abroad advocated the use of three-phase currents until within the last few months. Since my announcement of the principles of my system before the Great Barrington Convention, the development of the single-phase alternating-current railway motor has made remarkable strides, both in this country and abroad, and while at that time it had few friends the development has been such since, that it now seems destined to take its place as the leading railway motor, thereby effecting a revolution in electric railway work.

Many of your readers also know that, since announcing the principles of my system before the Great Barrington Convention, I have refrained from giving out any further information regarding it, giving as my reasons therefor my desire to test the system thoroughly before making further public statements regarding it, and then to present a full and complete description of it, together with the results of its operation, in the form of a paper before the American Institute of Electrical Engineers. Consistently pursuing that policy I have conducted my experiments privately and at my own expense, and had so perfected my apparatus that I had hoped to be able to celebrate the incoming of the year 1904 with a public demonstration, over 20 miles of railroad, which would conclusively prove that the single-phase electric railway is not only operative but efficient, and less in first cost and operation than any system now in vogue, not meaning to imply, thereby, that the system which I have developed was necessarily the only system or the best system, for only time can prove the correctness or incorrectness of such statements, but that it was a system which would successfully do the work, and the system which was first developed and first to be put in actual operation upon the first electric railway in the world, especially built for single-phase alternating-current motor operation.

That I would have made a demonstration on Jan. 1 was a certainty to me, until Dec. 18, when I learned by telegraph, while in New York, that the car houses, located at Lansing, Mich., of the road upon which I had been experimenting, were completely consumed by fire at 4 o'clock that morning. The fire, apparently, originated from a stove in the engine house, and was communicated so rapidly to the car houses that it destroyed a steam locomotive and two new cars built for my system, as well as my experimental locomotive, thus leaving me unable to make the demonstration as I had planned. In view of the fact, however, that the single-phase electric railway is now receiving so much attention at the hands of engineers and inventors in many parts of the world, and that I believe that the year 1904 will be an epoch making one, marking the revolution from the direct-current to the alternating-current motor for railway work, as well as the beginning, on a large scale, of the displacement of the steam locomotive on railways by the use of a substantial form of overhead construction rather than the third rail, and from the further fact that I cannot get another machine ready in the near future, I have concluded that I will give to the technical press a record of my work up to the present time, in order that it, and the system which I have developed, may be properly weighed in comparison with the work and systems of others, leaving the more complete description of the system and the results of its operation to be presented at a later date before the American Institute of Electrical Engineers.

On Jan. 10, 1900, I rode over the country between Lansing and St. Louis, Mich., a distance of about 60 miles, with a party of gentlemen who desired to build an electric road between these points. This trip resulted in my advising them that the territory was such that I believe the road should be built as economically as possible, and, inasmuch as they desired me to assist financially in its construction, I told them I would do so provided I was allowed to construct the road in accordance with certain ideas that I then had in mind, for by such construction the first cost of the road could be kept sufficiently low to warrant its construction, and that if it were built on any one of the systems, standard at that time, the advisability of building it was questionable. The result was that on April 23, 1900, a contract was entered into wherein I undertook to build and equip the road. Engineers were at once placed in the field to locate it, and after the plans were sufficiently completed the grading, bridging and track work of 20 miles of the road followed, and this much of the road was completed, to such an extent that steam trains were put in regular operation over it about Nov. 15, 1901.

For financial reasons the completion of the road was delayed, and, in the meantime, the development of my system was taking place and the parts being perfected in different offices and shops.

Since it was my intention to experiment with pressure as high as 15,000 volts on the working conductor, all of the line material had to be specially designed, but the work progressed to such an extent that the overhead and line work of 20 miles of road was practically completed and ready for operation about Dec. 15, 1902, and the power installed, so that experiments began in March, 1903. On June 15, 1903, two trips were made, each about 3 miles long, with my first experimental machine, shown in Fig. 8 of the accompanying description. On the first trip seven persons were carried, and on the second trip thirteen persons were aboard.

The result of the experiments with the first motor proved the correctness of the theory and that the machine would work. Inasmuch as it consisted of but one somewhat crude electro-pneumatic motor, it was impossible to get full and efficient tests of the system, and it was thought best to conduct no further experiments until a complete new double equipped truck could be perfected. Not being connected with manufacturing establishments I have been compelled to develop this system under trying circumstances, necessitating the construction of parts in different shops and assembling them at far distant points with crude facilities. This fact, combined with the financial difficulties that have arisen, and the necessity of my having to give the main part of my attention to other matters, have been the causes of the delay in completing the road and the system.

A new double-motor equipment, in the form of a locomotive, was finally built and brought to perfect working condition on the evening of Dec. 17, and it was this locomotive with the necessary instruments for testing purposes that was destroyed by fire the following morning. Since it is going to be impracticable for me to get a new one constructed for some time, I have thought best to state the facts as outlined above, and give to the technical press a description of the apparatus and the road, reluctantly omitting the records of operation and the tests which I had hoped to have accompany any future statements I made, but which, through "the irony of fate," must now be left for the future. On the following pages will be found some particulars of the road and system.

ROADBED AND TRACK

The Lansing, St. Johns & St. Louis Railway was originally projected to extend from Lansing, the capital of Michigan, northward through St. Johns, Alma and St. Louis, a distance of about 60 miles, but up to the present time only that portion extending from Lansing to St. Johns, a distance of 20 miles, has been constructed.

This road was built in accordance with steam railroad practice, with easy grades and curves, so that steam locomotives could be operated over it until such time as electrical equipment could be put upon it; the idea being to complete the road in

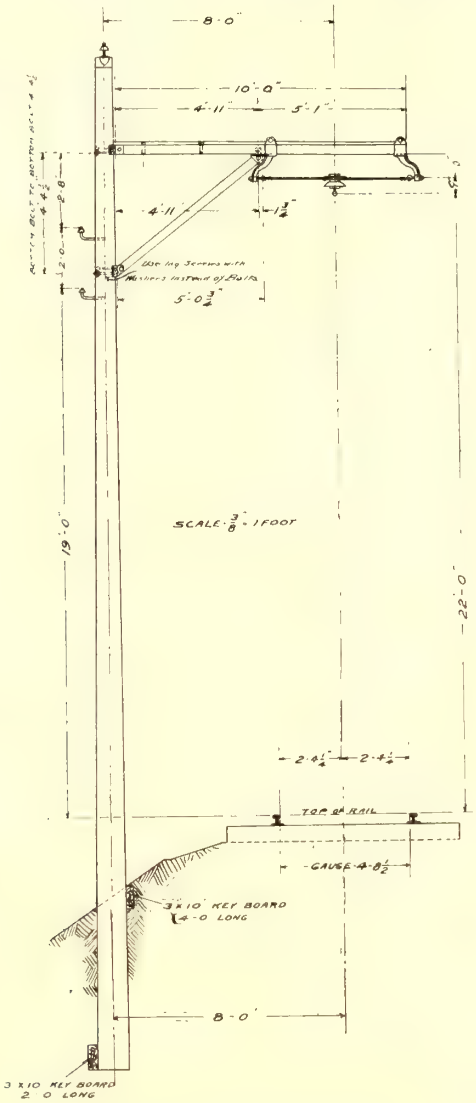


FIG. 1.—TYPICAL STRAIGHT LINE OVERHEAD CONSTRUCTION

such a manner that it could be utilized for both freight and passenger service, and thus secure all the business available from the territory through which it passes.

The road is equipped with 67-lb. T-rail, laid on ties spaced 2 ft. apart between centers, and as alternating high-tension current was to be used but one of these rails was bonded with 38-in. 0000 bonds, extending entirely around the splice bars.

Since it was impossible to secure rails from the rail manufacturers in time rails and splice bars were secured from one of the leading steam railways, and this necessitated the adoption of a supported joint and a long bond, as there was not room under the splice bars for concealed bonds.

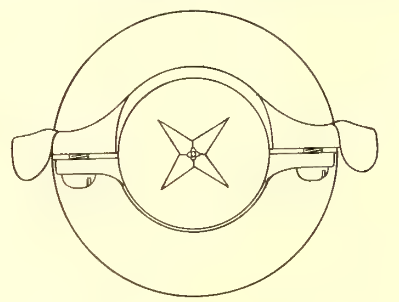
The road as at present constructed between Lansing and St. John has no grades exceeding 1 per cent, and no curves exceeding 7 degs., except in the cities themselves, where the terminals of the road run over the streets and make such curves as ordinary street cars make, the minimum radius being 50 ft. At each city a terminal was planned so that all freight would be diverted to connecting steam roads, thus making it unnecessary for the freight service to pass over the city streets or curves.

At the Lansing end it was necessary to pass over the steam railway tracks of the Pere Marquette Railroad, and this necessitated the construction of a bridge with pile approaches. The grade, as approached from the Lansing end, being 4 per cent for a distance of about 700 ft., and after passing over the bridge the descending grade is 2.3 per cent for about 500 ft. At the St. Johns end there is a grade on the principal street of the town averaging about 2 per cent for about 1500 ft.

OVERHEAD CONSTRUCTION

Considerable care was taken in planning a suitable insulator for carrying the trolley wire, and Fig. 1 shows the construction of the annealed glass insulator used.

Fig. 2 shows a typical arrangement of the straight line overhead construction, and it will be noticed that wood is used for the pole, cross-arm and braces, and that the insulator is supported by means of a short span wire from iron brackets secured to the wooden cross-arm. This construction insured a high insulation at a low first cost, the entire line having been constructed for but a slightly increased expense over the cost of standard construction, and at the same time so built that in case of failure of the alternating-motor system the standard direct-current motor system could be put into service without changing any parts, even holes for the pins for carrying the extra feeders which would be required were provided, as shown.



It will thus be seen that the line and track work were con-

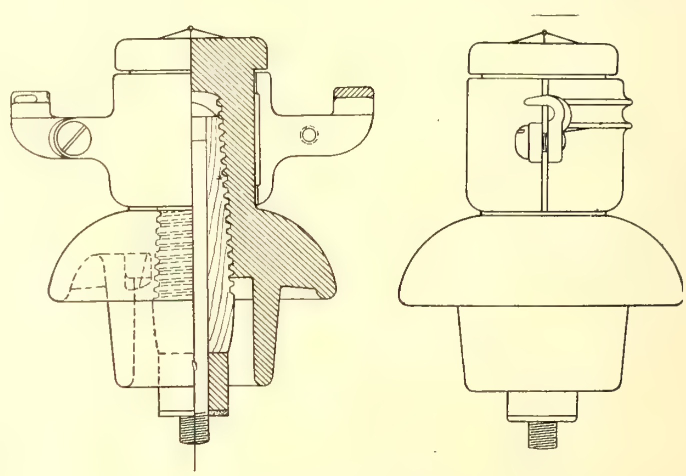


FIG. 2.—SPECIAL INSULATOR USED

structed in such a manner that no expense was incurred for any parts which would not be required for standard construction in case it became necessary to ultimately adopt the standard direct-current motor system; the entire idea in the construction of the road being to save first cost and to invest all that was invested in such a manner that all material purchased would be utilized in case either system were adopted, and should the alternating system prove successful the additional investment for a direct-current motor system need not then be installed.

The working conductor was placed 22 ft. above the top of the rails in order that trainmen, when standing upon the tops of the freight cars going over the road, could not come in contact with the working conductor.

It was planned to operate the entire road from a single 0000 trolley wire, and with one rail bonded as hereinbefore mentioned; this amount of copper being sufficient to operate four 40-ton cars at an average speed of 30 m. p. h., with power house located 1½ miles from one end of the line, and operating with from 6000 volts to 10,000 volts on the working conductor.

The power house is located at one end of the line, owing to the electric company, from which power is purchased by the railroad, having a water-power at this point. Current is transmitted to the nearest end of the line over two No. 3 wires. The power is furnished from a 300-kw rotary converter, generating at 380 volts at 25 cycles, the energy from which is stepped up to the working pressure of the line. It was the intention, after experimenting a sufficient length of time to determine the

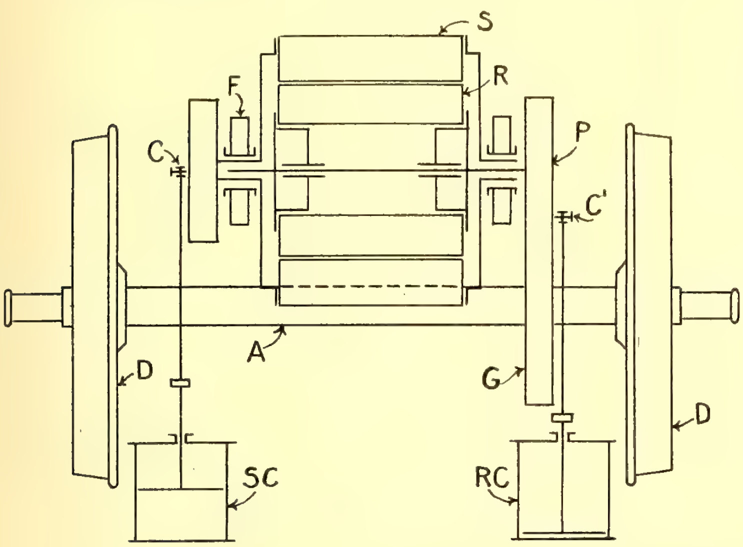


FIG. 3.—DIAGRAMMATIC ARRANGEMENT OF ELECTRO-PNEUMATIC MOTOR

R—Rotor.
S—Stator.
F—Frame.
P—Pinion on rotor.
G—Gear on car axle.
A—Axle of the car.
D—Driver of the car.
RC—Rotor cylinder.
SC—Stator cylinder.
C—Crank of stator.
C'—Crank of rotor.

best voltage for the working conductor, to have the generators for the permanent plant constructed so as to generate at this determined voltage, and it was for this reason that a temporary rotary converter was first installed to conduct the experiments with.

During the preliminary experimental period upon the apparatus, hereinafter described, all power was transmitted from the abovementioned power house to a point about 2 miles distant, where were located the car houses in which the preliminary experiments were made.

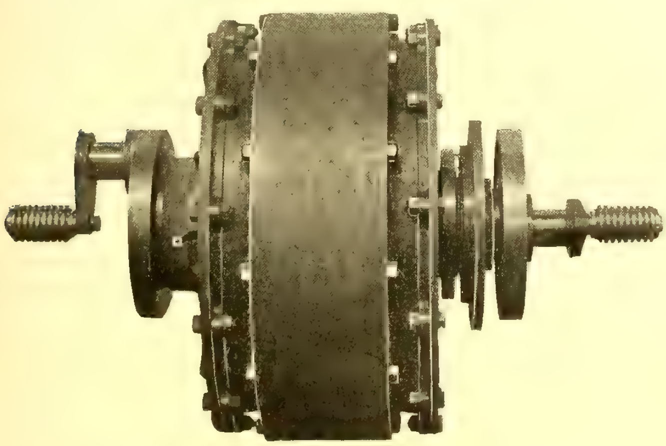


FIG. 5.—OUTSIDE VIEW OF ELECTRIC MOTOR

The conditions under which the first application of the system took place having thus been set forth, it may be well, in order to get clearly before the reader the principles on which the system is based, to quote here the statements made by me before the Great Barrington Convention on June 19, 1902, as follows:

"The principles underlying the system I advocate, and which I call an electro-pneumatic system, are as follows:

"1. A single-phase or multi-phase motor, mounted directly upon the car, designed for the average power required by the car, and running continuously at a constant speed and a constant load, and, therefore, at maximum efficiency.

"2. Instead of stopping and starting this motor and dissipating the energy through resistances, as is customary with all other systems known to me, I control the speed of the car by retarding or accelerating the parts usually known as the rotor and stator of the motor, by means of compressed air, in such a manner that I save a portion of the energy which is ordinarily dissipated through resistances, and store it to assist in starting

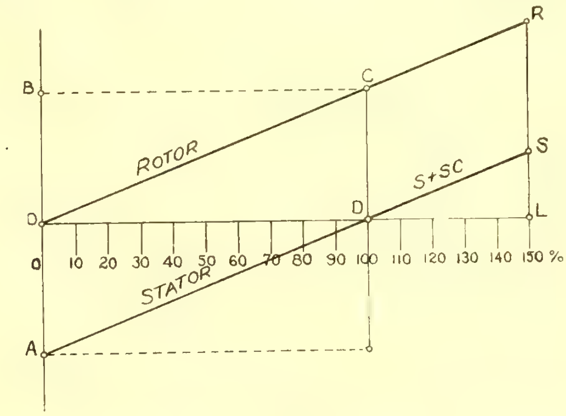


FIG. 4.—DIAGRAMMATIC REPRESENTATION OF OPERATION

the car, helping over grades, for use in switching purposes and for the operation of the brakes.

"3. By this method of control I secure an infinite number of speeds from zero to the maximum speed of the car, which may or may not be at the synchronous speed of the motor, for with the air-controlling mechanism working compressing, the speeds below synchronism are maintained, and by reversing the direction of the air through the controller speeds above synchronism may be attained for reasonable distances. This feature gives to the alternating-current motor the element absolutely essential for practical railway work, for it permits a car or train to ascend a grade at any speed with the motor working at its maximum efficiency and imparting its full torque to the car. When descending the grade the motor may utilize its full

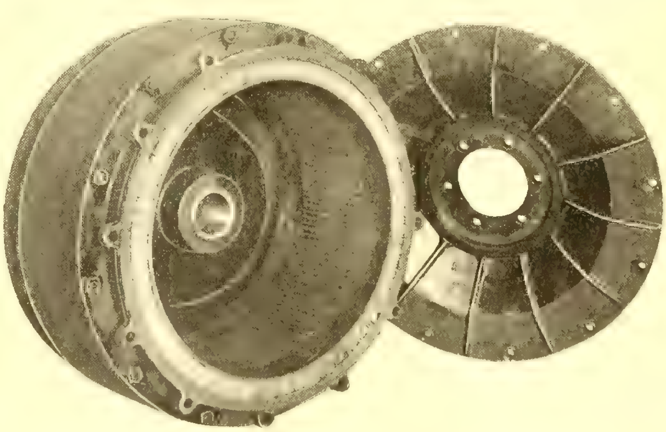


FIG. 6.—INTERIOR VIEW OF ELECTRIC MOTOR

power drawn from the line in compressing air, or it may be used to compress air with the stored energy of the train, thereby acting as a brake.

"4. By virtue of the air storage feature each car becomes an independent unit, and capable, in case of loss of current from the line, of running a reasonable distance without contact with the working conductor. This feature will enable a car to work on a high-tension trolley wire or active conductor over private

right of way, and allow the active conductor to be stopped where the private right of way ceases, and the car to proceed through a city or town on any tracks, whether electrically equipped or not, until it reaches the outskirts of the city or town where it can take up the working conductor again on private right of way. This feature is also valuable in switching work, for each car being independent it can leave the main line

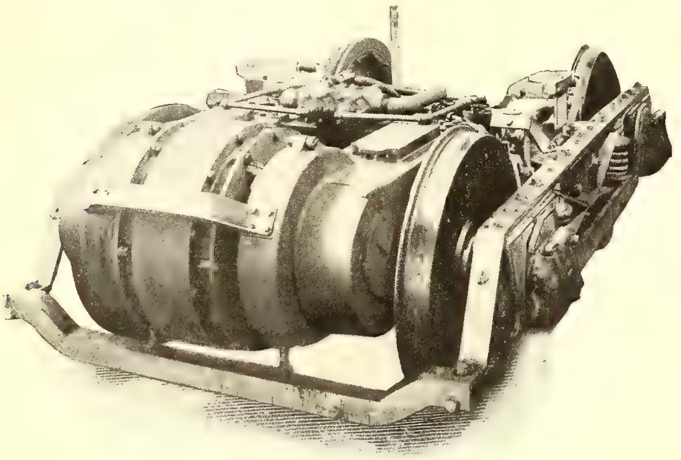


FIG. 7.—VIEW OF FIRST EXPERIMENTAL MOTOR, WITH MOTOR FORWARD

track and operate over switches or sidings without complicating the yards with additional overhead or third-rail conductors, thus necessitating through-line conductors over main-line track or tracks only.

"5. Since a single-phase motor can be used the motors can be supplied with current from a single overhead wire or third rail, and with a single-rail return circuit, thus permitting the overhead construction, or third-rail construction, to conform to the standard of to-day, except that a much higher working

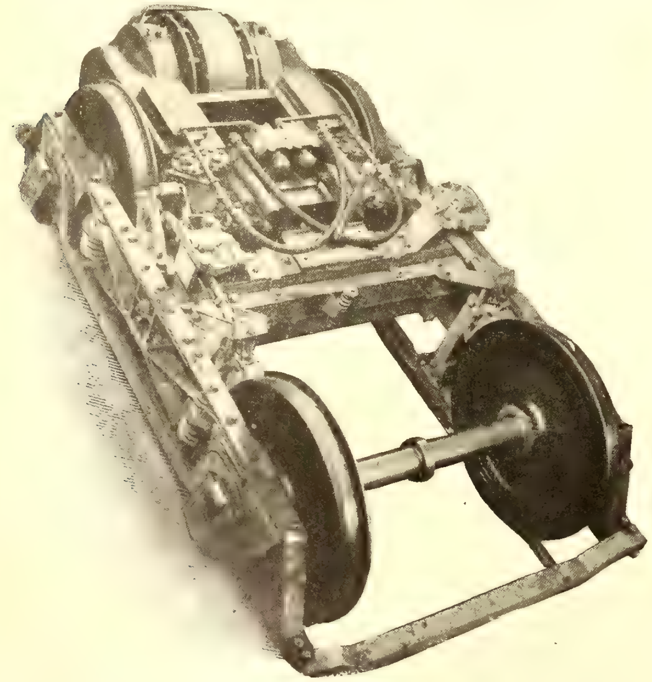


FIG. 8.—VIEW OF FIRST EXPERIMENTAL MOTOR, WITH MOTOR IN THE REAR

voltage can be used, provided the insulation is taken care of. Furthermore, in steam railway work this system, by virtue of its single-phase features, will only require the use of one of the track rails for the return circuit, thus leaving the other rail for the use of the signal system, which, up to the present time, does not seem to have been satisfactorily solved without the use of one of the track rails.

"6. The current will be taken from the working conductor at any voltage up to the limit of the insulation, and in case this voltage is high (I am building my line for 15,000 volts), a static transformer will be carried upon each car and the pressure reduced from the line voltage to the voltage of the motor, which, in the case under construction, is designed for 200 volts. Where it is unnecessary to utilize so high a line pressure the motor may be designed for the working voltage, and the current fed directly from the working conductor into the motor, thus eliminating the static transformer. When a high-voltage working conductor and static transformer are used, and it is thought advisable to use a working conductor through cities or towns, this working conductor will be supplied with energy through a stationary transformer at each city limit, thus making the working conductor through the cities or towns safe.

"7. By virtue of the speed of the motor and its constant load,

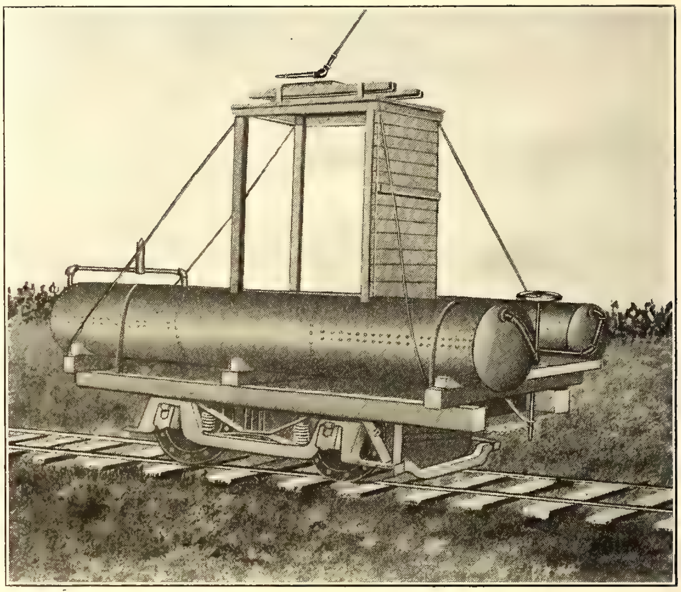


FIG. 9.—FIRST EXPERIMENTAL LOCOMOTIVE.

either when the car is in motion or when it is standing still, and the motor is compressing air, the variable load now customary in electric railway power plants is eliminated, and the power station works at practically a constant load, thereby eliminating a large part of the investment at present requisite in power station and line construction. Furthermore, by virtue of the air storage feature each car, in the particular apparatus I have designed, is capable at any time when current is on the working conductor, of delivering to the car wheels a much greater torque in proportion to the capacity of the motor than is possible with any electrical system known to-day."

"I believe that by the adoption of this system the following results will be accomplished:

"1. The entire elimination of the present standard system of rotary converter sub-station plant, together with the maintenance thereon, and the cost of the necessary attendants.

"2. The absorbing and rendering available for useful work in starting, or otherwise, a large percentage of the energy stored in the moving mass, which, under the present methods of operation, is dissipated at the brake-shoes.

"3. A large reduction in the first cost of electrically equipping long-distance railroads, thereby making it feasible, from an engineering and business standpoint, to equip many roads which cannot now be shown advisable, thus opening up the steam railway field to the industry in which we are now engaged."

The following description will explain more in detail the application of the principles of the system and the mechanism of its working parts:

Fig. 3 represents diagrammatically the working parts of one form of the system. The rotor R of a single-phase induction motor is geared to the axle of the car, and by means of crank pin, C, secured in pinion P, also drives the compressor cylinder R C, while stator S can freely revolve around the rotor and drive by means of crank pin C the compressor cylinder S C. Both cylinders are piped to air reservoirs located under the car, and are also provided with suitable valve manipulated from a single controller on the car platform for making them perform their various functions, thus the entire regulation of the speed and power of the car are controlled by the air cylinders, and no other regulating devices are necessary. The cylinder valves are electrically operated, which makes it possible for each cylinder, when driven by the electric motor, to compress air into the tanks, and when operated b compressed air to furnish mechanical energy for moving the car. When, for instance, the cylinder is compressing air the valves work like inlet and outlet poppet valves of a common air pump, while on the other hand if the cylinders are supplied with compressed air each valve is operated electrically by a pilot solenoid connected with the valve seat in such a manner that the energy for moving the valve is supplied by the compressed air, thereby making the valve practically self-actuating. The time of operation of the valves is controlled by a series of collector rings revolving with the engine shaft, and their regular operation is interrupted and varied to suit the requirements by means of the motorman's controller. When a rotary or turbine type of air engine is used all of the above valves and reciprocating parts are eliminated and the entire controlling mechanism consists of two air valves, operated from a single engineer's valve, which may be located upon the platform of the car or in the cab of the locomotive, and so arranged that one or more units may be operated from the platform of cab of any unit without the necessity of connecting wires between the units.

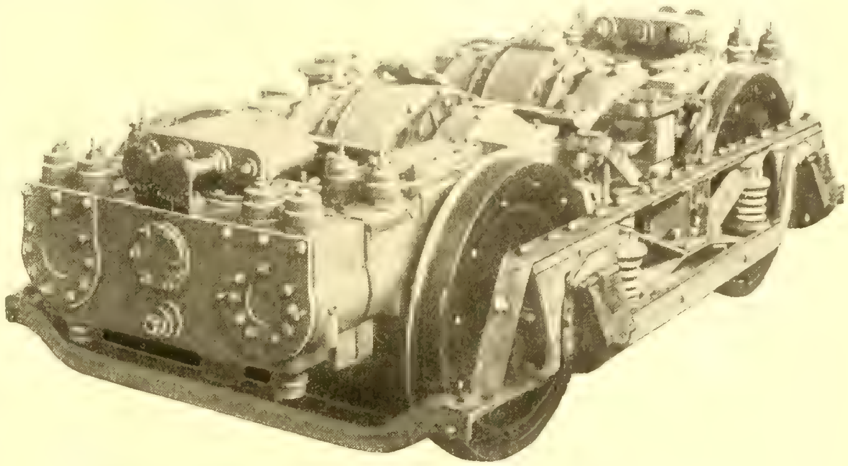


FIG. 10.—END VIEW OF LATEST DOUBLE MOTOR EQUIPMENT, WITH TRUCK

Since the motor may be of the simplest types of induction motor without a commutator, and the system does not require the manipulation or breaking of the main current the motor may be designed for any working voltage, and be of any type which will maintain a constant speed when provided with a constant load. This eliminates the necessity of all step-down transformers, resistances or other regulating devices and confines the current to the motors themselves, and as these are below the car floor the danger from the current is reduced to the minimum.

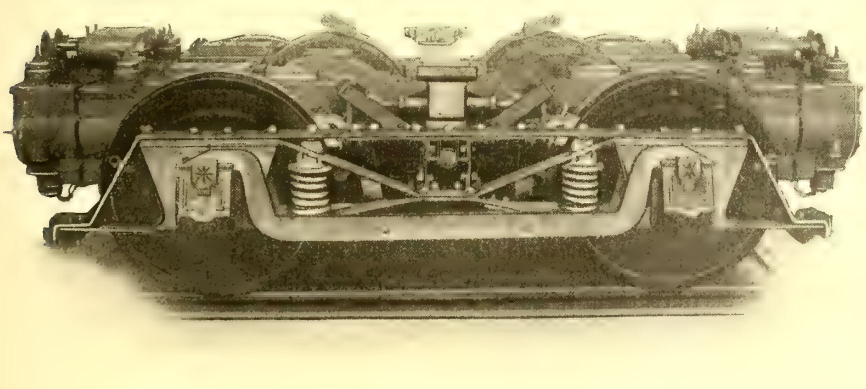


FIG. 11.—SIDE VIEW OF LATEST MOTOR EQUIPMENT, WITH TRUCK

At the same time the air cylinders, in addition to performing all the functions of speed control, give to the machine the independent unit element, and the ability to store the kinetic energy of the train in stopping and utilizing it in starting. On account of these and other features the electric motors of this system can be much smaller in capacity when rated as continuous working motors, than those of other systems not possessing this equalizing load feature, and the capacity of the power house and line can be reduced to about one-half of what would be required with systems where the fluctuating starting loads of the cars are transmitted back to the power house.

In order to better understand the different operations of the system, Fig. 4, showing a speed diagram, has been prepared, in which, on the axis of abscisse, O D L, are represented the different car speeds in percent of the synchronous motor speed, while the co-ordinate axis, A O B, represents the rotor and stator speeds corresponding to the car speeds shown.

The operation of the car may be divided into the following periods:

1.—STANDING IN THE STATION

Referring to Fig. 3 the rotor R is standing still, while the stator S runs with full synchronous speed. The stator is then transferring the full energy of the electric motor through crank C to the compressor cylinder S C, which energy is being delivered in form of compressed air into the air reservoir.

Since the relative velocity between the stator and the rotor is, under all conditions of operation, constant, the speed curves of stator and rotor may be represented by two parallel lines, O C R, and A D S, in Fig. 4. The origin O of the given co-ordinate system represents the period of rest of the car, and, therefore, indicates zero rotor speed and full stator speed in a negative or downward direction, as the stator is now revolving in the opposite direction from that which the rotor must revolve to drive the car forward.

Let it be further assumed that for an instant O A equals the active torque of the stator, then it will be easily understood that O B, which equals O A, represents the reactive torque of the rotor exerted on the car axle, meaning that if the car is free to move the reactive torque can be used advantageously for the starting and acceleration of the car.

When the car is standing in a station it is held at rest by moving the controller to such a position that the outlet pipe from rotor cylinder R C is throttled, thereby increasing the pressure behind the piston to such an extent that it overcomes the effort of the rotor R to revolve, thus tending to cause the stator S to revolve and at the same time holds the car at rest without the use of wheel brakes.

2.—STARTING AND ACCELERATION

To start the car the air cushion behind the piston of R C is removed, and the air, which is being compressed by cylinder S C, supplemented by the stored air from the tanks, is ad-

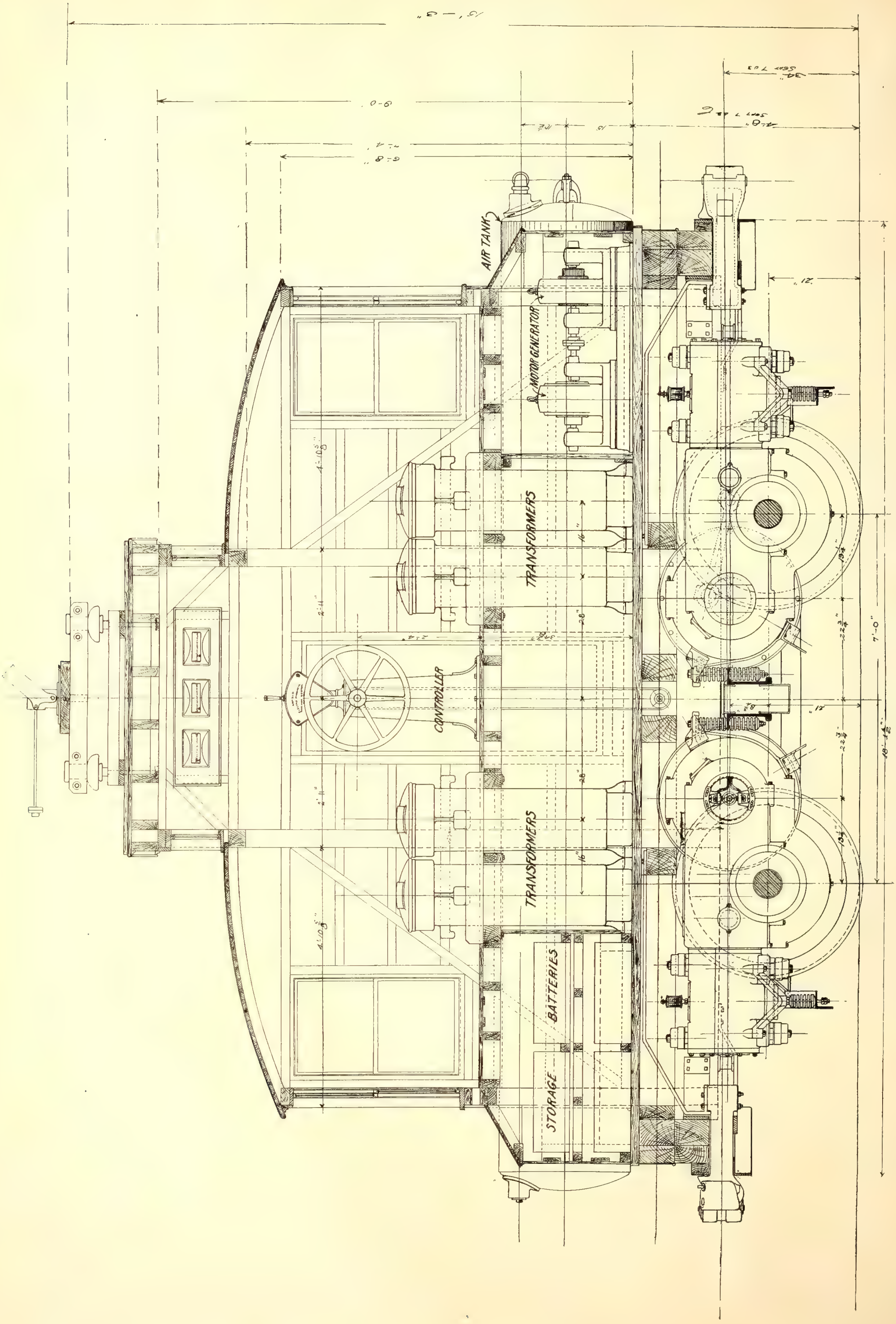


FIG. 12.—LONGITUDINAL SECTION OF LOCOMOTIVE

mitted to cylinder R C, with the controller at the position of maximum cut-off. The rotor then begins to revolve, and as it accelerates the stator slows down by exactly the same amount that the rotor has increased its speed, and as the rotor and car speed increase the controller is gradually moved to a smaller percentage of cut-off, until the car speed corresponds to the full synchronous speed of the motor, at which time the stator comes to rest.

During this period of acceleration the air compressed by cylinder S C, instead of being delivered to the tanks to lose its heat, is delivered, hot, directly to the rotor cylinders, thus greatly increasing the efficiency of the combination, as the heat usually lost in air systems is utilized, and the advantages of heated air gained without a reheater, and as the pressure used is low many of the ordinary difficulties in the use of compressed air disappear. If the rate of acceleration is such that cylinder R C uses all of the air supplied by cylinder S C no exhaust to the atmosphere from cylinder R C takes place.

Referring now to Fig. 4, which graphically represents this process, since the electric motor runs always at a constant speed and a constant load, it has a constant torque, and, therefore, the distance between lines O C R and A D S may be considered as representing the energy delivered by the electric motor.

The length of any ordinate extending from O D to O C represents the proportionate amount of energy derived from the electric motor, which is applied directly through pinion P and gear G of Fig. 3 to the propulsion of the car, while the corresponding ordinate extending below O D to A D represents the proportionate amount of the energy of the electric motor which is absorbed in compressing air through cylinder S C, which energy, in the form of air, is immediately transferred to cylinder R C, and is utilized in accelerating the car.

In practice, however, since there will be a loss in transferring the energy from electrical energy to energy in the form of compressed air and back again into mechanical energy, this loss, whatever it may be, must be drawn from the storage tanks, and the requisite amount of air from these tanks supplied to rotor cylinder R C in order to maintain the full power of the electric motor upon the car axle during the period of acceleration. Should it be desired to accelerate at a greater rate than the full power of the electric motor is capable of giving to the car, the additional energy may be supplied in the form of air from the storage tanks through cylinder R C, thus increasing the total energy given to the car during acceleration, in which case this total power would be represented for any given instant by a point above line B C.

3.—FULL SPEED

When the rotor has reached full synchronous speed, by the previous operation, this speed can be maintained by moving the controller to another position, which will throttle the outlet pipe of cylinder S C until the reaction due to the pressure behind the piston equals the full capacity of the electric motor. An overload or underload may be placed upon the motor by varying this pressure, but under normal conditions of operation cylinder S C is provided with an automatic valve, which keeps a constant pressure behind its piston, thus maintaining an absolutely constant load upon the electric motor, and consequently a uniform demand of electrical energy from the line. This uniform load is represented by the parallel lines O C R and A D S of Fig. 4.

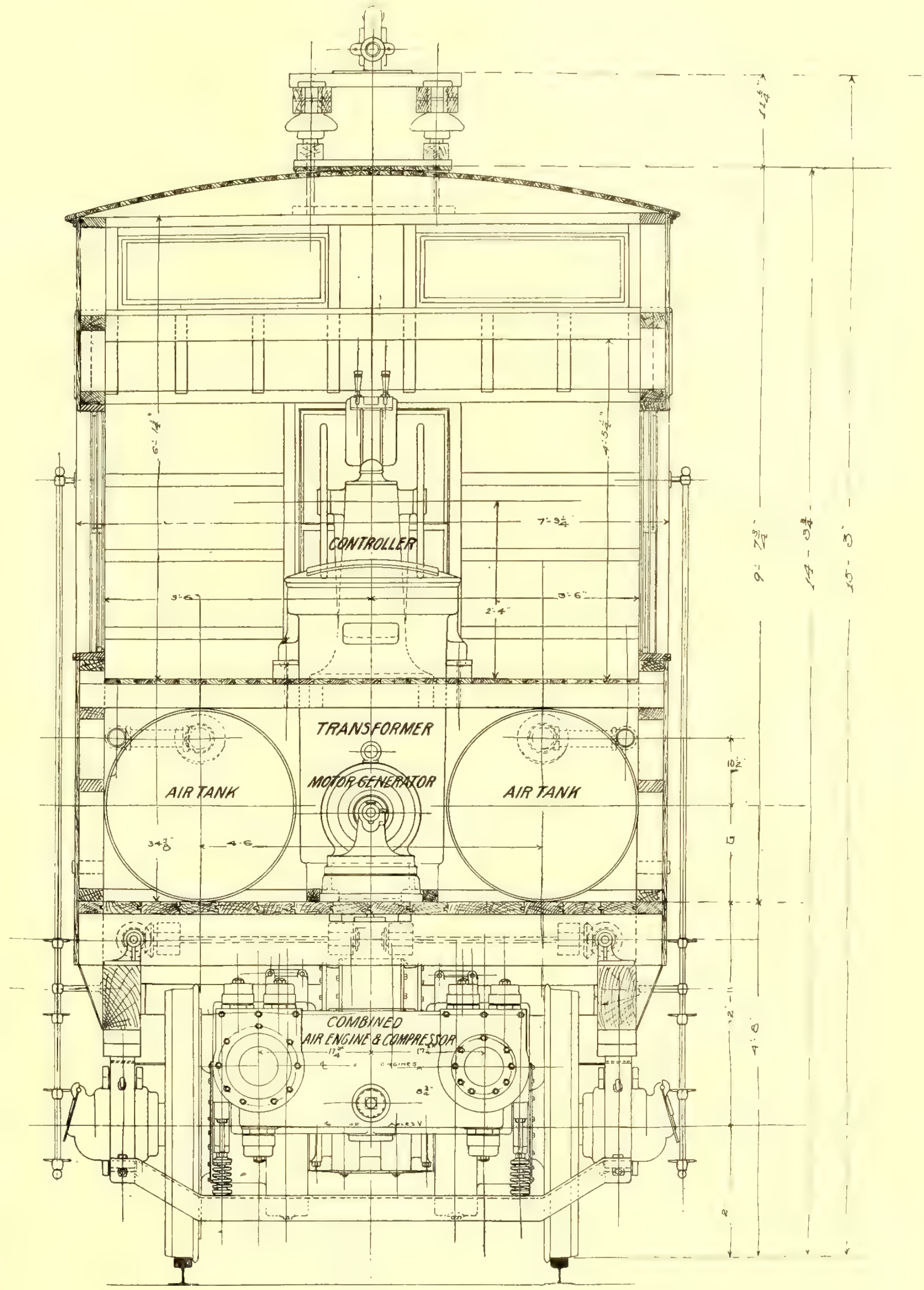


FIG. 13.—TRANSVERSE SECTION OF LOCOMOTIVE

With the controller set at full-speed position the inlet valves of rotor cylinder R C are held open and the piston runs free and the electric motor now gives its full power to the car axle, and the stator and its air mechanism will remain at rest as long as the car runs at the speed corresponding to the synchronous speed of the motor,

4.—SPEED VARIATIONS

There are usually certain places on any road where high rates of speed can be maintained for short distances, and as these speeds might be higher than the synchronous speed for which the motor was designed they are provided for as follows:

Assuming that the car is running at synchronous speed the controller may be moved to such a position that the valves of stator cylinder S C operate in such a manner as to cause it to act as an engine and revolve stator S in the same direction as rotor R is revolving. This now causes, owing to the constantly electrically maintained relative difference in speed between the stator and the rotor, an increase of speed of the rotor and car axle, due to the motor automatically working as a magnetic clutch, without mechanical contact, and if the resistance of the car or train is less than the capacity of the electric motor, the air necessary for revolving the stator can be obtained, hot, from the rotor cylinder R C without drawing from the tanks, and a speed above synchronism indirectly proportioned to the resistance of the train maintained indefinitely. When the resistance of the train is greater than the capacity of the electric motor speeds above synchronism can be obtained only by supplying rotor cylinder R C with stored air from the tanks, and can only be maintained for short distances, or until the storage capacity of the air reservoirs is exhausted. This condition corresponds to the spurts that can be made by a steam locomotive when working above the steaming capacity of the boilers. The distance from the line O D L to that portion of the line A D S above O D L in Fig. 4 represents, at any given speed, the proportionate amount of energy which must come from the tanks, and be supplied through cylinder S C, and the distance from D L to C R represents the total energy given to the car by the combined action of the electric motor and the stator cylinder when operating under these conditions.

The energy delivered to the car can be still farther increased by admitting air into rotor cylinder R C, and allowing it to works as an engine.

5.—RETARDATION

To bring the car or train to rest, instead of applying mechanical brakes to the wheels in the ordinary manner and thereby dissipating the entire stored energy of the car or train in the form of heat, this energy is saved in the form of compressed air, to assist in starting the car or train, by setting the controller in such a position that rotor cylinder R C compresses air and delivers it into the storage tanks. Any desired rate of retardation can be secured by throttling the delivery pipes from rotor cylinder R C, and in practice this pipe is provided with an automatic valve, which releases just before the slipping point of the wheels, thus allowing the motorman to brake as rapidly as he desires without liability of flattening the wheels. Supplemental wheel brakes are provided for emergency, but need not often be used, and the ordinary wear and tear on them is saved. When the car is again at rest the cycle of performance as above given is repeated for the next run.

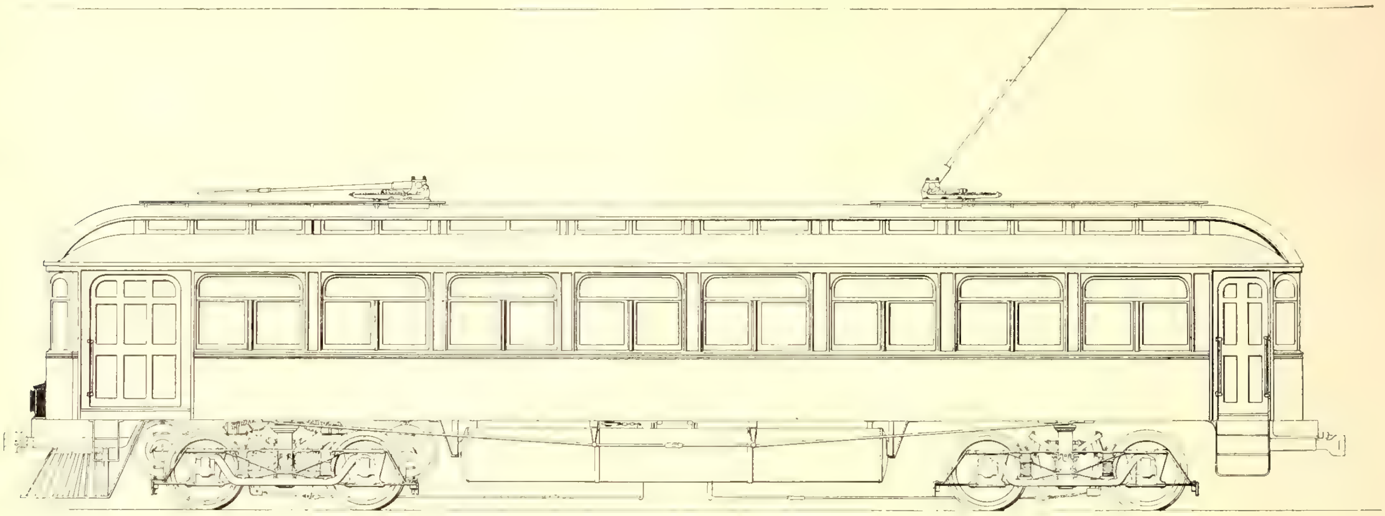


FIG. 14.—DRAWING OF COMPLETE CAR

FIG. 15.—PHOTOGRAPH OF COMPLETE CAR

6.—REVERSING

When it is desired to run the car backward for short distances the electric motor is not disturbed and the power is furnished by the rotor cylinder R. C. by reversing the action of the valves, but if it is desired to run backward for any great distance, the current is thrown off the motor, the stator engine reversed, and the stator brought to speed by the air, when the current is again thrown onto the motor, and the cycle of operation is the same as when running forward.

Fig. 5 represents the exterior of the electric motor, showing the cranks of the stator and rotor, also collector rings for operating the valves of the air cylinders when working as engines.

Fig. 6 shows an interior view of the stator of the motor with the flange removed, the rotor of the motor being of the standard squirrel cage induction type.

Figs. 7 and 8 show, mounted upon a truck, two views of the first electro-pneumatic motor constructed, and upon which the first experiments were conducted.

Since the single motor represented in Figs. 7 and 8 was too small in capacity to propel so large a car, it was decided to experiment with an improvised locomotive, consisting of the truck and motor shown in Fig. 7 and 8, carrying suitable air tanks and transformers upon a temporary frame structure.

This locomotive, shown in Fig. 9, was the one upon which the trial runs were made and passengers carried on June 15, 1902.

Figs. 10 and 11 show the end and side views of the new electro-pneumatic motor constructed after the preliminary experiments had been made on the first motor. For experimental purposes this truck was fitted up in the form of a locomotive, as shown in longitudinal and transverse section by Figs. 12 and 13, and it was this locomotive that was recently destroyed by fire. In order that the locomotive might operate as an independent air unit upon tracks not equipped with overhead electrical conductor, it was provided with a small storage battery and small motor generator for charging the batteries, and for operating the headlight. These auxiliaries are not necessary for the successful operation of the system, provided the locomotive can always be supplied with electric current from the working conductor, for then the valves can be made to operate from alternating current, and thus eliminate the use of motor-generator and batteries. When, however, it is desired to operate independently of the electric conductor these auxiliaries are necessary, and one set may supply an entire train. It will be seen that the locomotive is also provided with transformers, another auxiliary which is unnecessary in case the motors are designed for the voltage transmitted over the working conductor, but in this case transformers were used because the manufacturer of the motors could not be induced at the time they were purchased to build a high-tension motor for railway work, consequently the parts of a standard motor were utilized, and a pressure of 200 volts adopted for the motors, as this was the most economical voltage that could be used with the particular parts selected. This locomotive was provided with all necessary testing instruments, and had been operated in the car houses for some time, and found to perform all its functions successfully, and would have been placed on the road, and experiments with it would now be in process had it not been destroyed.

NEW Y. M. C. A. BRANCHES

The railroad department of the Young Men's Christian Association has recently established a branch on the lines of the Public Service Corporation of New Jersey. Another is being formed among the men of the Virginia Passenger & Power Company, of Richmond, Va.

INDICTMENTS FOR CHICAGO STRIKE RIOTERS

The grand jury at Chicago has indicted thirteen union labor leaders, members of the union and sympathizers, for inciting or taking part in acts of violence accompanying recent strikes in Chicago. The majority of these men were caught in connection with the strike on the Chicago City Railway.

DOUBLE TRACK FROM JOLIET TO CHICAGO

The Chicago & Joliet Electric Railway Company has now completed the double tracking of its line between Joliet and the Chicago city limits, with the exception of two short stretches, one of which requires about 1 minute to pass over on ordinary schedule, and the other about 3 minutes. This company has a heavy Sunday traffic in summer, which it has been constantly endeavoring to surround with all possible safeguards since the road started in operation. Block signals were used on the road when operated as a single-track line, together with a telephone despatching system and a very rigid set of rules.

That portion of the line from Joliet to Lockport, 5½ miles, is somewhat remarkable for the traffic it enjoys. A 15-minute service is given on this part of the line. Lockport, according to the census of 1900, has a population of 2659, and many who work in Joliet live in Lockport.

LONDON LETTER

(From Our Regular Correspondent.)

Now that the fiscal question is so prominently before all Englishmen, the question of the import of materials used on tramway and general electrical construction is receiving considerable attention by Town Councils and other purchasers of material. The London County Council has recently been considerably criticised for placing its orders for tram rails in Belgium, and so acute has been the discussion that the "Daily Telegraph" has a long letter from its special correspondent at Liege trying to give reasons why the Belgians can beat British manufacturers of tram rails in price. The chief reason given is that the Belgians, like the Germans, use the "basic" process for the production of their steel, which, it is claimed, can thus be produced much more cheaply, though the process is also used by British manufacturers. In addition to that, however, the Belgians work longer hours and are receiving in wages a much lower rate than is paid in England, and troubles with trade unions appear to be of the slightest character in Belgium. It would appear also that a more continuous employment enables them to manufacture more cheaply, and that the Belgian rolling mills are evidently organized on the latest scientific principles and use the most efficient apparatus.

The resignation of Mr. Metzger from his position as chief engineer to the electricity department of the Manchester Corporation was announced last month, and quite recently S. L. Pearce has been appointed to succeed him. Mr. Pearce will take up his duties on Feb. 1, and at present is acting as deputy chief engineer. The Manchester Corporation, however, has made arrangements with Mr. Metzger to have him continue as consulting engineer until the large extension scheme which was commenced under his regime has been completed. Mr. Pearce will receive £800 per annum. He has been engaged in electrical and mechanical engineering for a long time. Most of his experience in electric transportation was acquired while he was connected with the British Thomson-Houston Company, of London, and later with the Central London Railway, where he was superintendent engineer of the power house.

John Young, general manager of the Glasgow Corporation Tramways, has just issued a report on the arrangement of duties —day's work—of the motormen and conductors employed by the Glasgow Corporation. It has been long recognized by the progressive tramway managers that an efficient service of tram cars entails a variable day's work for both motormen and conductors. The Glasgow tramways have always been worked on these lines, but now other changes are being made. The chief result of the last change will be that 70 per cent of the duties over the whole system will be overtaken within twelve hours, as against 35 per cent at present, and all "spread overs" exceeding fifteen hours will be abolished. The average working day will still be nine hours, with a minimum of eight hours and a maximum of ten hours. Mr. Young has also submitted for approval a scheme to provide for motormen a premium or bonus for those who have enjoyed freedom from collisions and accidents. He proposes that every motorman who has fulfilled the conditions for a period of six months shall be entitled to a bonus of 26 shillings.

The fifteenth annual dinner of the Institute of Electrical Engineers was held recently at the Hotel Cecil, R. K. Gray, the president, occupying the chair, and about 500 members and friends being present. In replying to the toast of "Railways and Telegraphs," proposed by Mr. Swinburne, Sir C. J. Owens, chairman of the London & Southwestern Railway, stated that it was obvious to those interested in the subject that the time was fast approaching when electricity would be the sole motive power for railways. Lord Charles Hamilton, chairman of the Great Eastern Railway, in reply to the toast of "Our Guests," made the remark that while railway chairmen were rather at sea with regard to electricity, and hesitated to embark in a course that might soon become out of date, yet they were thoroughly alive to its importance and that they were closely studying all its developments.

The Corporation of Swansea has at last decided on the electrification of its tramways, and has recently placed the contracts for most of the necessary work. The largest part of the contract, that for the construction and electrical equipment of the permanent way, has been given to Dick, Kerr & Company, London, whose tender of £81,571 has been accepted, though this does not include the supply of cables. Dick, Kerr & Company quoted for British made rails and fish-plates, and the tender has been accepted on that condition.

Another hitch has arisen between the Leith Corporation and Edinburgh District Tramway Company with regard to the

leasing of the Leith system by the lessees of the Edinburgh lines. It will be remembered that all passengers from Edinburgh to Leith or vice versa have to change cars at Pilrig, which is the boundary line between the two cities, and it was to obviate this difficulty that both the Leith Corporation and the Edinburgh Tramways Company have been working. The Edinburgh Tramways Company desires to continue its cable system to the bottom of Leith Walk, while the Leith Corporation, which intends electrifying its horse car system, very naturally desires to continue its overhead system to St. Andrew's Square, in Edinburgh, which would solve the problem for the present. With the present hitch, therefore, the Pilrig "muddle" seems still some distance from solution.

It has been officially reported by the highways committee of the London County Council that the New Cross and Greenwich tramways will shortly be opened for electric traction. This addition to the system will relieve the main lines from the grave inconvenience of having horse cars from Greenwich and New Cross sandwiched with the electric cars from Tooting and the Brixton cable terminus. The new lines radiate from the Elephant and Castle, via the New and Old Kent Roads, to the terminus at Greenwich, and from the Elephant and Castle by way of Walworth Road, Camberwell Road, and Peckham Road to New Cross Gate. A few weeks after the opening of these important lines the new branch from the Elephant to St. George's Church in the borough, and the new route to the foot of Southwark Bridge, will also be in operation. Temporary arrangements have been made with the London Electric Supply Company at Deptford, where large engines and generators belonging to the London County Council have been placed to produce the necessary energy.

By thirty-six votes to twenty the new progressive Borough Council of St. Pancreas has recinded a resolution of its predecessor, and thus given statutory consent to the construction of a new tramway system. The proposed service is to connect with the tramway in Hampstead Road, and pass across Euston Road and along Tottenham Court Road to a point opposite the Horse Shoe Hotel.

In connection with the general electrification of the tramway system of London, the highways committee of the London County Council is considering the question of dealing with the northern lines which have been leased to the North Metropolitan Company. They have now decided that certain sections of the lines which could be worked with through services of electric cars shall be first constructed, and to these it is intended to apply the underground conduit system of electric traction. The lines in question are: (1) Theobald's Road terminus, via Clerkenwell Road, Old Street, Great Eastern Street, Commercial Road, and Leman Street to near the London Docks: (2) Norton Folgate terminus, via Shoreditch, Kingsland Road, High Street, and Stoke Newington Road to Stamford Hill; (3) Aldgate terminus, via Commercial Road, Commercial Road east, and East India Dock Road to Poplar; (4) Moorgate Street terminus, via Finsbury Pavement and City Road to junction with Old Street; (5) Holborn terminus, via Gray's Inn Road to junction with Theobald's Road; and (6) along Old Street between Great Eastern Street and Shoreditch. The length of these tramways is about 22¼ miles of single line, and it will be practicable for the whole of them to be worked from the electricity generating station which is being established at Greenwich.

Details in the form of public Parliamentary notices have been published in connection with a new bill to be promoted by the London United Tramways Company in the next session of Parliament for the purpose of securing powers to construct new tramways in Middlesex, Bucks and Surrey; to obtain special provision with regard to compensation for lands acquired under the scheme, and to extend the time for compulsory purchase of land and for the completion of authorized tramways. The Parliamentary notice shows that the proposed new lines are intended to form an extension to the company's system in the Brentford, Hounslow and Ealing districts, and so continue the tramways into Bucks.

A tramway scheme is contemplated in Northeast Lancashire, detailed drawings being prepared for a light railway between Blackburn, Whalley, Burnley and the intervening townships, for which powers have been obtained and notices to treat served on landowners on the line of route. Application is to be made to construct a line between Blackburn and Preston, and further application made for a line between Preston and Lytham. If the schemes are carried out in their entirety there will be an unbroken line of tramways and lightways from Fleetwood and Blackpool on the one hand to Rawtenstall in the Rossendale Valley on the other—a distance of over 60 miles.

At a meeting of the Leeds Corporation tramways committee a report was presented by the general manager (J. B. Hamilton) in regard to the "split turn" system. In the document Mr. Hamilton pointed out that the old system, by which a certain number of cars were run continuously from morning till night, regardless of the requirements of traffic, was no longer workable.

A. C. S.

PARIS LETTER

(From Our Regular Correspondent.)

The Metropolitan Railway has been having considerable trouble with snow and sleet on its overhead or viaduct section, and this division was completely tied up on Dec. 1, last, on account of the snow fall. The company has no scrapers or apparatus for cleaning snow or ice from the head of the third rail, and a number of insulators were burned out when the cars attempted to run in the early morning. Later some salt was used to melt the snow, and there was still greater trouble with the insulators. In one instance the arcing between the shoe and the third rail set fire to the shoe cables and the motor car was pretty badly burned in consequence. The third-rail insulator, it appears, has but a thickness of 15 mm (about ½ in.) of insulation between base and iron cap. Temporary wooden blocks will be used by the Metropolitan Company to carry on the service on the viaduct section, and new type of insulators will be adopted for this section of the line as soon as possible.

In consequence of this and the possibility of future trouble from sleet and snow, the Metropolitan and Ouest Railway Companies are studying the subject of sleet scrapers for use on their third-rail lines. Definite data cannot yet be given regarding the type to be adopted, as tests are not yet completed.

Meanwhile the Metropolitan Company is endeavoring to satisfy certain demands from the public, namely, the establishment of smoking compartments in the trains and permission for the conveyance of small dogs in the cars. As regards smoking compartments, certain tests have been made in the presence of the prefect of police, M. Lepine, and the Municipal Council. Ordinary cars were transformed by the addition of a suitable ventilating blind, and it was decided that the ventilation was good enough and that smoking could be tolerated. There is considerable opposition, however, on the part of a certain part of the public, and especially from certain influential medical and hygienic societies. It is therefore unsafe to predict an early settlement of the question. Special cars, however, are being added to certain trains in operation to allow the continuation of the tests.

The extension of the circular line of the Metropolitan between the Trocadero and the River Seine is now open to traffic and the terminal station is temporarily removed from Trocadero to Quai de Passy. The next step toward completion of the circular line will probably be to equip the part of the road situated on the south side of the River Seine and put it in operation without awaiting the completion of the connecting bridges across the river. The foundations of these important bridges have only just been laid, and even under the most favorable circumstances they will not be ready for the passage of trains before the summer of 1905. The following figures on cost have recently been made public: The total cost of the line between the Trocadero and the Place d'Italie amounts to about f. 23,000,000, or something over f. 3,000 per running meter. On the right bank, the Maillot-Vincennes line cost but f. 2,600 per meter, and the northern circular line (No. 2) but f. 2,800. The higher cost of the southern line is explained by the fact that it is in great part a viaduct, and there is also the expensive bridging of the Seine.

As a result of the accidents of the last few months the city authorities have created a new office, that of electrical engineer, especially to control the operation of the Metropolitan. A credit of f. 8,000 has been voted for the salaries attaching to the position. There are strong tendencies in the city administration toward municipalization of the public services. At present this principle has been authorized only for the gas supply, and very recently has been proposed for the electric lighting. It cannot, however, be yet considered that the policy of the city is definitely in favor of taking over all public utilities. The recent proposition to operate the public lighting met with strong opposition from a large part of the public.

An event of great importance is slowly making progress. This is the realization of the North-South line, which has been so long proposed by different traction promoters. Among others, the scheme has been carefully considered by Berlier, a well-known contractor, and one of the first concessionaires of the existing Metropolitan lines, since turned over to the Metropolitan Railway Company. This new line will unite the three important centers of traffic, Gare St. Lazare, Gare d'Orleans and Gare Mont-

parnasse, and pass through one of the most densely populated parts of Paris. It will pass under the Seine by a shallow tunnel. The scheme will be commenced as soon as possible after the approval of Parliament, or about March next.

Meanwhile the No. 3 line, uniting Courcelles-Menilmontant, is rapidly approaching completion, and will be opened for service about next Easter. The immense work in front of the Opera is now about completed and the vicinity is assuming its ordinary appearance after months of obstruction. It will be remembered that at this important junction there are three tunnels superimposed one over the other, and this has necessitated an exceedingly solid structure, the whole forming practically one block of masonry and iron girders.

As the readers of your paper know, a strong opposition to the trolley system has always existed in Paris. The Cie Générale des Omnibus is one of the principal sufferers in this respect, and submits proposition after proposition to the city authorities for the improvement of its affairs. The following is the latest proposition made by this company: (1) The abandonment of eight of its existing unprofitable omnibus lines. (2) Changes to thirteen other lines, reducing the runs and the hours of service to from 8 a. m. to 8 p. m. (3) In consideration, the Cie Générale proposes to experiment with a 30 per cent reduction of fares, making a 20 centime fare in place of 30 centimes for the interior places. The prefect of the Seine has not given a very favorable reception to this plan, and has asked the city authorities to endeavor to secure from the national government a tramway franchise. In the meantime the trolley system, temporarily permitted in place of the Diatto system, whose operation was disturbed by the work on the Metropolitan tunnels, is still in service on the lines of the Est Parisien and a few others. The surface contact systems are not entirely moribund, and the Dolter system in particular appears to be making progress. This company installed a short line recently from the Bois de Boulogne to Suresnes, and states that it is about to install the same system in Dresden, Germany. This city has a trolley system in the suburbs and uses storage batteries in the center of the city. It is these sections which, it is said, are to be replaced by the surface contact system.

On all sides storage battery cars are disappearing, as well from street railways as from regular railway lines. In Italy, for instance, the storage battery lines Bologna-St. Felice and Bologna-Modena are being superseded.

Another French undertaking which is receiving an amount of public favor in Italy is the trackless trolley. The Lombard-Gérin system is now being installed between Gallarate and Samarate, and a uniform fare of 10 centimes will be charged.

Great activity is reported from the Italian side of the Alps in traction matters. We have but to mention two of the more important, viz., the extension of the Valtellina line from Lecco to Milan, and the still more important Naples-Rome scheme. The two latter cities are united by a steam railway line, 250-km in length, and express trains at present take five hours for the journey. A royal commission has recently reported in favor of a new line with a maximum grade of 1.5 per cent and with a minimum curve radius of 980 meters. Electric traction is advised, and high-tension three-phase current seems so far to be preferred. The trains will be composed of three carriages of 120 tons total weight, and a speed of 100-km per hour is specified. Hydraulic power will be used for current generation, and the total cost is estimated at f. 110,000,000.

It is reported from Versailles that a great amelioration in the affairs of the traction company has taken place. At the general meeting, on Nov. 26, it appeared that this improvement was not due to increase in traction receipts, but to increasing distribution of power and lighting. This ratio of working expenses to receipts is some 75 per cent. This ratio has been dropping ever since 1899. By economies in the distribution the company was able to add f. 158,000 to the profits carried forward from the preceding year.

INTERURBAN BETWEEN FREEPORT AND DIXON, ILL.

Active steps have been taken toward building an interurban line between Freeport and Dixon, Ill., by the Freeport-Dixon Electric Railway Company. The Arnold Electric Power Station Company, of Chicago, has been retained by the railway company to prepare preliminary plans and report on the proposed line, which is about 35 miles in length and connects the towns of Freeport and Dixon. The officers of the road are: President, O. T. Smith, of Freeport; vice-president, W. A. Hance; secretary and treasurer, T. W. Sieke.

ECONOMY TEST OF WESTINGHOUSE-PARSONS TURBINE

An economy test of a 1250-kw Westinghouse-Parsons steam turbine generator set for the Interborough Rapid Transit power house was made on Dec. 21. Dry saturated steam was delivered to the turbine throttle at 150 lbs. gage pressure, and the net results showed a steam consumption of 15 lbs. per electrical horse power with 27 ins. of vacuum, and 14½ lbs. with 28 ins. of vacuum; barometer reading, 30 ins. The automatic safety stop, with which all the Westinghouse-Parsons turbines are equipped, was tested at the close of this economy test by holding down the governor lever so that the speed of the turbine was uncontrolled, resulting immediately in the turbine accelerating its speed. However, before the rate of speed reached 10 per cent above the normal rate the safety stop automatically released and shut the steam off. The third test was for regulation under extreme conditions. The full load was thrown on and off several times, and the change in the speed of the unit between no load and full load, as indicated by the change in tone of the note given out by the generator, was barely perceptible.

AUTOMOBILES AS AUXILIARIES TO ELECTRIC RAILWAYS

The Winton Motor Carriage Company, of Cleveland, Ohio, is making a special effort to interest electric railways in its product. During the past year a number of railway managers have purchased automobiles for their own use, and the Winton Company is prepared to demonstrate that an automobile can be made a profitable item in the equipment of any electric railway company. Managers of several companies are using Winton cars for inspection purposes and on emergency runs, because a reliable automobile can cover a large city system in much less time than even in a special car, and with a great deal less trouble and expense. For use on an interurban system the advantages of a speedy automobile are still more numerous; especially is this true with a road under construction. Two hundred miles in a day is not a great hardship for a Winton car, and a sustained speed of 30 miles to 35 miles an hour is possible. An automobile maintained on construction work can be used in carrying the men from point to point at a great saving of time and expense over the customary method of hiring livery rigs for such work. Managers of interurban roads in operation find that a Winton automobile is practically as speedy as a special car, even in the case of high-speed roads, since there is no occasion for a consideration of schedules, and, if desirable, the automobile may leave the route of the railway and make cross-country cuts.

The Buffalo, Dunkirk & Western Railway Company, of Buffalo, has been using a Winton automobile on its construction work during the past year, and has found it of great advantage over the method usually followed by electric railway builders, of hiring horses and carriages. Before purchasing the automobile, the company figured that it had been paying from $5 to $20 per day in livery bills, beside losing time. It was estimated that a Winton automobile costing $2,500 and provided with a canopy top could be used in all kinds of weather and that it would effect a saving of time and cash over the old method. The results of the experiment have been most pleasing. The company wisely decided to hire a man to operate the car and keep it in first-class order. The car is stationed at some central point on the system, and at any hour of the day or night is prepared for service to take employees to points along the line. At times officials of the company use the automobile to inspect work along the line or to take prospective investors over the system. The car has practically saved its cost in livery bills this season, and the company has an asset which is still in excellent condition and good for several years to come.

The Winton gasolene two-cylinder motor develops 24-hp, which is sufficient to propel the car over any kind of roads and grades at high speed. The operation is extremely simple, as there are but two levers, one operating the high-speed gear and emergency brake and the other the hill-climbing gear and reverse gear. The speed of the motor is regulated by pressing a foot button. The lubrication of all parts is entirely automatic, and it is only necessary to keep a tank supplied with oil. Fuel supply for 250 miles can be carried on the car and a new supply purchased at any cross-roads store. Danger of tire troubles has been reduced to a minimum through a new tire designed for the Winton Company. Every car is fitted with a canopy top with rolling side-curtains and a hinged glass front, which renders the car serviceable in any kind of weather. The company has agents in every large city in the country and maintains branch sales depots in New York, Boston, Chicago, Cleveland and Philadelphia.

CHRISTMAS AT ST. LOUIS—INCREASE IN PAY

Ninety-nine conductors and thirty-one motormen of the St. Louis Transit Company had unusual opportunities to enjoy Christmas. They were beneficiaries of the first annual distribution of bonuses made by the company. Each of them got 1 cent for each hour he had worked during the year, the total averaging about $32 for each man. The men who got the bonuses were those who, during the year, had not had an accident, or had not been responsible for events which had caused the company to defend suits or effect compromises. The discrepancy between the number of conductors and motormen who got the bonuses is due to the fact that conductors have less opportunity for figuring in accidents.

The company has been paying bonuses since November of last year, but this is the first one which covers a period of a full year. The previous payments have been for shorter periods, ranging from one month at the first payment to eleven months at the eleventh payment. The total paid out by the company for bonuses was more than $4,000.

In many cases the men also got letters from the management of the company thanking them for the care they have taken, not only in the running of their cars, but for their general deportment and their attention to the appearance and cleanliness of their cars. One of these is a man who boasts of a twelve-year service with the Laclede and Lee Avenue lines, without a reprimand, a "lay-off," an accident or a quarrel with a passenger.

An increase of 1 cent an hour for all men will go into effect Jan. 1. The present scale is 21 cents an hour, with ten hours constituting a day, no less than eight and a half hours being given each man sent out, and extra pay for overtime.

OPENING OF DUNEDIN, NEW ZEALAND, ELECTRIC TRAMWAYS

The conversion of the Dunedin tramways from horse to electric traction, which was undertaken for the Dunedin municipality on Feb. 27, 1903, by Noyes Brothers, of Sydney, Melbourne and Dunedin, has now been completed with the exception of the suburban extensions. The first trial runs were successfuly made on Nov. 30, 1903, under the personal direction of W. G. T. Goodman, of Noyes Brothers, under whose supervision the tramways were rebuilt. Although the first car left the car house as early as 3 a. m., it had on board a distinguished party, including Mr. Scott, now mayor of Dunedin and former chairman of the Dunedin Tramways Committee. The cars to be used on this line were built by the J. G. Brill Company, and are each equipped with two Westinghouse No. 68 motors and Westinghouse magnetic brakes.

NO COMPETING LINE IN BRONX BOROUGH, NEW YORK

The New York State Railroad Commission has refused to grant a certificate to the New York City Interborough Railway Company for a street railway system in the Bronx. The Interborough Company was incorporated on March 21, 1902. The president was Robert C. Wood. The company's system of 40 miles was planned to tap many parts of the Bronx and parallel the tracks of the Union Railway Company, controlled by the Metropolitan Company, in a large part of the territory. It was on the point of ruinous competition that the latter opposed the Interborough Company.

Before making application to the State Railroad Commission the company went to the Board of Aldermen for a franchise for its system. This was granted by the Aldermen in March last. In addition to granting the company a franchise then, the city recently, when the Union Company got the right to cross Macomb's Dam Bridge in order to connect its lines on the West Side with those in this borough, inserted a clause in the franchise requiring the holder of the franchise to allow the Interborough Company to use its tracks across the bridge, thus giving it access to Manhattan.

The Interborough Company, before proceeding to construct its lines, had to get a certificate, under the railroad law, from the State Railroad Commission that its lines were a matter of public convenience and necessity. Its application, which has just been denied, was made on June 2, 1903. Many hearings have been held since then by the commission to determine whether or not facilities in the Bronx were adequate and whether a rival street railroad system was needed. Briefs in the case were submitted on Dec. 7. Under the law appeal can be taken to the Appellate Division of the Supreme Court from decisions of the State Railroad Commission, and, it is said, this will probably be done by the Interborough Company.

AMERICAN EQUIPMENT FOR MANILA STREET RAILWAY

The Manila Electric Railroad & Lighting Corporation, which has acquired a franchise for the construction of 40 miles of electric railway in and around Manila and for the lighting of that city, has placed an order for a complete power equipment for the traction system of that city, through Westinghouse, Church, Kerr & Company, which comprises the following machinery: Three 750-kw Westinghouse turbo-generator units, two compound engine exciter units, one motor-driven exciter unit, three 500-kw rotary converters, one 300-kw rotary converter, four 250-kw oil-insulated transformers, complete switchboard, and one series-booster, mounted on the extended shaft of one of the rotary converters. The car equipments will comprise ninety double No. 68-C outfits, and ten double No. 56 outfits, using standard Westinghouse controllers.

The first turbo-generator unit will be delivered in about nine months. The turbine will operate at 150 lbs. steam; 26 ins. to 27 ins. vacuum, and 150 degs. superheat. It is fitted with the usual by-pass for securing an overload capacity of 50 per cent. It is also equipped with a quick-closing throttle valve.

The turbo-generators will furnish three-phase, 60-cycle current at 380 volts; part of the current will be converted to direct-current by the power house railway sub-station, and the remainder will go to transformers for supplying high-tension distributing system. The transformers are oil cooled and connected in the two-phase, three-phase, or Scott system for three-phase transmission. The turbine machiney will also furnish current to the local light and power system.

The president of the company is Charles M. Swift, of Detroit, Mich. F. H. Buhl, ex-president of the Sharon Steel Company, is vice-president. F. H. Reed, of J. G. White & Company, of New York, is secretary. The directors are: Charles M. Swift, F. H. Buhl, Peter L. Kimberly, of Sharon, Pa.; J. G. White, of J. G. White & Company; Henry C. Conant, of Westinghouse, Church, Kerr & Company, and George C. Smith, of the Securities Company, of Pittsburg. J. G. White & Company are building the lines, which are expected to be in operation by the end of next year.

THE QUESTION OF POWER BRAKES IN CLEVELAND

Last week the Board of Public Service, of Cleveland, conducted an open discussion of a proposed ordinance to compel the Cleveland Electric Railway Company to equip all its city cars with power brakes. President Andrews and General Manager Stanley of the company were present, and concisely stated their opposition to the adoption of power brakes. Mr. Andrews stated that his company had already experimented with a number of different kinds of power brakes and that all had proved unsatisfactory. He stated that it would cost $200,000 to equip all the cars with power brakes, and he thought it would be more desirable to spend this money in purchasing more cars. Former employees of the company and representatives of labor unions spoke strongly in favor of power brakes. The members of the Board of Public Service took no part in the discussions, and they finally decided that a special commission be appointed, consisting of the board of control, the committee on street railways, one representative of the railway company, a representative of the motormen, and the Mayor, to investigate the workings of the different types of brakes.

SOME NEW HYDRO-ELECTRIC PLANTS INSTALLED BY THE OERLIKON COMPANY

As is well known, the abundance of water-falls in the Alps has given great impetus to the installation of hydro-electric plants on an extensive scale. One of the largest of these will be the lighting and power station now being built in the province of Brescia, on the Italo-Austrian boundary at Caffaro. The station will be equipped with five generating units of 2500-hp each, furnished by the Oerlikon Company, of Oerlikon, near Zurich, Switzerland. The main line to Brescia will be 50-km (37.5 miles) long, and will transmit power at 40,000 volts. In connection with this plant there will be a transformer sub-station of 3250-hp capacity for furnishing current to an electro-chemical works.

The Oerlikon Company has also received the contract for the Engelberg-Obermatt plant, for transmitting current to Lucerne, 30-km (22.5 miles) distant, at a tension of 27,000 volts. The generating station will have 14,000-hp capacity. At the Lucerne substation the potential will be reduced to 2600 volts for transmission to the surrounding districts, including the entire canton of

Obwalden. Current will also be supplied to the Engelberg Railway.

Several weeks ago the great power station of the Compagnie Vaudoise des Forces Motrices des Lacs de Joux et de l'Orbe was placed in operation. This power station will supply over 190 villages in the canton of Waadt with light and power. It will have a capacity of 10,000-hp, deriving its energy from the Lac de Joux Falls, near Vallorbe. The Oerlikon alternators in this station will give 13,000 volts for transmission without using step-up transformers.

Another light and power station has just been started at Drammen, Norway. It receives its power from Gravfos Falls over a transmission line 38-km (28.5 miles) long. The entire electrical equipment, both for the station at the falls and the one in Drammen, was furnished by the Oerlikon Company. The power station at the falls is of 5400-hp capacity, and consists of six 900-hp units. The current is transmitted at 25,000 volts.

TO TAKE WASHINGTON, BALTIMORE & ANNAPOLIS LINE OUT OF RECEIVER'S HANDS

A plan has been announced for taking the Washington, Baltimore & Annapolis Traction Company out of the hands of the receiver. This is the road which is being equipped with Westinghouse single-phase motors, and its future is being watched with great interest. The company was promoted and financed by Clevelanders, and a few months ago it was placed in the hands of a receiver, due to the failure of some of the underwriters to respond to the call for funds. The company has called for $690,000, and has received from the underwriters $496,650. The incomplete property is worth $590,860. It has a floating debt of $120,813. To meet the debts now due and soon to become due, it is proposed to raise $250,000 by a proportionate payment from the various underwriters. This will be used to discharge the receiver, get the property back into the hands of the owners and devise plans for the future. The payments that will be required represent about 20 per cent of the underwriting. The underwriters have until Dec. 28 to sign the new agreement, deposit the receipts issued for the former payments and secure a new receipt. The reorganization committee is composed of E. G. Tillottson, W. N. Gates, W. S. Hayden and F. T. Pomeroy. As soon as the receiver is discharged plans will be made for refinancing the company.

THE CAR LICENSE LAW IN ST. LOUIS

The new street car law governing the license paid on street cars goes into operation in St. Louis Jan. 1, and the City Register has sent out letters to all of the street railway companies notifying them of the fact. Licenses for cars will be based upon the number of paying passengers carried. The companies will turn in reports of the passengers carried and will be taxed accordingly, the licenses being payable on April 16, July 16, October 16 and January 16. The amount is 1 mill for each pay passenger carried. The new law was passed by the last Municipal Assembly and approved by the Mayor March 25, 1903. The car companies will have to pay about $150 a car, where they formerly paid $25. It is expected that they will carry the matter to the courts. The minimum fine for not complying with the ordinance is not less than $5, while the maximum is not more than $500.

THE WORCESTER & SOUTHBRIDGE REORGANIZATION

At a meeting of creditors of the Worcester & Southbridge and the Worcester, Rochdale & Charlton Depot Street Railway Companies, both of which are in receiver's hands, at the Essex Hotel, Boston, Dec. 18, a proposition was made by Charles M. Thayer, of Worcester, one of the receivers, to pay 50 cents on the dollar to secured creditors, and 40 cents on the dollar to unsecured creditors, in cash, Feb. 8. The creditors did not accept the proposition, but appointed a committee made up of W. D. Luey, receiver of the First National Bank, of Worcester; Henry F. Harris, of Worcester; John M. Graham, president of the International Trust Company, of Boston; N. W. Jordan, of the American Loan & Trust Company, of Boston, and John N. Massey, president of the People's Savings Bank, of Providence, R. I., to examine into the financial condition of Fred Thayer, of Woonsocket, R. I., and George W. Wells, of Southbridge, endorsers of the notes of these two companies, and to ascertain whether the offer of a settlement on a cash basis is really the best one. The committee reported at a meeting Dec. 22. The statement was made at the meeting by Fred Thayer, of Woonsocket, R. I., that the name of Edmund S. Parker, auditor of the companies, had been forged, and that every note issued after Dec. 10, 1902, was a forgery. The offer for a cash settlement for the creditors was made possible by an offer of William E. Rice, of Worcester, a creditor to the extent of $80,000, who proposed to furnish $650,000, taking in return a second mortgage for that amount.

PERSONAL MENTION

MR. SAMUEL M. MANIFOLD, formerly of the Western Maryland Railroad, has been appointed general manager of the York County Traction Company's lines.

MR. C. M. REUTHER has resigned as master mechanic of the Landsdale & Norristown Street Railway Company, of West Point, Pa., and has accepted a position in the electrical department of the J. G. Brill Company.

MR. FRANK GALLAGHER has resigned as superintendent of the Bradford Electric Street Railway Company and the Olean, Rock City & Bradford Electric Railway Company, of Bradford, Pa., and has been succeeded by Mr. George Mitchell, of Philadelphia.

THE LANCASTER COUNTY RAILWAY & LIGHT COMPANY has accepted the resignation of General Manager Frank S. Given, and abolished that office. Vice-President Charles A. Keller and Superintendent C. E. Titzel will manage the railway part of the business.

MR. HUGH J. McGOWAN, who is president and general manager of the Indianapolis Traction & Terminal Company, chairman of the executive committee of the Cincinnati Traction Company and prominently identified with other street railway companies, has just returned to the United States after a trip to Europe. England, Italy, France and Germany were among the countries visited by Mr. McGowan. The trip was primarily one of pleasure, and Mr. McGowan is said to have returned much benefited in health.

HON. WILLIAM J. BUCHANAN, who was recently appointed by President Roosevelt to the post of Envoy Extraordinary and Minister Plenipotentiary of the United States to Panama, and who left about a fortnight ago on a special mission to that part of the world, will return within the next few weeks for the purpose of taking general charge of the various Westinghouse interests in Europe. Mr. Buchanan was appointed in 1894 United States minister to the Argentine Republic and served there until 1900, when he returned to this country and became director-general of the Pan-American Exposition. After his duties at Buffalo had ended he went back to the Argentine Republic to settle up some affairs for the United States. Until recently he has acted as South American agent of the New York Life Insurance Company.

MR. GEORGE H. HARRIS, who has just been appointed general manager of the railway department of the Birmingham Railway, Light & Power Company, of Birmingham, Ala., to succeed Mr. John B. McClary, resigned, has been connected with the Birmingham Company and its constituents since 1890. Mr. Harris is a graduate in civil engineering, and was connected with the engineering departments of the Chattanooga, Rome & Columbus Railroad, Briarfield, Blockton & Birmingham Railroad, Southern Railway, Alabama, Georgia & Florida Railroad, and Georgia, Midland & Gulf Railroad. It was in 1890 that Mr. Harris left the last named company to superintend the conversion of the Birmingham system from mule power to electricity. At the completion of the reconstruction Mr. Harris became master mechanic, in which capacity he served until about two years ago, when the office of superintendent of traffic was created. Mr. Harris was immediately chosen to fill this position, and continued in it until the present time. Mr. Harris is a young man, being still in the early thirties. His long connection with the Birmingham system and his thorough knowledge of the system, its needs and its workings, make him a worthy successor to Mr. McClary.


G. H. HARRIS.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Including all lines operated.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Nov. '03	69,049	38,021	31,028	22,755	8,273
	1 " " '02	63,362	34,672	28,690	17,517	11,674
	11 " " '03	810,623	441,285	369,338	244,866	124,471
	11 " " '02	680,889	375,143	305,746	187,084	118,662
AURORA, ILL. Elgin, Aurora & Southern Traction Co.	1 m., Nov. '03	34,616	22,297	12,319	9,173	3,146
	1 " " '02	33,465	20,421	13,043	9,050	3,993
	5 " " '03	206,678	116,887	89,791	45,862	43,928
	5 " " '02	118,897	103,839	85,058	45,248	39,810
BINGHAMTON, N. Y. Binghamton Ry. Co.	1 m., Nov. '03	16,909	9,938	6,971	------	------
	1 " " '02	15,975	9,135	6,840	------	------
	5 " " '03	109,029	54,522	54,508	------	------
	5 " " '02	98,335	53,710	44,625	------	------
BOSTON, MASS. Massachusetts Electric Companies	12 m., Sept. '03	6,145,531	3,931,686	2,213,845	1,380,213	833,632
	12 " " '02	5,884,979	3,567,667	2,317,312	1,466,321	850,991
BUFFALO, N. Y. International Trac. Co.	1 m., Oct. '03	332 194	198,711	133,482	134 613	†1,131
	4 " " '02	296,449	162,339	134,110	130,158	3,952
Chicago & Milwaukee Elec. Ry. Co.	1 m., Nov. '03	30,219	10,627	19,592	------	------
	1 " " '02	14,112	6,389	7,723	------	------
	11 " " '03	268,162	88,309	179,853	------	------
	11 " " '02	177,251	72,784	104,467	------	------
Lake Street Elevated Ry. Co	12 m., June '03	834,050	465,491	368,560	417,738	†49,178
	12 " " '02	794,042	409,155	384,887	381,194	3,693
CINCINNATI, O. Cincinnati, Newport & Covington Light & Traction Co	1 m., Nov. '03	104,151	*59,603	44,548	20,979	23,569
	1 " " '02	99,152	*53,193	45,959	21,223	24,736
	11 " " '03	1,115,933	*641,474	474,459	231,347	243,112
	11 " " '02	1,003,408	*556,495	449,913	231,987	214,926
CLEVELAND, O. Cleveland & Southwestern Traction Co	1 m., Nov. '03	37,861	22,909	14,952	------	------
	1 " " '02	27,924	16,503	11,421	------	------
	11 " " '03	411,750	242,523	169,227	------	------
	11 " " '02	276,135	153,985	122,170	------	------
Cleveland, Painesville & Eastern R. R. Co	1 m., Nov. '03	15,791	11,272	4,519	------	------
	1 " " '02	16,808	11,385	5,423	------	------
	11 " " '03	199,010	116,977	82,034	71,439	10,595
	11 " " '02	185,683	106,203	79,480	68,258	11,222
COLUMBUS, O. Columbus, Buckeye Lake & Newark Traction Co	1 m., Oct. '03	14,350	9,811	4,539	------	------
	1 " " '02	12,518	8,843	3,675	------	------
DETROIT, MICH. Detroit United Ry *a*	1 m., Nov. '03	347,843	204,627	143,216	84,007	59,208
	1 " " '02	321,882	182,493	139 389	81,109	58,279
	11 " " '03	4,068,806	2 386,345	1,682,461	912,890	769,571
	11 " " '02	3,661,990	2,059,733	1,602,257	866,306	735,950
DULUTH, MINN. Duluth Superior Traction Co	1 m., Nov. '03	51,684	28,558	23,126	10,832	12,294
	1 " " '02	46,416	26,426	19.990	9,811	10,179
	11 " " '03	570 577	314,609	255,969	115,756	140,213
	11 " " 02	489,261	259,674	229,589	106,221	123,366
FORT WORTH, TEX. Northern Texas Traction Co	1 m., Nov. '03	40,358	------	------	------	------
	1 " " '02	30,796	------	------	------	------
	11 " " '03	423,224	230,104	193,120	101,886	91,233
HARRISBURG, PA. Central Pennsylvania Traction Co	1 m., Nov. '03	38,704	33,990	4,714	------	------
	1 " " '02	37,277	23,013	14,264	------	------
	11 " " '03	471,473	346,828	124,645	------	------
	11 " " '02	419,263	251,298	167,965	------	------
HAZLETON, PA. Lehigh Traction Co	1 m., Nov. '03	10,686	6,742	3,944	------	------
	1 " " '02	7,583	8,916	†1,333	------	------
	11 " " '03	128,485	70,909	57,576	------	------
	11 " " '02	88,719	58,810	29,909	------	------
HOUSTON, TEX. Houston Electric Co.	1 m., Oct. '03	36,313	25,604	10,709	8,081	2,628
	1 " " '02	33,686	18,461	15,225	6 250	8,975
	12 " " '03	423,696	268,561	155 135	80,938	74,197
	12 " " '02	346,259	197,882	148,377	------	------
JACKSONVILLE, FLA. Jacksonville Electric Co	1 m., Oct. '03	20,436	15,102	5,334	3,100	2,234
	1 " " '02	17,513	12,577	4,936	2,875	2,061
	10 " " '03	202,291	135,864	66.427	------	------
	10 " " '02	162,118	112,122	49,996	------	------
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Nov. '03	259,228	126,583	132,645	72,805	59,840
	1 " " '02	239,015	105,878	133,137	67,663	65,474
	11 " " '03	2,769,177	1,392,954	1,376,223	796 309	579,914
	11 " " '02	2,493,809	1,167,289	1,326,521	732,288	594,232
MINNEAPOLIS, MINN. Twin City R. T. Co	1 m., Nov. '03	335,266	160,057	175,209	60,946	114,262
	1 " " '02	309,468	147,168	162,300	60,233	102,067
	11 " " '03	3,704,755	1,720,395	1,984,360	670,020	1,314,339
	11 " " '02	3,280,880	1,478,713	1,802,166	651,200	1,150,966
MONTREAL, QUE. Montreal St. Ry. Co	1 m., Nov. '03	189,561	116,609	72,952	17,903	55,049
	1 " " '02	172,872	103,628	69,244	16,077	53,167
	2 " " '03	396,162	227,318	168,844	36,825	132,019
	2 " " '02	354,278	200,047	154,231	32,068	122,162
NEW YORK. Interurban St. Ry. Co. *a*	3 m., Sept. '03	5,940,436	2,761,600	3,178,836	3,015,459	163,377
	3 " " '02	5,797,616	2,736,022	3,061,594	2,915,224	146,370
PHILADELPHIA, PA. American Railways	1 m. Nov. '03	104,322	------	------	------	------
	1 " " '02	94,037	------	------	------	------
	5 " " '03	643,328	------	------	------	------
	5 " " '02	543,946	------	------	------	------
ROCHESTER, N. Y. Rochester Railway Co.	1 m., Nov. '03	104 939	53,847	51,091	25,914	25,177
	1 " " '02	91,775	44,469	47,306	24,827	22,479
	5 " " '03	551.147	278,033	273 113	------	------
	5 " " '02	478,898	239,740	239,158	------	------
SAO PAULO, BRAZIL. Sao Paulo Tramway, Light & Power Co., Ltd	1 m., Nov. '03	111,300	31,300	80,000	------	------
	1 " " '02	100,608	32,688	67,920	------	------
	11 " " '03	------	------	825,000	------	------
	11 " " '02	------	------	634,806	------	------
SAVANNAH, GA. Savannah Electric Co	1 m., Oct. '03	43,697	26,264	17,433	10,449	6,984
	1 " " '02	41,004	23,979	17,025	9,583	7,442
	12 " " '03	513,207	306,276	206,931	117,587	89,344
	12 " " '02	474,638	276,668	197,970	------	------
SEATTLE, WASH. Seattle Electric Co	1 m., Oct. '03	186,501	138,617	47,884	22,906	24,978
	1 " " '02	173,005	117 059	55,946	22,373	33,573
	10 " " '03	1,725,108	1,228 567	496,541	241,153	255,388
	10 " " '02	1,522,295	1,059,423	462,872	219,757	243,115
STATEN ISLAND, N.Y. Staten Island Midland R. R. Co	3 m., Sept. '03	67,484	49,075	18,409	13,187	5,222
	3 " " '02	58,681	25,124	33,557	13,741	19,816
SYRACUSE, N. Y. Syracuse Rapid Transit Co	1 m., Nov. '03	68 387	38,945	29,442	20,254	9,188
	1 " " '02	60,429	32,395	28,033	19,025	9,008
	11 " " '03	350,995	196,089	154,906	101,460	53,446
	11 " " '02	304,328	166,263	138,065	95,125	42,940
TERRE HAUTE, IND. Terre Haute Elec. Co.	1 m., Oct. '03	44,409	28,135	16 254	8,399	7,875
	1 " " '02	38,258	22 011	16,247	6.621	9,626
	4 " " '03	456,534	300,384	156,150	82,241	73,909
	4 " " '02	318,845	262,403	56,442	75,049	†18,607
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Nov. '03	140,718	75 210	65,508	40,871	24,697
	1 " " '02	125,936	55,817	70,119	38,739	31,380
	11 " " '03	1,509,299	781,189	728,110	448,907	279 203
	11 " " '02	1,319,483	662,889	656,594	420,280	236,314
Lake Shore Electric Ry. Co	1 m., Nov. '03	46,817	33,731	13,086	20 370	† 7,284
	1 " " '02	42,539	30,981	11,558	9,375	2,183
	11 " " '03	570,067	360,456	209,611	220,373	† 10,762
	11 " " '02	427,088	284,557	102,531	103,125	39,406
Toledo, Bowling Green & Southern Trac. Co.	1 m., Nov. '03	23,859	16,267	7,592	------	------
	11 " " '03	267,085	163,455	103.630	69,697	33,933

INDEXED

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, JANUARY 9, 1904 No. 2

Published Every Saturday by the
McGRAW PUBLISHING COMPANY

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York,"—Lieber's Code used.

TERMS OF SUBSCRIPTION.

In the United States, Canada and Mexico......................$4.00 per annum
Single copies, first issue of each month, 25 cents; other issues, 10 cents.

To all Countries outside of the United States, Canada and Mexico.... $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.
Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Mistakes in Hurried Locations

The selection of the route for an electric railroad, operating over a private right of way, is a matter of immense importance, because mistakes in location will not only constantly affect the operation of a road, but they can never be corrected save by expensive changes in location or large sums spent in cuts and fills. It is surprising, therefore, to see the haste and lack of care in this particular given by many interurban railway companies. In many cases this is explained by the lack of experience which the projectors have had in this field; again, it may be due to a desire to pre-empt the district entered; in any event, it is imprudent and in many instances costly.

After the promoters have decided to build an electric road between certain points, the civil engineer with his party is usually sent out to survey, hurriedly, a preliminary route. Right at this point in the project there is likely to come in a race against time which is all out of proportion to the deliberation shown in connection with other matters of much less importance in the engineering of the road. Of course, quick work on the part of a surveying party is not to be condemned, but it does not stand to reason that in anything but an absolutely level country the best location for a railroad can be selected in a single survey carried on at the record-breaking rates we sometimes hear of. As one civil engineer remarked upon hearing of an unusually rapid piece of railroad surveying: "If I had done as quick a job as that I would be ashamed to tell about it." It is true that interurban lines are sometimes forced to take what they can get in the way of a location rather than what good engineering would dictate. On the other hand, it is quite too easily possible to go over almost any electric interurban line where rapid promotion and construction has taken place and point out numerous places where there is very defective location, or where unnecessary curves or grades have been introduced into the line. It is such mistakes as these that a second and careful survey and study would eliminate. Railroad location is as much a fine engineering art as the selection of motor equipments and location and design of a power station, and, in some respects, errors of judgment in this part of the work are even more fatal to satisfactory financial results than in the electrical engineering. The sooner electric railway companies realize this the better.

The Single-Phase Motor in 1904

In the opinion of a number of prominent electrical engineers, the present year will be known in the future as that of the single-phase motor. From the condition of an industry at the opening of the year it is impossible to tell the developments which the coming twelve months will produce, but it is certain that the single-phase motor, in its several forms, which have attracted so much attention recently, will be given that extended practical test which alone will determine its future. As yet, only one of the large manufacturing companies in this country has announced the commercial completion of this form of traction motor, but it is an open secret that the engineers of the other large manufacturers of electrical apparatus have been engaged for some time upon the development of a single-phase motor of another type, and that a public announcement will be made of it soon, in the form of a paper to be presented before one of the leading engineering societies of the country. In addition, we have the two single-phase motors developed abroad, one in Germany and one in Italy, which have been described in recent issues of this paper; the Leonard system, proposed by H. Ward Leonard, a number of years ago, and taken up by the Swiss engineer, E. Huber, of the Oerlikon Machine Works, and the Arnold combination single-phase pneumatic motor described by the inventor in the last issue of this paper. In this article Mr. Arnold has given dates for the construction and equipment of the Lansing, St. Johns & St. Louis Railway, which seem to indicate that he was the first to equip a commercial electric railway with the single-phase system and to make actual runs over it with a motor of this type. To him and to all who have advocated single-phase systems, in spite of considerable criticism, a great deal of credit is due. We anticipate during the coming year a most interesting competition on merit between all the various motors of the single-phase persuasion, and believe that our readers will find much to interest them in the developments of this new type of equipment.

Electric Road Schedules in Cold Weather

The recent blizzard and the exceptionally cold wave which has prevailed over all of the northeastern part of this country during the last week, have proved very clearly that interurban electric railways possess a number of advantages over steam railways in maintaining their schedules during the conditions which have prevailed. The snow-storm interfered somewhat with the regular operation of cars on a number of the city

systems, owing to the difficulties in the removal of the snow. With roads operating over their own private right of way, however, where the snow can be piled up on either side of the road, there has been little trouble of this kind.

As an instance of the difference of immunity from snow between a steam and an electric railway, we might cite an instance which occurred during the recent blizzard on an interurban road in one of the Middle States. The car, in running through drifts, kept plowing up the snow so that it became packed around the motor in the front end of the car, and was finally forced up through the trap-door over the motor into the car body. It came in so rapidly that the passengers were driven into the rear compartment, while the snow filled up the interior of the car to a height of over 1 ft. above the backs of the seats in the middle of the car. Three men with shovels and others with brooms were required to clear out the hard-packed snow.

Practically every interurban railway company in the Northern States has now, or should have, an efficient snow-fighting equipment. This usually includes several nose or shear plows and one or more rotary snow-plows. As the motors for these plows, and even the bodies themselves, in the case of the nose and shear plows, can be used for other purposes during the spring, summer and fall months, a large amount of extra equipment is not required, and the provisions for fighting snow on an electric road are, consequently, simpler and more complete than on a steam road, where special apparatus has to be employed. In addition there are few track switches to become frozen up, and no locomotive boilers to be chilled by the unusually low temperature, and as the motors will carry a higher load in cold weather than in warm, electric railways are far better equipped for operation under frigid weather conditions than are their steam railroad rivals.

Electric Power on the New York Central

We have already commented on the curious coincidence that the great contract of the New York Central for electric equipment should have been closed on the very eve of the announcement of success in traction by alternating currents. Such things must necessarily happen in the history of any rapidly changing art, as when the advent of the Monitor in the Civil War revolutionized naval architecture. But in the present instance, since the officials of the great railway must have received information of the coming changes, and undoubtedly took the step of ordering direct-current apparatus only after full consideration of the matter in every light, there has been somewhat free criticism of their decision, and a statement of the reasons which led to it would undoubtedly be of public interest. Although the railroad officials naturally do not care to take the public into their counsels in a matter which would have evoked criticism whatever the decision, we understand from an authoritative source that the following considerations carried much weight in the final settlement of the question:

Foremost, we judge, should be placed those larger reasons of policy which must of necessity be considered by a great railroad system. The facts, as they stand, are that the metropolis is now partly and is still being equipped, at expense of very heavy investments, public and private, with electrical rapid transit above, on and under the streets. This service is by a direct-current distribution, so far as all the operating equipment is concerned, and will not be changed over to a new alternating system until there shall be most weighty and conclusive reasons for a change involving so great expense. Whatever may prove to the advantages of alternating-current motors for interurban and long-distance work it is, in our opinion, long likely to remain an open question whether for heavy urban work the alternating-current equipments should displace the existing ones. Now, the New York Central and its immense suburban system is, or should be, an integral part of the great network of communications about New York. It was, therefore, judged unwise to adopt at the present time a system which would prevent free interchange of cars with existing lines when such action should become necessary. With the alternating-current system, as it was developed at the time the decision was made, this could not be done, and the company seemed likely to find itself, with respect to its present neighbors, in much the same position as if it had adopted a 6-ft. gage for its tracks. An interchange of motor trains with the elevated or subway systems of New York City may never take place, but its desirability is a question for the financiers and the operating managers to determine later, not to be settled at the present time by the engineers. At all events, with this possibility in mind the strategic advantage of a direct-current equipment was obvious and convincing, and even if a general change comes subsequently, it will quite certainly be deferred until the useful life of equipment bought now has been in great measure utilized.

Another consideration, we think, must have been strongly felt, and that is the need of prompt action. The railroad stood committed to the public in the matter of a change of motive power in the tunnels. It wished to carry out fully and promptly this public obligation, without taking any chances in the necessarily somewhat slow development of a new system of motive power. However ably such an innovation may be engineeered, and however fully it may be guaranteed as to final results, a complete success on a colossal scale and under exceptionally trying conditions cannot in the nature of things be regarded as immediately certain. We think it greatly to the credit of the railroad officials that they did not attempt to use the impending change as an excuse for protracted delay in meeting a public demand, but took the chances of future loss by re-equipment and went ahead.

Looking at the question in these broader aspects the decision reached is fully comprehensible whatever may be one's judgment as to the purely technical issues. Of these latter the most serious is that of the actual status of the alternating-current apparatus, taking into account the magnitude of the proposed operations and the importance of immediate action. It seemed, therefore, to the responsible officials of the New York Central that for handling the great complex traffic of the system as it exists at the New York terminal, the alternating-current equipment had by no means shown immediate fitness, however hopeful the outlook might be. This position, we must admit, is well taken, in spite of our belief in the commanding future of alternating currents in electric traction. This judgment involves no criticism of the strong advocacy and unqualified guarantees of the alternating system on the part of big electrical companies. It simply voices the fact that alternating-current traction on such a scale is as yet untried, and that the railway system which controls the entrance by land to a metropolis of hard upon 4,000,000 inhabitants is not exactly a conservative place in which to try it.

This decision also sets no precedent as to future extensions of electric power over other parts of the system. Each will be judged by its surrounding conditions, just as the decision to equip the New York terminal was reached in the light of local circumstances. In fact, the section from New York to Croton,

on the Central division, and that to White Plains, on the Harlem division, which are the ones to be equipped with electric power, have been aptly termed a "direct-current zone." Each of these places practically marks the limit of the purely suburban or commuter traffic on its division, and within the zone so delimited the suburban traffic will be cared for by motor-car trains, operated on the multiple-unit system, while the through trains, made up largely of cars from other roads, will be hauled into New York by electric locomotives. This plan, of course, would not interfere with the successful operation in the future of any other "alternating-current zones," and if a change at Croton or White Plains was necessary it could be made as easily from an alternating-current to a direct-current locomotive as from steam to direct current as the present plan contemplates.

Of the specific technical difficulties involved in the change of motive power on the New York Central, and considered by the engineering committee, the most considerable appears to have been the question of working conductors. The space above the cars in the terminals is very limited, the clearance being sometimes reduced to hardly more than 4 ins., while that between the tunnel and the stacks of the locomotives, which must be retained in use during the conversion, is a bare 1½ ins. This renders the problem of safely installing high-voltage working conductors overhead a very troublesome one. If the alternating system were adopted without high-voltage working conductors the gain in economy of distribution within the zone at present to be equipped for electrical traction would be somewhat problematical. If the third-rail plan must be adopted, it is better fitted for continuous than for alternating currents, on account of the considerable virtual resistance to the latter, while to lower the tracks enough to give easy head-room would require the expenditure of at least half a million dollars. Moreover, both the subway and elevated systems in New York are equipped with the third rail, and if the interchange of traffic already hinted at as possible should ever be consummated, the cars must be interchangeable, not only as regards collecting devices, but also with respect to clearances. In other words, an overhead collecting system in the Park Avenue tunnel would involve clearance problems for the interchangeable Interborough cars in the subway which would be as serious at least as those over which the Central engineers themselves had direct control. It is, of course, possible that means of dodging the space difficulty could be found, but granting this, there would still remain a troublesome question as to relations with abutters in case of the installation of an overhead conducting system on the Park Avenue viaduct. In the tunnels and on this viaduct a third rail forms by far the simplest means of getting power, although in the yards an overhead system seems to be necessary. It is most unfortunate that these difficulties of overhead construction should exist, since they tend to obscure the real issue between alternating-current and direct-current apparatus, and because we consider adherence to third-rail practice a hindrance to the development of large work in electric traction. When the third rail is so arranged as to permit operation at high voltage or safe operation at any voltage it becomes a lateral or overhead conductor, and ceases to be a rail. The hooded third rail meets the requirements of safety fairly well, but even it is objectionable on lines with grade crossings. However, in the case in hand constructural difficulties exist and must be taken into consideration.

The other technical reasons which are understood to have entered into the New York Central decisions were the greater weight of alternating-current locomotives, supposed to offset the advantages in distribution; the greater cost of maintenance of alternating apparatus and equipment, particularly in gearing, and the greater depreciation of value of the alternating apparatus when discarded for change in the art, as compared with the more saleable direct-current equipment. It might be desirable to take these up seriatim and consider the effect which each had on the ultimate decision.

In considering the greater weight of the alternating apparatus the fact should be borne in mind that the conditions on the New York Central differ materially from those of some other installations in which electric locomotives have been used. The specifications call for locomotives capable of making a maximum of 75 m. p. h., which, with the trains to be hauled, is equivalent to an average effort during acceleration of 2500 hp. The direct-current locomotive selected has a weight of 85 tons, which is in excess of that required for traction purposes, so that, other things being equal, additional weight to the locomotive, as required by the alternating-current equipment, would be a detriment instead of an advantage. The question of relative depreciation between direct-current and alternating-current equipment is one which can be determined by experience only. Without intending at all to detract from the admitted advantages which alternating-current motors possess over direct-current motors in many particulars, it must be admitted that the design of the motor is such as to call for better insulation, and, hence, greater care in maintenance. Moreover, in the New York Central equipment the direct-current motors adopted are of the gearless type, whereas the submitted designs of the alternating-current locomotives were of the geared type, so that the question of the wear of the gears alone might have made a considerable difference in the total maintenance account of the propositions.

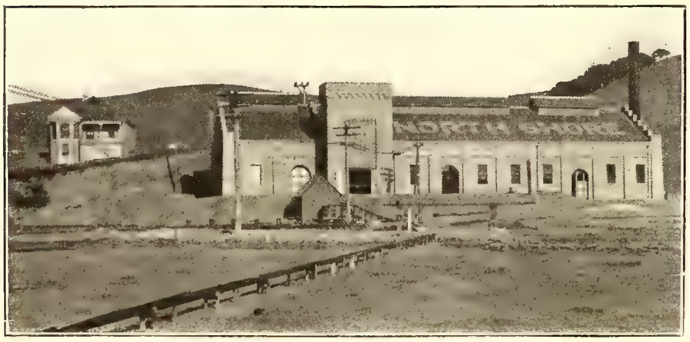
The final consideration, viz., the supposedly greater depreciation due to change in the art, is one upon which there may be considerable difference of opinion. As a rule, in the past, antique electrical apparatus has had a saleable value in inverse ratio to its seniority of design. It should be remembered, however, that direct-current apparatus has now become so standardized that future machines of this type will probably not differ greatly in design from those used at present. For this reason, unless we consider the entire direct-current system as one which is rapidly becoming obsolete for traction work, motors of this size and type will have a usable value for some considerable time to come. On the other hand, alternating-current motor history is being rapidly made, so that it is not unlikely that motors of this size might become antiquated more quickly than their direct-current counterparts.

These, at least, are technical arguments for the adoption of direct-current apparatus, which are reported to have affected the final decision, and which, consequently, are worthy of consideration. If to them we add the larger arguments, based on the general questions of policy and local conditions referred to above, we are inclined to believe that thinking engineers and managers will endorse the judgment of the engineers of the great road in their decision in favor of direct-current working. If the future shall prove that they have underrated the as yet undemonstrated powers of the new alternating-current systems they will, at least, have erred on the side of caution, and will already have promptly and faithfully discharged their obligations to the public.

ELECTRICAL EQUIPMENT OF THE NORTH SHORE RAILROAD FROM SAN FRANCISCO TO SAN RAFAEL—II

POWER SUPPLY

The railroad receives its power supply at the standard direct-current railway potential of 550 volts, from a main power station at Alto, a little over 4 miles north of Sausalito, and from a motor-generator sub-station at the San Rafael terminus. The Alto power house is designed to receive three-phase current at



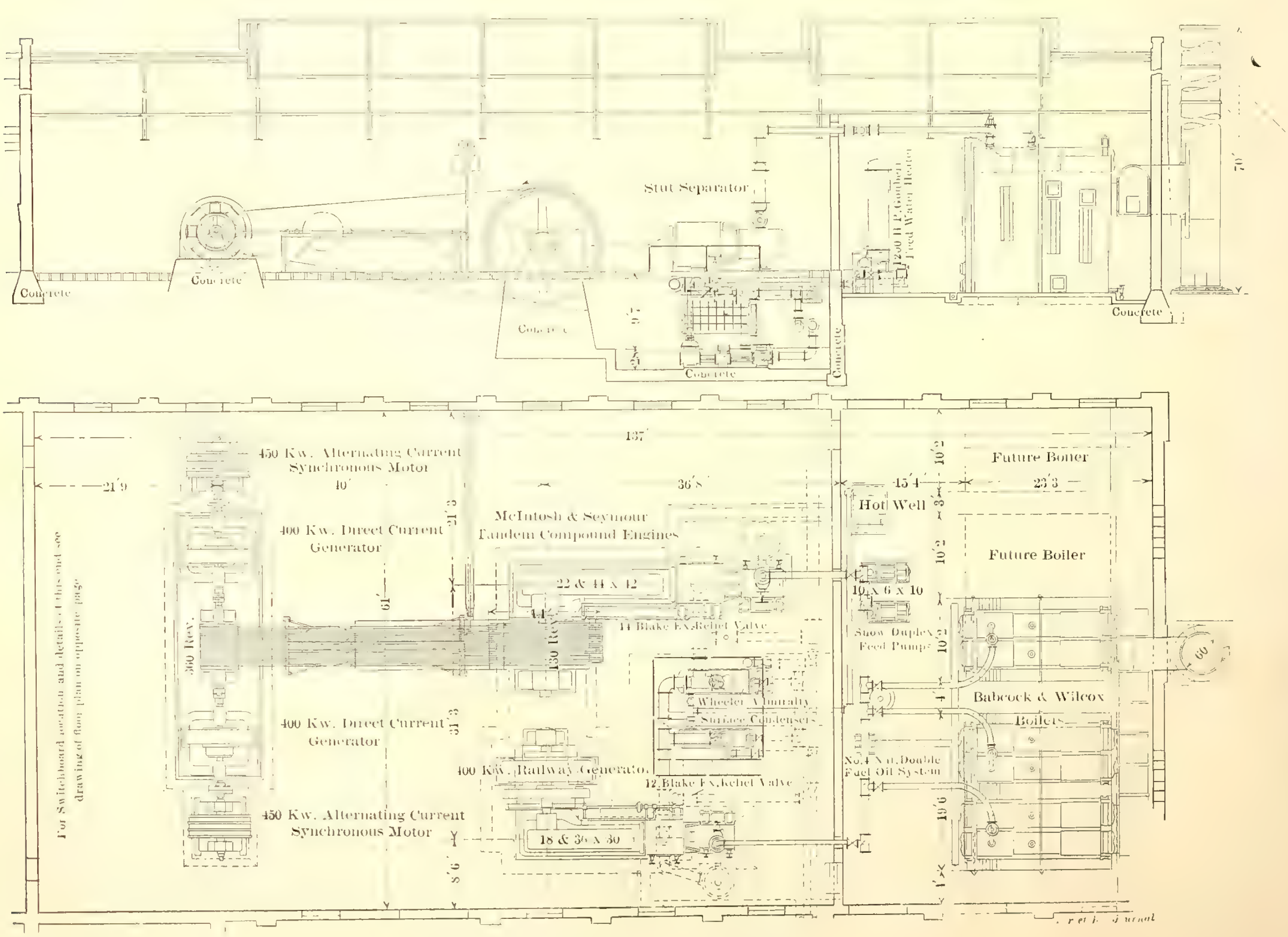
ALTO POWER HOUSE, RETURN TRACK FEEDER IN TROUGH IN GROUND

50,000 volts from the transmission lines of the Bay Counties Transmission Company, and after transforming it down to 4500 volts, to convert it to the direct-current railway voltage, by means of two motor generator sets. To serve as both reserve and auxiliary plant a modern steam equipment has been installed, consisting of a direct-connected, direct-current railway generator unit, and an engine connected by means of rope drive to the motor-generator sets, so as to operate the inductor alternators of these sets to supply alternating current to the transmission line when necessary. This latter arrangement has been made so that the North Shore station may be used as a steam reserve for the Bay Counties system, supplying power, in case of a shut-down on the high-tension system, to the California Central Gas & Electric Company, which is the distributing sub-company of the Bay Counties system in the vicinity of San Rafael and Sausalito. That this arrangement is a beneficial one to the Bay Counties system has been demonstrated many times since the Alto power house was started up, as it has enabled the management to cut off the main supply from this part of the State during certain parts of the day, thus affording opportunity for repairs or new work without shutting off the supply to customers in this section. It is also interesting to note that the Alto power house is the terminus of the longest transmission line of the Bay Counties system, it being 180 miles from the power house at Colgate. Power has been occasionally transmitted over longer distances by this company, but it has been by connecting with the lines of the Standard Electric Company.

MAIN POWER HOUSE

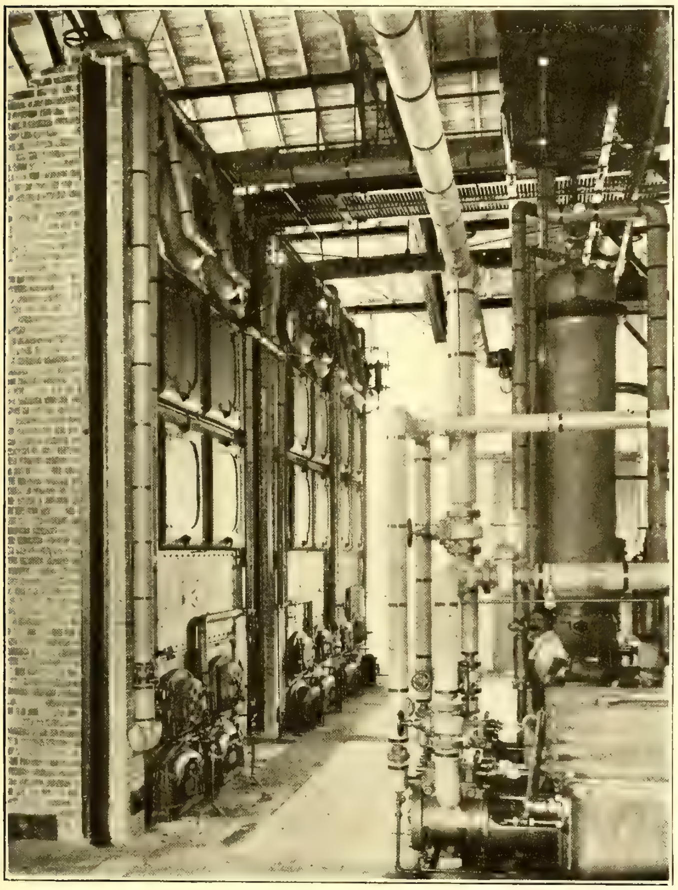
The Alto power station is situated on the side of a hill close to a salt-water marsh and lagoon, which connects with San Francisco Bay. Water for condensing purposes is thus convenient, and a short siding, connecting with the main track, affords facilities for delivering material and fuel.

The building was designed by Dodge & Dolliver, architects, San Francisco, and is constructed of brick, with steel roof trusses and slate roof. The general dimensions of the building are 61 ft. x 171 ft., and it is divided by cross partitions into a storage battery room, 35 ft. x 61 ft.; an engine room, 98 ft. x 61 ft., and a boiler room, 38 ft. x 61 ft. A three-story high-tension

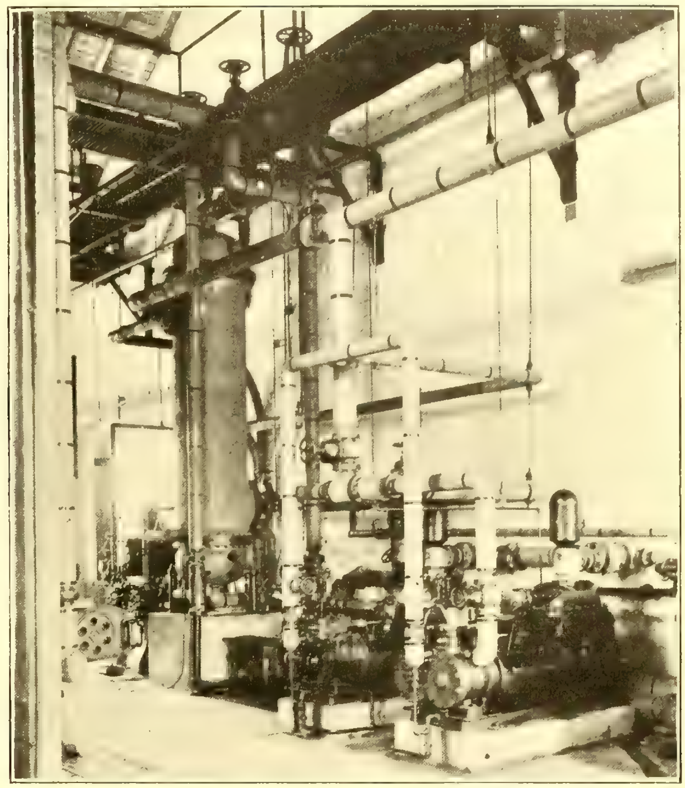


PLAN AND SECTION OF POWER HOUSE

tower, with interior dimensions of 10 ft. x 20 ft., adjoins the engine room at its northwest corner. There is a clear height below roof trusses of 19 ft. in the engine room, and of nearly 23 ft. in the boiler room, thus providing excellent ventilation. The floors consist of a 6-in. layer of sand and a 6-in. layer of concrete. In the engine room on top of the concrete has been laid a select tongued and grooved 1½-in. floor with an oil finish. In the high-tension tower and battery room the flooring consists of vitrified brick laid on edge. The battery room has a wooden truss roof supported by a center row of 12-in. x 12-in. posts. The roof of the high-tension tower is composed of 3-in. terra-cotta book tile, and the partition walls in the tower are also constructed of terra-cotta tile. The walls of the building are 1 ft. 5 ins. thick. The general arrangement of the power plant and important details are shown in diagrams and half-tones reproduced herewith.



BOILER ROOM

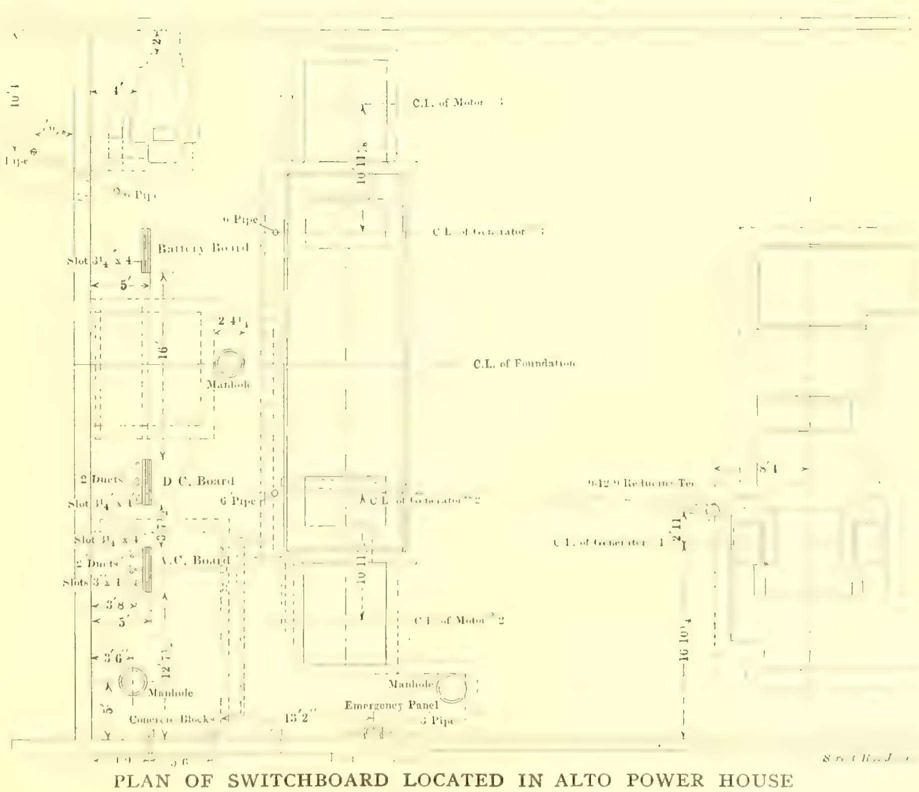


BOILER FEED-WATER PUMPS; FEED-WATER HEATERS, AND FUEL-OIL CIRCULATING PUMPS IN POWER HOUSE

BOILERS

Owing to the use of crude oil as fuel the boilers are set facing the engine room, thus placing the boiler room under the direct observation of the engineer, and, at the same time, providing space in the rear of the boiler room for the later addition of fuel economizers, should this prove desirable.

There are three Babcock & Wilcox water-tube boilers of the vertical-header type, each containing 2646 sq. ft. of heating surface, and consisting of twelve sections of twelve 4-in. tubes, 16 ft. long, and two steam and water drums, 36 ins. in diameter. Two of these boilers are set in one battery, and the third is set singly, with provision for later increase in boiler capacity. There is a nominal capacity of 800 boiler horse-power to take care of 1600 ihp on the two engines at rated load. The boilers are fired with crude oil, and are equipped with the latest marine oil furnace designed by the Babcock & Wilcox Company. The bridge wall is moved to the rear of the boiler, giving the furnace a length of about 10 ft. The burner is put in from the front of the boiler and reaches clear to the bridge wall, whence it points forward, discharging its flame toward the front of the boiler, contrary to the older practice in firing fuel

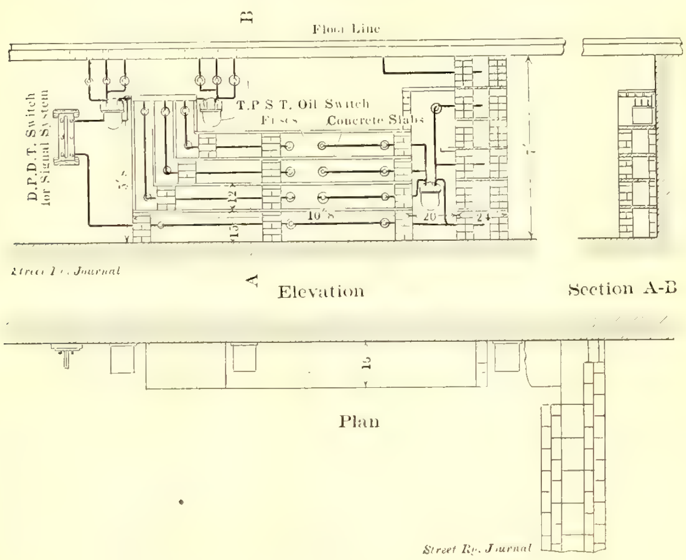


PLAN OF SWITCHBOARD LOCATED IN ALTO POWER HOUSE

oil. By means of this arrangement not only is there obtained an increased efficiency in combustion, but also a uniform distribution of flame over all the lower row of tubes exposed to the furnace, greatly increasing the boiler capacity and removing the danger of burning out of tubes.

CONDENSING SYSTEM

There are two Wheeler "Admiralty" surface condensers, each mounted over combined direct air and circulating steam-driven pumps. The condensers contain respectively 1800 sq. ft. and 900 sq. ft. of cooling surface, and have respective rated capacities of 18,300 lbs. and 9500 lbs. of steam per hour.



BARRIER FOR FEEDERS, ALTO POWER HOUSE

Salt water is used for condensing purposes, it being impounded at high tide by means of a flood gate in a reservoir above the power house. Condensing water is pumped from this reservoir and discharged by a flume and canal to the upper end of the reservoir. During high tide the hot-water is discharged below the dam, and a new supply of cool water is impounded. The difference in elevation between tides being from 5 ft. to 6 ft., and high tide coming about every 11 hours to 13 hours, afford a very convenient and inexpensive method of obtaining cool condensing water.

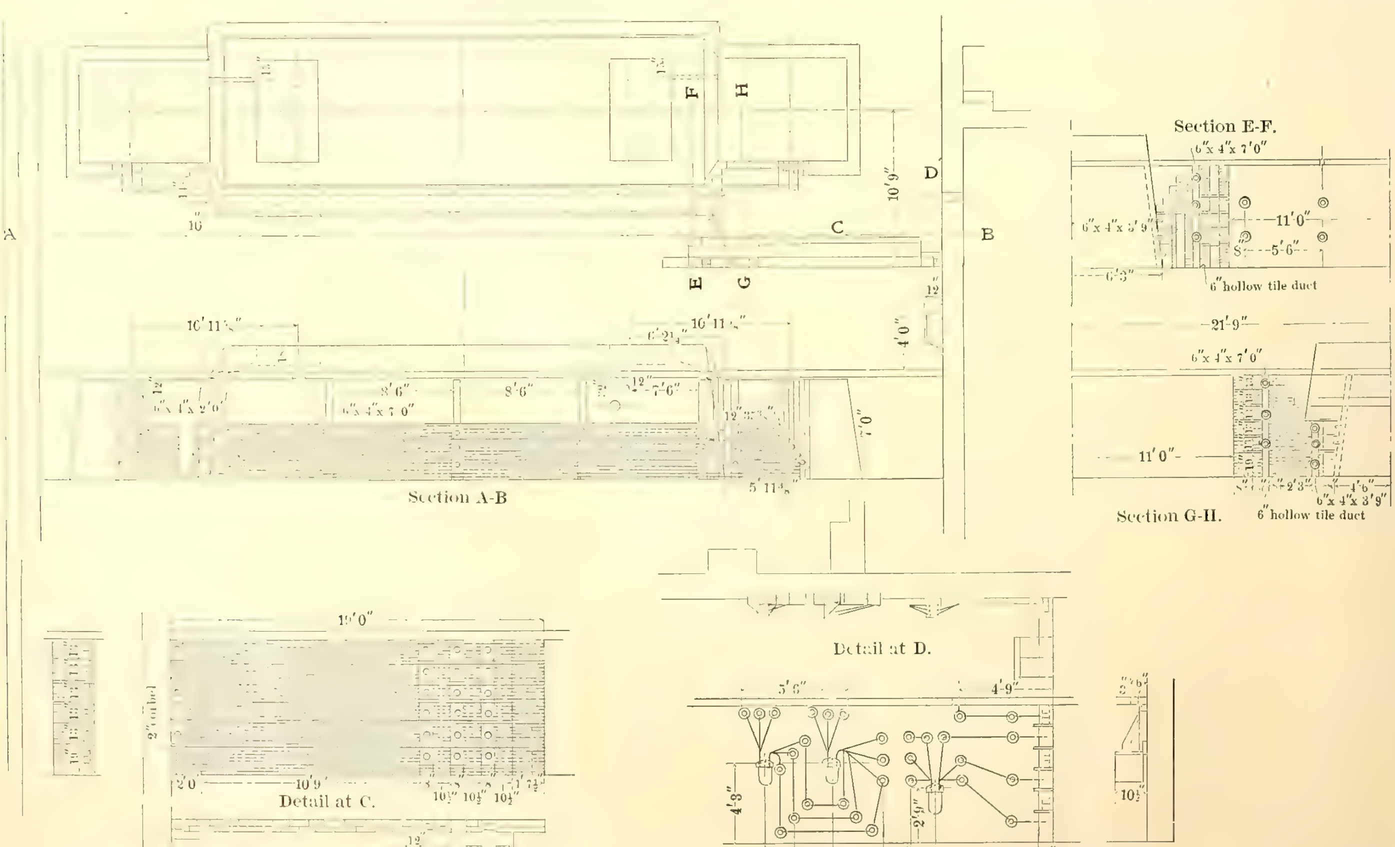
STEAM AUXILIARIES AND PIPING

Owing to the fact that there is no lift on the circulating pumps, except the pressure necessary to overcome friction in the piping, the steam consumption of auxiliaries is comparatively small. All of the auxiliary exhaust steam, including trap discharges from the reheater receivers, is led to a vertical Goubert auxiliary feed-water heater, having 400 sq. ft. of heating surface on a rated capacity of 1200 boiler horse-power. Water is fed from a hot well and enters boilers at a temperature of about 190 degs.

It is thus seen that the amount of exhaust steam is comparatively small; it is all condensed in the feed-water heater and the heat is returned to the boilers. At no time is exhaust steam visible from the exhaust pipe leading from the auxiliary feed-water heater to the atmosphere. It is, therefore, evident that the actual fuel cost of the steam to drive the auxiliaries is but a small fraction of the total steam supply to the auxiliaries, on account of utilization of all of the exhaust steam. Under these circumstances the economy of the plant, probably, could not have been increased had electrically-driven auxiliaries been installed. All steam condensed in the feed-water heater is drained to the filtering hot well and returned to the boiler feed.

There are two Snow 10-in. x 6-in. x 10-in. duplex boiler feed pumps. One pump is of ample capacity to operate the entire plant, leaving the second pump as reserve. Fresh water is piped about 2 miles from Mill Valley, and is stored in a 50,000-gal. tank outside the power house.

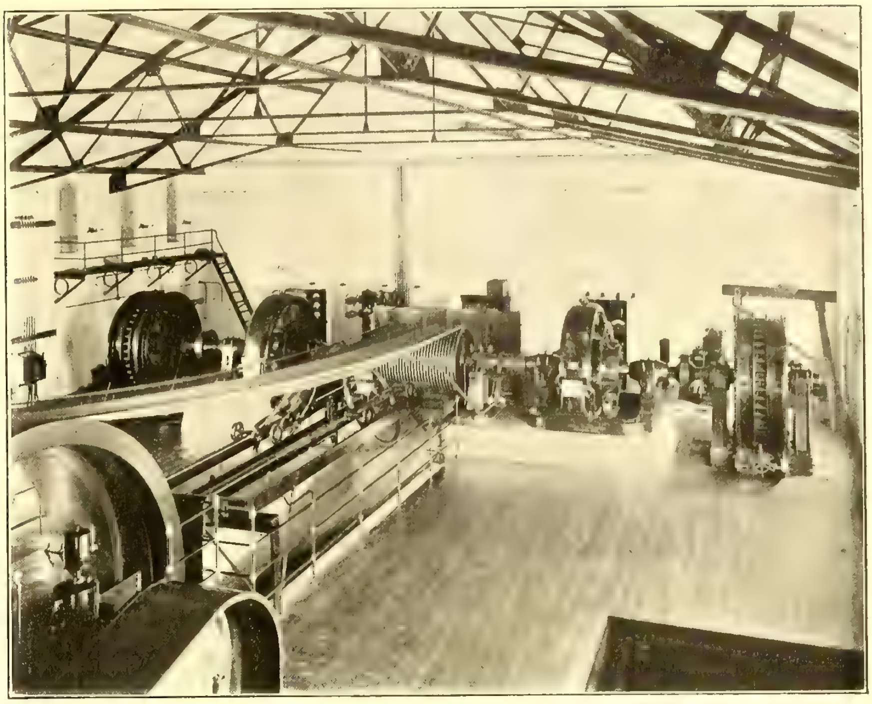
Mounted on the throttle valve of each engine is a vertical Stuts separator. These separators are of neat design, and, while having considerable receiver space, are still of light weight, owing to their special construction. The steam is led in a roundabout course through the central pipe through the bottom of the separator. In addition to the action of centrifugal force in separating steam and water, steam is caused



BARRIERS AT ALTO POWER HOUSE

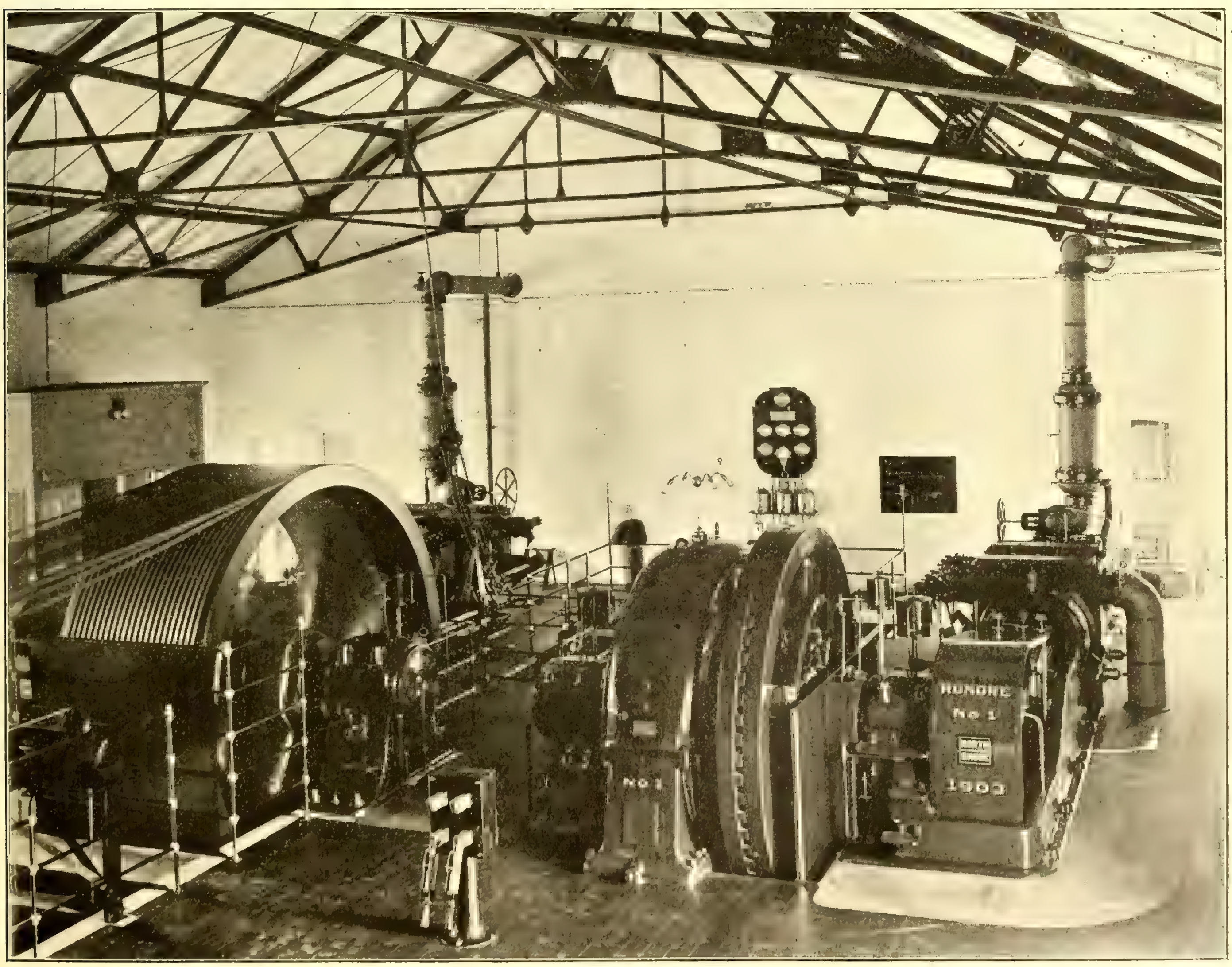
to pass through two sets of long, narrow slots, making it practically impossible for any large body of water to pass into the engine cylinders.

The fuel oil circulating system is that of the National Supply Company, of Chicago, and consists of two 4½-in. x 2¾-in. x 4-in. Snow pumps, mounted on a cast-iron stand of substantial construction. Mounted above the pumps and oil heater is a receiver of ample capacity, which utilizes the exhaust steam from the pumps for heating the oil before passing to the burners. There is also provided a pump governor to govern the speed of the pumps, so as to maintain a constant oil pressure. The relief valve, set at a pressure slightly in excess of the working oil pressure, has a safeguard to operate in case of failure of the pump governor. The whole system is neatly arranged and piped with all necessary drips, drains, etc. Oil is stored in a 70,000-gal. tank outside of the building, from which it is pumped under suction by means of the pumping system. It is found necessary in the colder weather to heat the oil in the main storage tank by means of a steam coil; the steam pipe from the power house being run along beside the main suction piping, so that the heat is maintained in the oil on its way to the oil pumps.



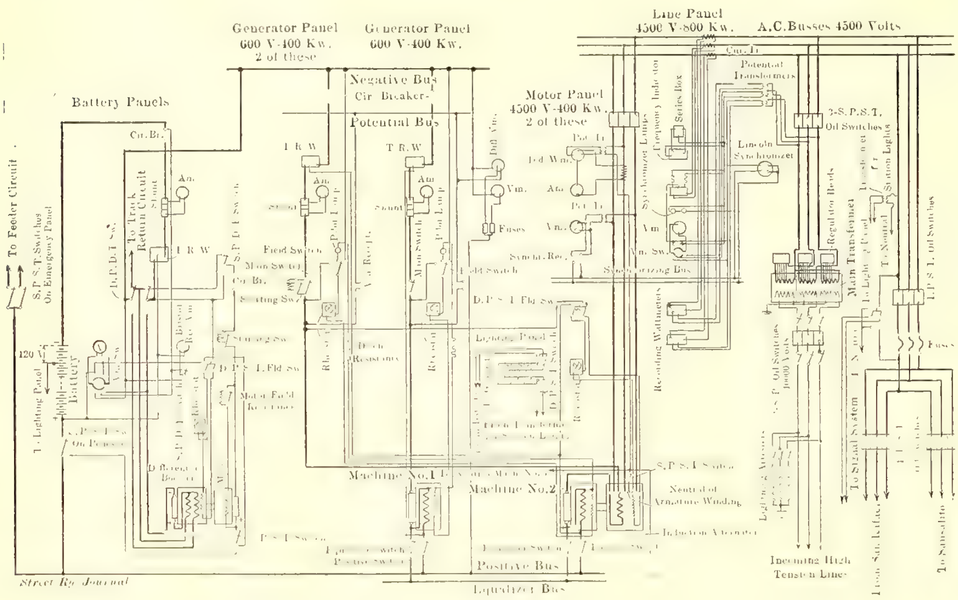
MOTOR GENERATOR SETS, ROPE DRIVE, SWITCHBOARDS AND WIRING IN MAIN POWER HOUSE

The arrangement of piping is shown in the illustrations and drawings. Chapman straightway double-seated gate valves and Chapman flanges are used throughout. All fittings are of special thickness, designed for 150 lbs. pressure. Long-radius bends are used wherever possible for flexibility and to reduce friction.



DIRECT-CONNECTED RAILWAY UNIT AND ENGINE WITH ROPE DRIVE IN MAIN POWER HOUSE

In each boiler branch there is, in addition to one Chapman gate valve, one Pearson automatic steam check and stop valve. This valve is so adjusted as to open only when the pressure in the boiler is in excess of the working steam pressure, and to close whenever the pressure in the boiler is reduced below the



WIRING DIAGRAM, ALTO POWER HOUSE SWITCHBOARD

working pressure, making it unnecessary to operate the valves by hand whenever putting boilers in or out of service. The valve can also be closed down by hand, serving as a boiler stop valve, thus giving in effect two valves in each boiler branch, which can be closed whenever it is necessary to open up or clean the boilers.

The exhaust piping is so designed that either one or both engines can be operated condensing or non-condensing, also so that either one or both condensers may be used at the same time, or independently.

There is provided in the exhaust line from each condenser a Blake automatic exhaust relief valve, which is designed to open the exhaust passage automatically and quickly to atmosphere whenever vacuum in the condenser is lost.

All piping above 4-in. diameter is flanged. All valves 2½ ins. and larger have flanged ends, so as to be easily removed should occasion require. The piping is well supported and anchored at critical points to prevent vibration. An iron platform is provided for easy access to the steam header and valves on the steam branches.

On account of the slight draft required when burning fuel oil, there is provided a short-guyed stack of steel construction. This stack is 60 ins. in diameter and 70 ft. in height, and while its rating when burning coal is comparatively small, it will easily develop a boiler capacity considerably in excess of the requirements when burning fuel oil. It has been found on the Pacific Coast that under ordinary conditions stacks will develop with oil from two to three times the boiler horsepower given by "Kent's" rating when burning coal.

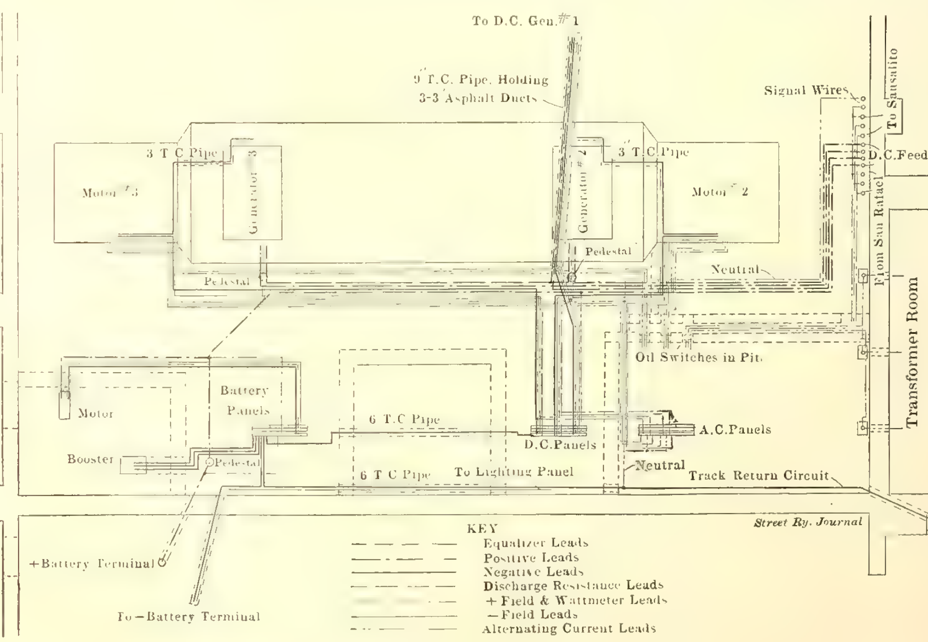
ENGINES AND GENERATORS

The direct-connected railway unit consists of an 18-in. x 36-in. x 30-in. horizontal tandem-compound condensing McIntosh & Seymour engine, driving a 400-kw Stanley railway generator. With steam at 150 lbs. pressure, and when running at 150 r. p. m., this engine will develop 600 ihp at .23 cut-off. It is guaranteed to develop 1 ihp at economical load with 14 lbs. of dry steam, 26 ins. effective vacuum.

The other engine is a 22-in. x 44-in. x 42-in. horizontal tandem-compound condensing McIntosh & Seymour engine, arranged with a grooved wheel for rope drive. This engine has a rated capacity of 1000 ihp, and is guaranteed to develop 1 ihp at economical load with 13 lbs. of dry steam, 26 ins. effective vacuum.

Both engines are built to withstand safely a continuous overload of over 50 per cent, and temporary overloads of from 75 per cent to 100 per cent. The high pressure cylinders of both engines are jacketed, and there are also supplied with each engine superheating receivers of large capacity between the high-pressure and low-pressure cylinders. About 10 per cent of the amount of steam required by each engine is condensed in reheater coils and returned to the feed-water practically at a temperature of the water in the boilers, thus adding to the economy of the plant.

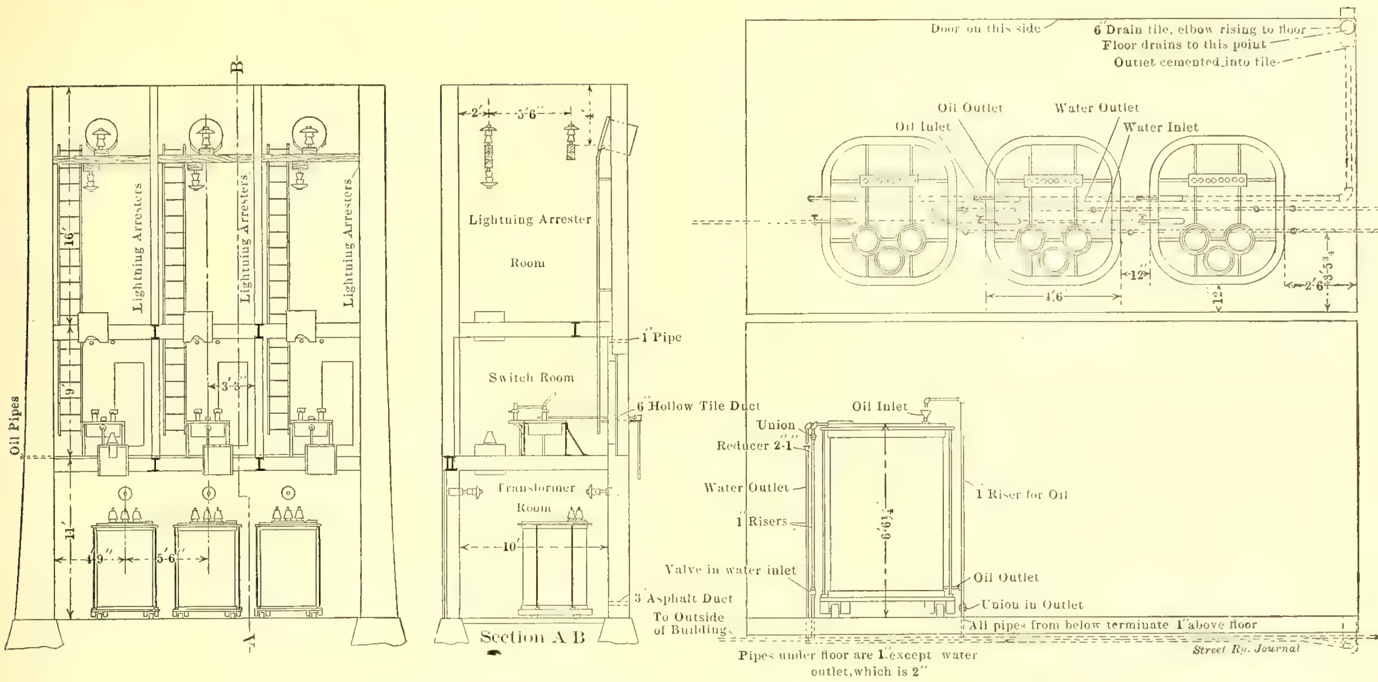
The speed of each engine is controlled by means of a powerful shaft governor, situated in the fly-wheel. The governor operates a shifting eccentric to which are connected the auxiliary steam valves on both high-pressure and low-pressure cylinders. The main distribution valves on both cylinders are connected to a fixed eccentric, as are also the main exhaust valves. As the load changes the cut-off is varied alike on both cylinders, maintaining at all times an equal division of the



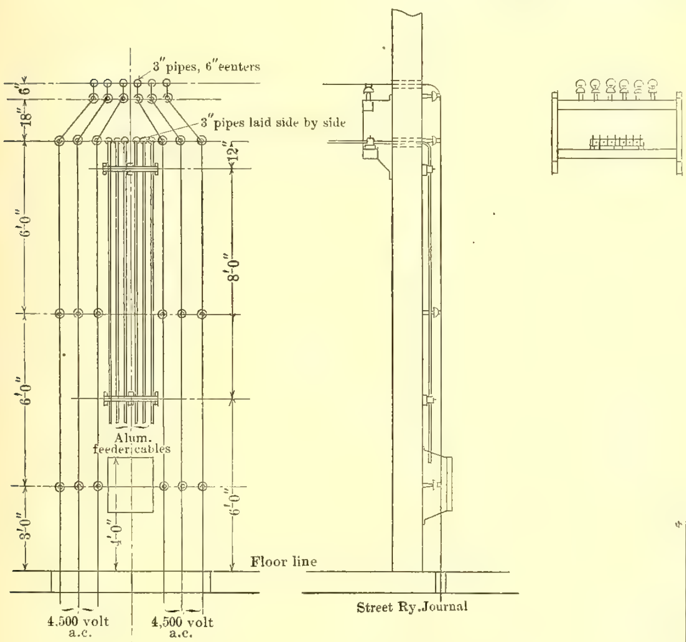
WIRING PLAN OF ALTO POWER HOUSE

work between high-pressure and low-pressure cylinders. The valves are of the quick-opening grid-iron type, giving a large port area as well as a minimum clearance. Each engine is fitted with an automatic lubricating system, delivering a supply of oil to all wearing parts under pressure.

A feature of special interest is the use of McIntosh & Seymour compound-delaying dashpots on the larger engine that



ARRANGEMENT OF APPARATUS IN TOWER AT ALTO



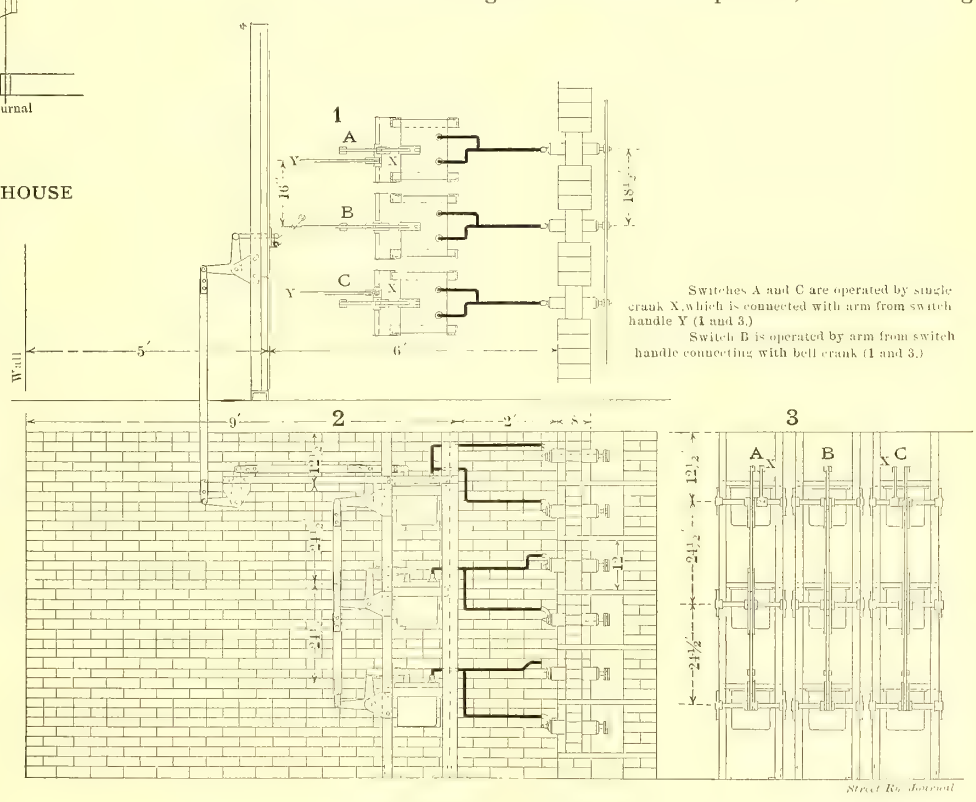
CABLES LEAVING POWER HOUSE

drives the motor generator sets. This comes into play when synchronous motors are driven as alternators in parallel with the transmission circuit. At each end of the main dashpot there is an auxiliary dashpot which is so adjusted as to require a certain interval of time before the governor can respond to any change of load. As a result of this the governor is practically locked against any tendency to surge or hunt when operating in parallel with transmission or other circuits, and successful parallel operation is easily accomplished.

The rope drive connecting the larger engine and the motor generator sets consists of twenty-four 1¾-in. manila ropes, installed as two independent transmissions of twelve ropes each on the American system. To prolong the life of the ropes there is furnished for each half of the system a rewinder sheave, running loosely on the driver shaft. The tension carriage moves horizontally on an angle-iron frame between engine and motor generator sets. This system is installed with about 35-ft. centers.

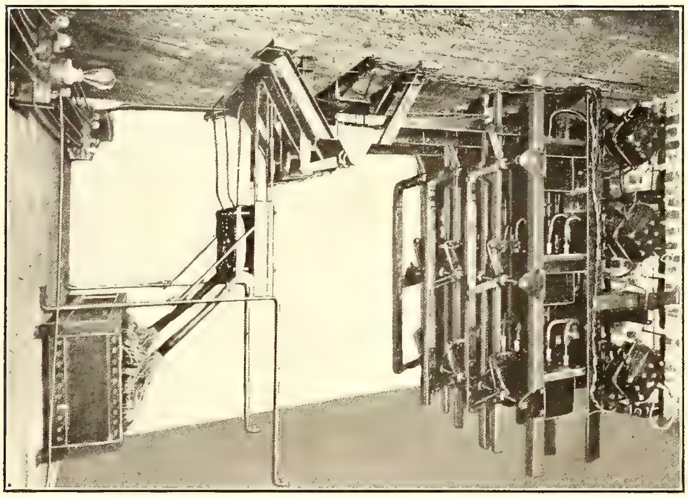
Clutches are arranged on both sides of the pulley so that the motor generator sets may be operated independently, or that either one or both sets may be driven by the main engine, thus furnishing direct current for railway purposes, also alternating current from the inductor alternators. The clutches are mechanically operated, and are of the jaw type, so arranged as to couple to the main shaft, so that the synchronous motors, when operating as generators, will always be in synchronism; in other words, they clutch in only one position.

The two motor generator sets are duplicates, each consisting



LOW POTENTIAL SWITCHES

of a 400-kw, direct-current 550-600-volt railway generator, and a 450-kw Stanley, type 15, 4500-volt, 7200-alternations, three-phase induction alternator, which operates normally as a synchronous motor. The motor generator sets have a speed of 360 r. p. m. Under normal operating conditions the small direct-connected generating unit and one motor generator set are run, the steam set being necessary so as to meet instant demands for power in case of failure of the transmission line.



4500-VOLT OIL SWITCHING GEAR IN BASEMENT OF POWER HOUSE

As it is necessary to keep steam up on the plant anyway, there is but little lost in running the small engine, and, by its operation, the road is assured of continuous service under practically all possible conditions.

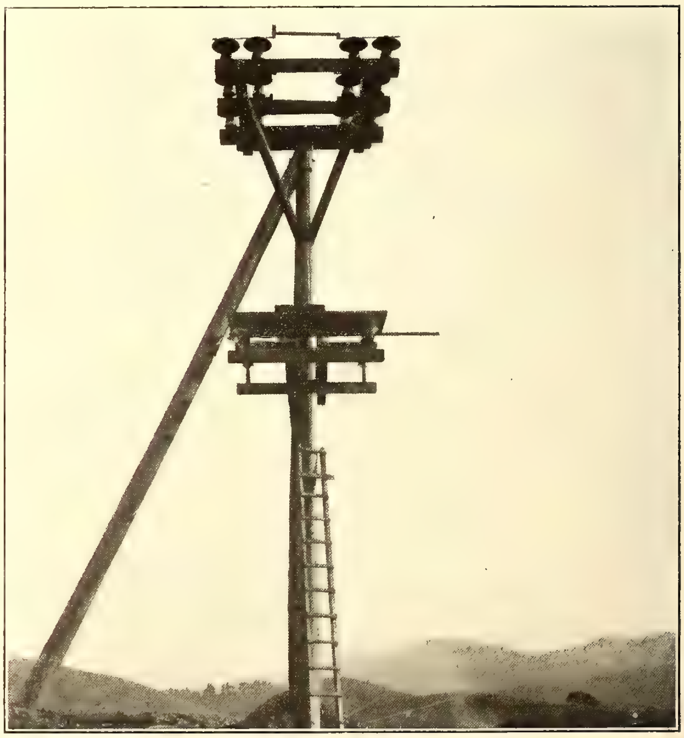
HIGH-TENSION SWITCHING

In the matter of protection against damage by fire or against liability of accident to employees, it would be hard to find a plant using high-tension current for operating motor-generator or rotary-converter sets for direct-current distribution in which greater precautions have been taken than are displayed in the design of the North Shore power station. The entire electrical engineering of the station has been performed by A. H. Babcock, electrical engineer of the North Shore Railroad Company, and the results of his experience, gained during his connection with the leading transmission companies in California, have been well applied in this station. The main idea sought, as may be inferred from the foregoing, is to give the minimum fire risk and the minimum danger to the attendant. To this end no high-tension wires or connections of any sort are placed inside of the engine and generator room, they being entirely enclosed in the high-tension tower. Access to this tower may be obtained from the engine room only, through fireproof doors that open onto a gallery. All low-tension switching gear, bus-bars, etc., are located in fireproof compartments in the basement, to which access is obtained through manholes in the floor of the engine room. More detailed mention of these features will be made below.

The 50,000-volt, three-phase, 60-cycle current of the Bay Counties transmission system is brought to the power house by three No. 6 bare copper wires carried on a pole line that, in its details of construction, is now regarded as the standard of the transmission company. The test pole stands on the brow of a hill just back of the station, and is a switching pole, as may be seen in the cut here presented. It is provided with an insulated platform from which the three copper blade switches of the three-phase circuit may be thrown out should occasion necessitate the complete isolation of the station from the high-tension line.

The wires pass over the power house and enter the top of the high-tension tower at the rear. They are supported by a framing on top of the roof, and where they enter the tower they are carried on insulators supported on a 6-in. x 6-in. wooden strip, that is fastened to the brick work by means of iron brackets. The wires pass through three circular windows, each composed of a 24-in. sewer pipe, inclined at a downward angle, to shed rain and moisture. Mounted in the pipes are glass plates with 5-in. central holes, through which the wires are carried to Locke brown porcelain 14-in. insulators, supported 4 ft. from the roof. Each wire enters a separate fireproof compartment, and the three wires are kept separate until they enter the transformer room on the ground floor. Mr. Babcock's experience has led him to believe that the greatest danger in handling high-tension circuits comes from the lightning arresters and switches, and as each of these for each phase has been mounted in a separate fireproof room it would seem as if the danger had been reduced to a minimum. It is a physical impossibility for trouble of any kind on any one of the three leads of the circuit to involve more than the one wire. It is not believed that fire can be prevented absolutely where such high potentials are used, but it is all the more the duty of every designing engineer to take the utmost pains to localize the possibility of fires. Already this design has demonstrated its value in a very practical manner at the North Shore power house.

From the lightning arrester rooms the wires are carried down through 24-in. sewer pipes and glass plates in the floor to the switches in the rooms below. A view in one of these switch rooms is shown. The switch used is the new Stanley horizontal 60,000-volt double-break oil switch that was recently so successfully tested on the Standard Electric Company's lines at Mission San Jose. The switches are operated mechanically from the floor of the engine room by means of a special gear, shown on the wall in the view of this arrangement.

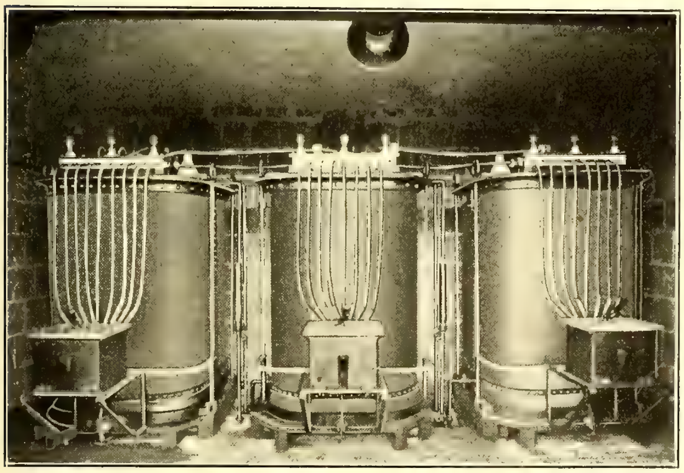


40,000-VOLT SWITCHING TOWER AT POWER HOUSE

Mounted on top of each oil switch is an auxiliary copper knife switch for entirely cutting off any live wires from the oil switch proper. These auxiliary switches are operated by means of ropes from the gallery outside the switch room doors, red and white handles being used to indicate which ropes to pull to throw the switches in or out.

From the oil switches the 40,000-volt wires are carried to the three transformers in the room below. They pass through the floor in sewer pipes, but instead of the glass plates, 1-in. slate

plates, 28 ins. in diameter, are set in the bell of the pipe and cemented in, and the wires pass through porcelain transformer insulators mounted in the center of the slate plates. The object of this construction is to isolate the transformers from the switch rooms above, so that in case of fire or explosion of the switches the transformers would not be damaged. The idea of separate compartments might have been carried farther, so as to include the transformers, but this was thought to be an unnecessary precaution, and, besides, it would have made the connecting of the transformers difficult. The transformers have capacities of 400 kw each, and transform the 40,000-volt current down to 4435 volts, the primaries being connected in star and the secondaries in delta. This method of connections is contrary to usual practice, but was decided upon after due consideration of all the line and operating conditions. The transformers were built by the Stanley Electric Manufacturing Company, and are oil-insulated and water-cooled. In a small



STEP-DOWN TRANSFORMERS IN HIGH-TENSION TOWER OF POWER HOUSE, HANDLING CURRENT AT 40,000 VOLTS

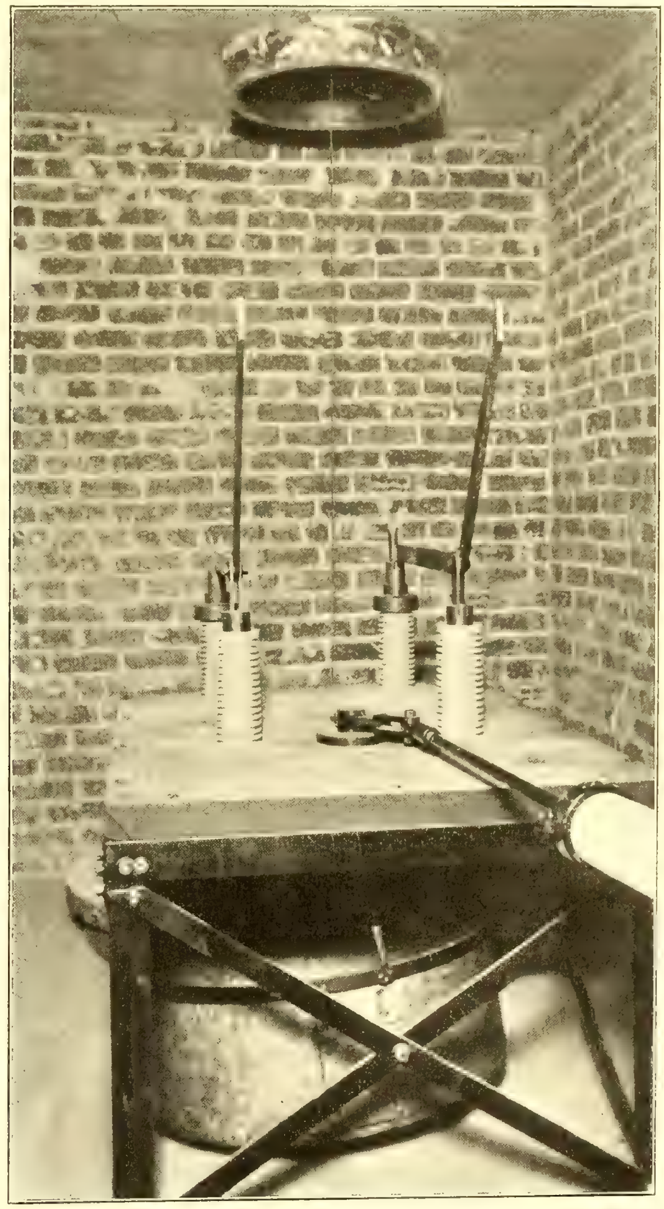
oil house near the transformer room there is a tank large enough to hold the oil from one transformer and half that from another, and a hand pump is provided for pumping the oil into tne transformers. For circulating the water a centrifugal pump, with 1½-in. discharge, is provided in the oil house. The pump is driven by a 1-hp, shunt-wound, 500-volt motor, that operates continuously. The water from the transformer discharges into a small tank outside the shed, and a float in this tank actuates a throttle valve in the pump discharge pipe, so that the whole circulation system is automatic. The transformer room is drained through a 6-in. tile into the bay. A brick platform has been built in front of the transformer room, so that in case of accident a transformer can be easily rolled out of the room and repaired.

LOW-TENSION SWITCHING APPARATUS

All the switches and bus-bars of the 4435-volt three-phase system are located in the basement of the engine room, only the operating handles and instruments being mounted on the switchboard above. The leads from the transformers are carried down and connected to aluminum bus-bars, ½ in. x 1½ ins. x 22 ft., mounted in fireproof compartments, between brick walls and separated by horizontal 1-in. slate barriers. Back of the oil switching gear the machine busses are interspersed in compartments between the main bus-bars.

To operate motors at the Sausalito yard and depot, and also the lights at that point, the California Central Gas & Electric Company has a 4500-volt three-phase circuit, running from San Rafael to Sausalito. This circuit is brought into the Alto power house and connections are made so that this station may feed 4500-volt current in either or both directions on their line. Ordinarily this San Rafael-Sausalito 4500-volt line is not tied together through the Alto station. The barriers for these circuits are shown in the cuts and give some idea of the precautions that have been taken in isolating each feeder and bus-bar.

The alternating switchboard is a three-panel, black enameled slate board. Each of the two generator panels (or motor panels in case the inductor alternators are operated as synchronous motors) is equipped with a double-scale wattmeter, indicating the true power in the one-phase and the total power on the machines, a 110-scale ammeter, a 150-scale voltmeter, rheostat and oil-switch handles, synchronizing plug, and at the bottom



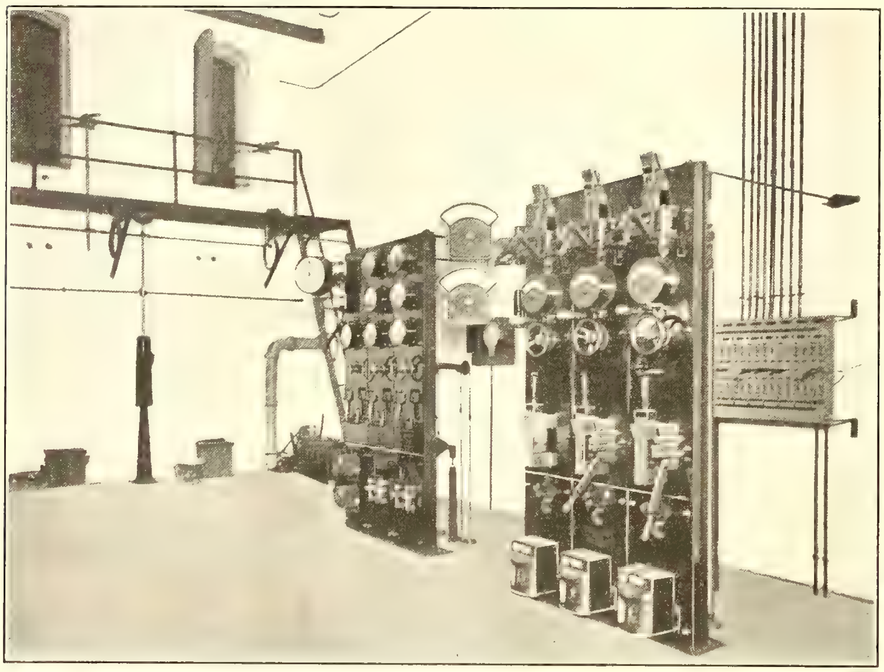
DETAILS OF HIGH-TENSION OIL SWITCH IN HIGH-TENSION TOWER. OIL TANK OF SWITCH IS DISCONNECTED, AND OPERATING TACKLE IS AT RIGHT

a double-pole, single-throw field switch with discharge resistance. On the line panel are mounted a frequency indicator, power-factor indicator, 150-scale voltmeter with switch, oil-switch handle, and two Stanley integrating wattmeters. A Lincoln synchronizer is swung from a bracket at the end of the board. To guard against accidents only 110-volt secondary circuits are taken to the alternating-current boards.

DIRECT-CURRENT SWITCHBOARD

The direct-current railway switchboard is composed only of generator panels. All the positive machine leads are carried from the generators directly to the line panel, which is mounted on the wall where the two feeders leave the building. This is purely an emergency device, intended not to be opened under load, but merely to enable the two parts of the system to be

worked independently, if necessary. For this reason it was placed away from the main boards, where its switches are not so likely to be opened under the excitement that sometimes accompanies station trouble. On each of the three generator panels are mounted a 1500-amp. I-T-E circuit breaker, 1500-scale ammeter, rheostat handle, one single-pole, single-throw, quick-break main switch and a Thomson recording wattmeter. On two of the panels are motor-starting switches, to provide for the starting of the generators as shunt motors. Each panel also contains a special field switch of Mr. Babcock's invention, which combines two switches and allows the direct-current machines to be started as shunt motors without short circuiting the series field. A differential voltmeter and a station voltmeter, both with illuminated dials, are swung from brackets at the left of the board. With the exception of the voltmeter leads no positive leads come to the direct-current boards, everything else being on the ground side of the circuit. It will be seen that all danger to boards and attendants is eliminated.



DIRECT-CURRENT AND ALTERNATING-CURRENT SWITCHBOARD IN POWER HOUSE; ALSO SHOWING HIGH-TENSION GALLERY AND TWO DOORS OPENING INTO OIL-SWITCH ROOM

STORAGE BATTERY

In order to regulate the heavy fluctuations on the station on account of the intermittent operation of the trains, a storage battery has been installed. It consists of 288 type G-15 chloride cells, with a discharge capacity of 560 amps. for an hour, and a capacity for fluctuating work 50 per cent greater. In connection with the battery there is operated a differential booster of the Western Electric type. The battery switchboard has the same arrangement as the direct-current boards, only negative circuits being controlled by it.

GENERAL ELECTRICAL FEATURES

All the switchboards were built from the designs of Mr. Babcock, and the same precautions against fire and danger to attendants as were used in other portions of the plant were incorporated here. The constructions are diagrammatically shown in the accompanying cut.

The three 800,000-circ. mil copper cables from the generator of the direct-connected set are carried to the switchboard in 3-in. asphalt paper ducts, the three ducts being laid in a 9-in. terra-cotta sewer pipe, shown in the wiring plan of the station. Another cut shows the arrangement of circuits leaving the power house.

The station lighting is controlled from ten circuits, connected to double bus-bars mounted on a marble panel. One bus is connected across sixty cells of the storage battery, and the other to the secondary of a lighting transformer off the 4500-volt mains. The battery connection is provided so as to allow the station to be lighted when everything else is dead.

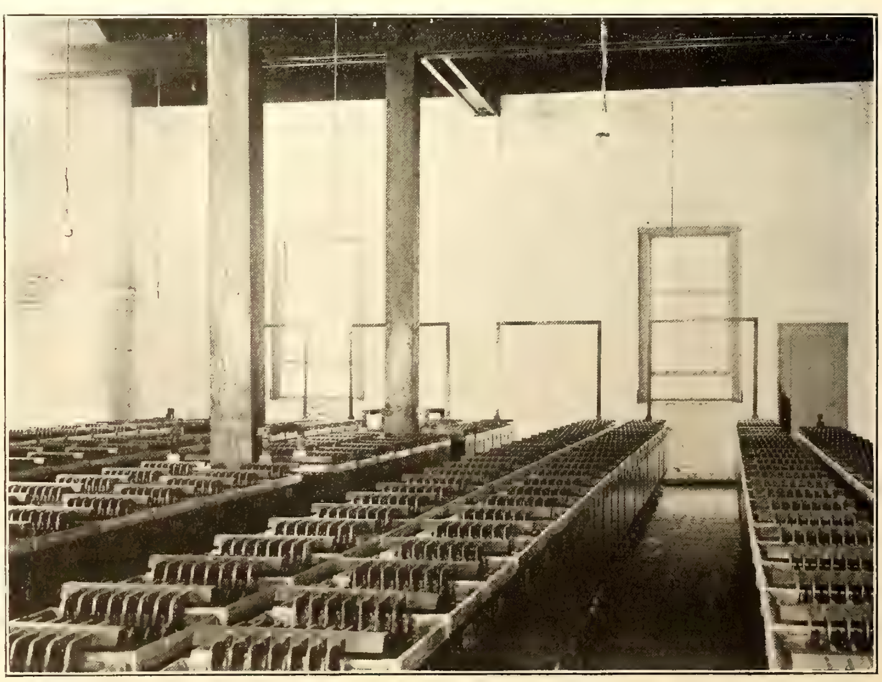
SAN RAFAEL SUB-STATION

In order to cut down the time of train operation over the 2 per cent grade near San Anselmo, a sub-station was installed at San Rafael. The outfit consists of a 225-kw, 550-volt General Electric direct-current generator, belt-driven by a S. K. C. synchronous motor. This station is fed regularly from the Bay Counties system, but connections are provided so that it can be operated from the Alto power house, either over the 50,000-volt system or the 4500-volt line. The present sub-station is only temporary, but it serves its purpose admirably.

ROLLING STOCK

The types of cars used in the regular service on the North Shore Railroad were illustrated and described in the Street Railway Journal of May 16, 1903. The motor cars are of the combined baggage and passenger type, and are 50 ft. long over bumpers, while the passenger coaches are of the standard light passenger type, and are 56 ft. 4 ins. long over all. The coaches seat sixty-six passengers, and the motor cars have a seating capacity of thirty-six and a 12-ft. baggage compartment. The North Shore Railroad Company has in service nine of these motor cars and twelve coaches, which were built by the St. Louis Car Company. Also it has rebuilt in its shops three motor cars and eight coaches, these eleven cars being Pullmans that were used on the road during its operation by steam.

The motor trucks of the combination cars are of the Hedley



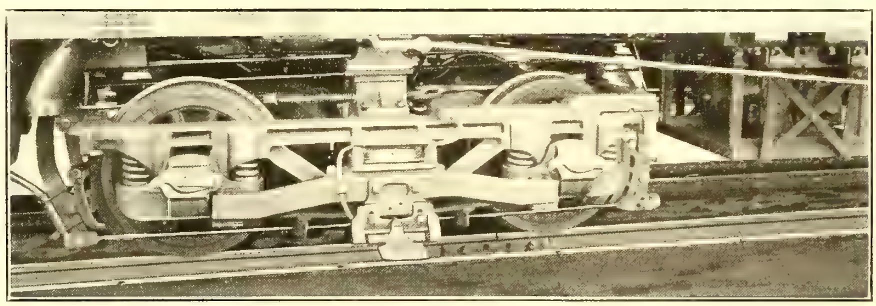
STORAGE BATTERY AUXILIARY AT ALTO POWER STATION

FOUR-CAR TRAIN, COMBINING PASSENGER COACHES, MAIL, EXPRESS AND BAGGAGE SERVICE

type, and are equipped with two General Electric 66-motors. For the contact the new Potter collecting shoe, made by the General Electric Company, is used. It is mounted on an oak

STANDARD MOTOR CAR, CARRYING PASSENGERS, MAIL, EXPRESS AND BAGGAGE

bar fastened to the equalizer, as shown. This shoe is practically the same as that used on the Wilkesbarre & Hazelton third-rail road, and while its general design is very satisfactory in that it permits perfect protection of the third rail at station platforms, etc., the management of the company believes that its details must be modified before it can be satisfactorily adopted for general use.



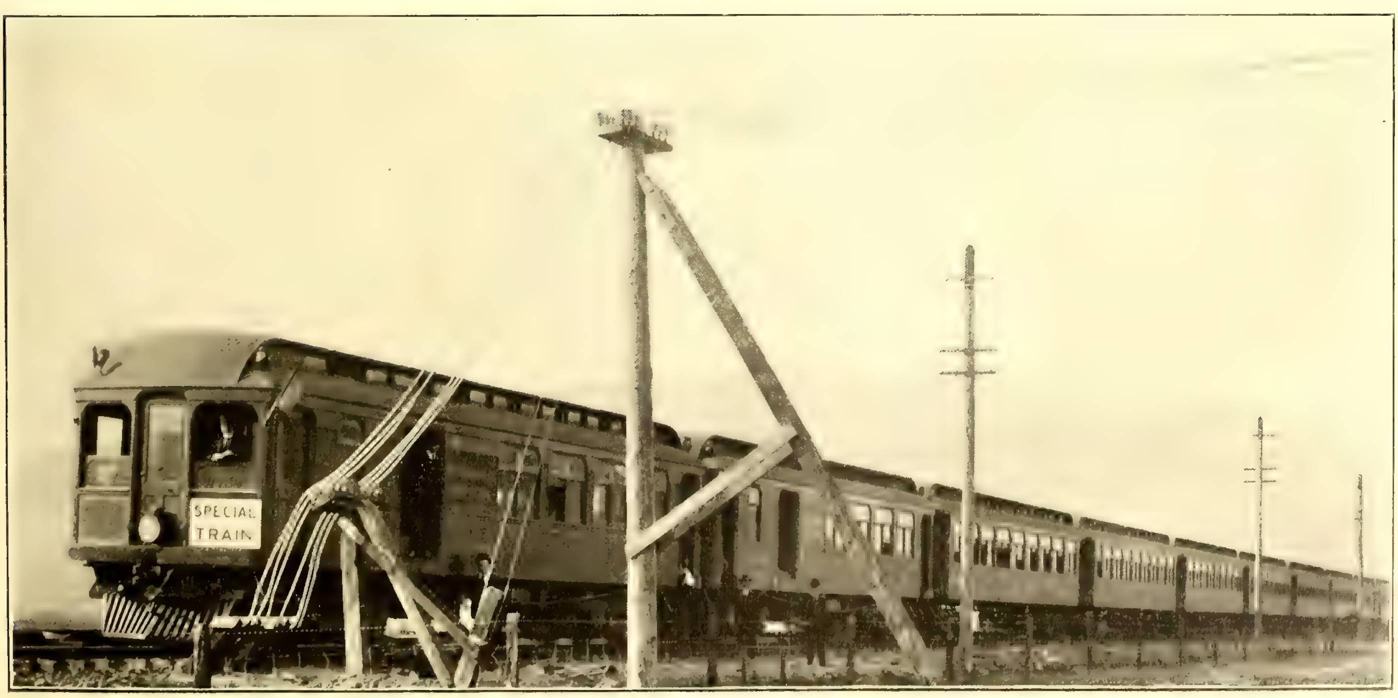
CONTACT-SHOE, MOTORS AND COMPRESSORS ON MOTOR TRUCK

The cars are equipped for train operation with the General Electric Company's type-M multiple-unit control, the only special feature being that a bus line, consisting of No. 0000 copper cable, runs the whole length of the train. This arrangement was made necessary by long road crossings, its function being to supply all the motors with current if only one shoe is in contact with the third rail.

Other furnishings of the cars include Janney couplers, Anderson-Smith arc headlights and interior lights, Westinghouse automatic air brakes on all cars, and Westinghouse motor-driven compressors and governors. The motor cars weigh about 30 tons each, and a five-car train, including two motor cars and three coaches, or trail cars, weighs, equipped, 130 tons.

TRAIN OPERATION

Under usual operating conditions three-car to five-car trains are operated, and four trains is the maximum number on the track at one time. At certain hours of the day three trains leave the Sausalito depot within 1 minute of each other, and this necessarily brings a heavy tax on the power plant, but with the aid of the storage battery the load on the



SPECIAL TRAIN OF TEN CARS OPERATED AT OPENING OF LINE TO SAN RAFAEL

REGULAR PASSENGER TRAIN, CARRYING MAIL, BAGGAGE AND EXPRESS

generators is smoothed out. At other periods of the day, when no trains are moving, there is practically no load on the station, and here again the battery comes into play, as it is charged during such periods, and thus keeps a more even load on the station. Several views of trains are shown.

The list of stations on the electric division of the road, with distances from Sausalito, is as follows:

	MILES
Sausalito	....
Alameda Point	1.24
Waldo Point	1.85
Manzanita	2.67
Mill Valley Junction	3.51
Millwood	4.5
Mill Valley	5.25
Alto	4.46
South Portal	5.05
North Portal	5.67
Corte Madera	6.07
Larkspur	6.87
Escalle	7.42
Kentfield	8.23
Ross	9.
San Anselmo	9.97
West End	11.43
San Rafael	11.95

The trains operate at a schedule speed of about 25 m. p. h. to 30 m. p. h., and have maximum speeds of between 50 m. p. h. and 60 m. p. h. During morning and evening an express service is given between Sausalito and the San Rafael end of the system.

The entire railroad, steam as well as electric, is operated under the American standard railroad rules. The engine drivers of the old steam system are used as motormen, and they go from steam to electric train, or vice versa, as they may be assigned.

SIGNAL SYSTEM

The road is operated by a train despatcher located in the depot at Sausalito, all despatching being done by telegraph. For the use of the officers and operating men a telephone system connects the terminal shops, power house and all suburban stations.

SIGNALS GOVERNING MILL VALLEY JUNCTION, AND INTERLOCKING TOWER AT RIGHT

An automatic block signal has been installed by the Union Switch & Signal Company for the double track between Sausalito and San Anselmo. This system embodies certain interesting features which are novel in the art of railroad signaling, in that alternating current is used in track circuits, which in turn actuate the motors that operate the signals. Electric transportation having reached the speed and other conditions common to steam practice, it follows that similar protective devices are called for, but the customary track circuit supplied by a primary battery or other source of direct current, is in this case proscribed for the reason that, at least, one of the rails must be used as a return conductor to the power station for the train current.

The general arrangement of the track circuits is similar to that on the Boston Elevated Railway except in the use of an alternating current in the signal circuit. One of the track

NORTH PORTAL OF TUNNEL, SHOWING SIGNALS AND ALUMINUM FEEDERS GOING OVER HILL. SIGNAL WIRE TRANSFORMER POLE AT LEFT

rails is insulated from the other, and is also divided into sections of varying length by the use of track splices or insulated sections, such as used in standard steam railroad signal work. The signals are then operated in the usual way, viz., when a car enters a block its axle furnishes a direct short circuit between

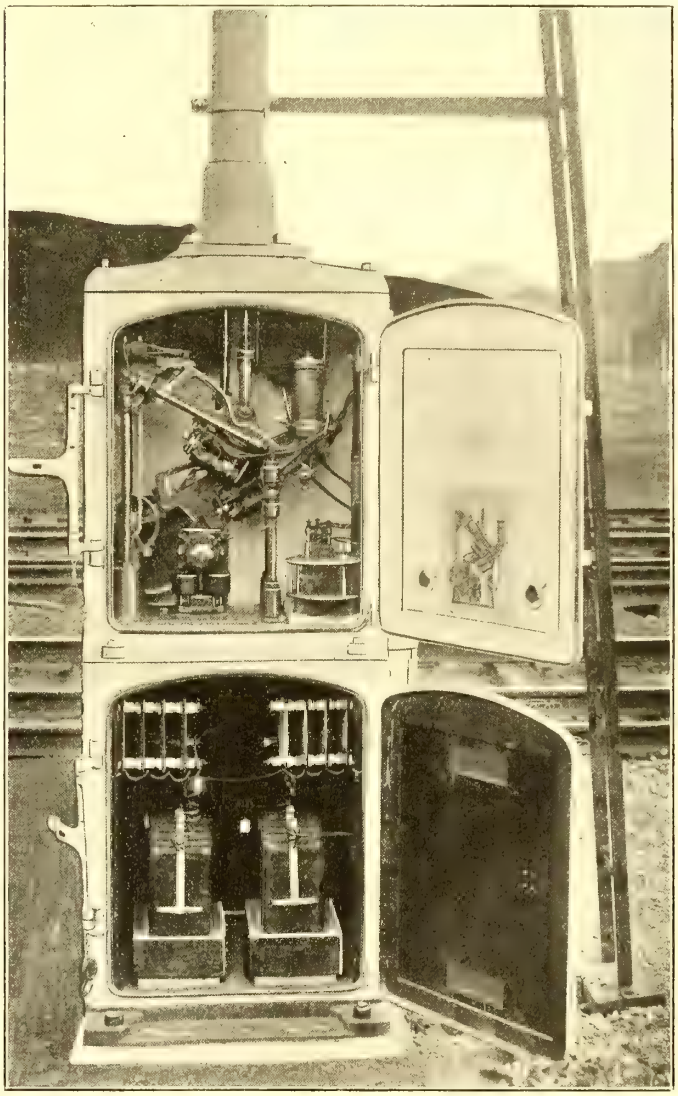
TYPICAL VIEW SHOWING SIGNAL SYSTEM AND METHOD OF LAYING CONTACT-RAIL ON CURVE

the signal track rail, which is kept at an alternating-current potential of from 9 volts to 15 volts, and the other track rail, which is grounded. This short circuit operates a relay controlling the signal, and this relay throws the signal, as will be described later. Alternating current has been adopted for the signal circuit in place of direct current, as used in Boston, because on a long line of this kind the voltage of the return track rail would vary considerably, owing to the fluctuating direct-current drop, and this difference in potential would tend to interfere with the proper operation of the signals. The use of alternating current corrects this, and offers the additional advantages common to high-tension distribution systems.

Alternating current for the signal circuits is taken from the main 4500-volt supply at the power house, making the system quite simple and easily maintained. One phase of a three-phase four-wire system is used, its voltage being 2300. This feeder is tapped off to small transformers, one for each block section, located at the ends of the blocks and enclosed in iron cases mounted on poles.

The alternating-current relay, which is short circuited by the presence of a train within the block, is contained in the upper half of the signal compartment at the base of the signal, and can be seen at the lower right-hand corner of this compartment in the illustration showing the details and mechanism of the signal apparatus. This relay is adjusted to pick up at about one-tenth of an ampere, and opens or closes the circuit breaker of the small 8-volt direct-current motor used to operate the semaphore signals. After the semaphore is raised, the motor, according to the regular system of the Union Switch & Signal Company, is cut out, and the signal is retained in position by current from the storage battery used to operate the motor. The battery consists of four chloride-type P T cells. A duplicate battery is installed so that one battery may be in operation while the other remains fully charged or is being charged. Current for charging the batteries is taken from the contact-rail, the proper resistance being interposed in the circuit. Where two signals are opposite, one battery serves for operating both.

The signals are lighted at night from the mains which supply the track circuits, as are also the way passenger stations. The signal lights are 6-cp 125-volt lamps, burning at 20 volts, so as to prolong their life. The signal itself is of the semaphore type, having both home and distant or caution arms. The semaphores give indication by position in daytime and by color at night, red indicating danger, yellow caution, and green clear. The upper or red semaphore is the home signal, and the lower or yellow arm, with fish-tail end, is the caution signal. There



DETAILS OF COMPARTMENT AT BASE OF SIGNAL TOWER

are thirty signal poles on the line, containing fifty-four signals, twenty-four poles being of the two-arm type and six of the one-arm type. Notwithstanding the fact that this is the first installation of automatic block signals using alternating-current track circuits, the system has given excellent service. Many of the block sections are upwards of a mile in length, which, coupled with the fact that the wet season is now on, constitutes a test which demonstrates the practicability and success of this new system.

In addition to the block-signal system there are three disc signals stationed on the legs of the Y-track at San Anselmo. These signals are controlled by the station agent, who can give right of way to the station to a train on any one of the three legs of the Y. Annunciators operated by trains approaching San Anselmo are located in the station, and give the agent information as to the approach of trains.

At Mill Valley Junction a mechanical interlocking plant is being installed, the main line semaphores of which are semi-automatic, and this feature makes the automatic block signal system in reality continuous. Information of trains approaching the junction is given to the operator in the tower by annunciators. A mechanical interlocking plant of some size is also being installed at Sausalito to control the switching in the terminal yards.

Throughout the tunnel, near Corte Madera, incandescent lamps have been placed 10 ft. apart and the height of a car window. Signal No. 18 at North Portal is always red whenever a train is in the tunnel block. In this position it closes a small switch that supplies current to the primary coil of a General Electric contactor, which in turn closes the circuit from the power rail to the tunnel lamps, these being connected in the usual multiple-series arrangement for 500-volt lighting. The operation of the lights is thus entirely automatic.

SAUSALITO LIGHT AND POWER

The 4500-volt three-phase power circuit from San Rafael and the Alto power house terminates at the pump house in the Sausalito terminal yards, where it is transformed for motor work at the ferry, and for incandescent and series arc lighting. The machinery at the shops is driven by a 30-hp induction motor. In the pump house is a vertical triplex 9-in. x 10-in. Allentown fire pump with 8-in. discharge and 8-in. suction. This pump is driven by a 50-hp General Electric induction motor. A 5-hp induction motor drives a 3-in. x 3-in. Dow triplex pump for filling the accumulator at the ferry apron.

CONCLUSION

The officers of the North Shore Railroad Company, who were in charge during construction, are: President, John Martin; vice-president, E. J. de Sabla; secretary and treasurer, F. B. Latham; auditor, O. F. Giffin; general manager, W. M. Rank; superintendent, E. L. Braswell; purchasing agent, S. F. Alden; general freight and passenger agent, George W. Heintz; electrical engineer, A. H. Babcock; engineer of maintenance of way and structures, B. H. Fisher; engineer of power station and steamers, George S. Ames; master mechanic, F. A. Stevens; car house foreman, W. W. Mason, Jr. Credit for the design and installation of the electrical equipment of the road is due Mr. Babcock. Mr. Mason, who came to Sausalito from the Boston Elevated Railway Company, has supervised equipping the cars with the type-M control system.

The entire steam power plant was designed and installed by Charles C. Moore & Company, of San Francisco, the details of design being approved by Mr. Ames. John Martin & Company, of San Francisco, supplied the electric generators, transformers, switches and switchboards, most of that equipment being of the Stanley Electric Manufacturing Company's construction. The aluminum rod used as feeders was furnished by the Pittsburg Reduction Works, through its agents, John Martin & Company.

Since this article was written the control of the property has passed to the Santa Fe, although that company has not taken possession as yet.

ROTARY CONVERTER RUNAWAY AT JANESVILLE, WIS.

One of the rotary converters in the sub-station of the Rockford, Beloit & Janesville Railroad Company, between Beloit and Janesville, recently ran away and wrecked itself, the runaway, of course, being due to the opening of high-tension lines and the turning of the motor into a generator with the compound winding of the fields, reducing the fields' strength so that the speed of the armature became very high.

THE INSPECTION OF CONDUCTORS FOR FAILING TO REGISTER CASH FARES

BY H. N. BROWN

The methods pursued by conductors for collecting fares and failing to register them are various. Perhaps the most popular is to collect a number of fares at one time and then register one or two less than the proper number. Many conductors believe that an ordinary passenger cannot detect this trick, and properly, because it requires close watching by a practised inspector. Another way to defraud the company is for the conductor to wait until the car is in the middle of a block, then to collect two or three fares just before the car reaches the next corner. If a passenger should be at this point ready to board the car, the motorman will stop to take him on, and the conductor will hurry to the rear platform to ring his car ahead, and thereby fail to register the fares just collected. He will leave the passengers in the car under the impression, however, that he had forgotten to ring the register, simply because his mind was attracted from his work to see that the passengers boarded the car before starting. Other conductors will collect and register every fare inside of the car, but will register one or two short from those collected on the rear platform, if there is any considerable number of platform passengers.

The most dangerous man among this class, however, is the one who will doctor his manifest or trip card. In other words, he will start out on his trip with thirty passengers on the car, collect all fares and register twenty-six of them, making four fares that he collects and does not register. Should he be suspicious of any passenger on the car he will report on his manifest that he carried thirty passengers on this trip, when, as a matter of fact, the inspector will report the trip as twenty-six on the register and four fares collected and not registered. When the manager checks up the inspector's report with that of this particular conductor he will naturally give the conductor the benefit of the doubt, and believe that when he arrived at the end of the line and found that he had four more fares in his pocket than accounted for, he rang them up on the indicator, which would make his report agree with the inspector's as to the number of passengers on the car. On the next trip this conductor will collect and register every fare in the car, but upon arriving at the terminus of the half trip instead of reporting on his manifest the full number of passengers carried on this trip he will deduct the four fares from proper amount. Should an inspector be on the second trip with this conductor his report will show four over the conductor's trip slips, and, naturally, when checking up the inspector's reports the manager will think that the inspector made a mistake in putting down his figures and give the conductor the benefit of the doubt on this occasion. In a case of this kind it is well for the manager, upon finding that an inspector's reports do not agree with the conductor's, to place this particular report aside and watch the balance of the reports sent in by the inspector on this conductor. Should he find that they do not agree with one another it is well to take the inspector's word in preference to that of the conductor in this case. That is, if the inspector's reports were found correct and checked with accuracy with nine-tenths of the conductors on the line, it stands to reason that they are undoubtedly correct as regards the other tenth.

There are other discrepancies in reports which a manager often does not take into consideration or does not think of at the time he is checking up the reports. Frequently, in a crowded car, a conductor, after collecting all fares and transfers, will return to the rear platform to examine the transfers, and among them will find one, two or three on which the time limit has expired, or which possibly may have been issued the previous day. After discovering his mistake in accepting these

transfers and not knowing from whom he received them, he will tear them up and throw them into the street. Naturally, the inspector will report the number of transfers he saw collected by this conductor, but when the latter's reports are turned in they may show one, two or three less than the inspector. In a case of this kind the conductor is again given the doubt, and confidence is lost in the inspector's reports.

On large roads conductors frequently have an opportunity to collect and fail to register fares before they reach the first transfer point, for at this point a number of passengers will leave the car for some intersecting line, and thereafter the passengers on the car will be way below the amount on the dial.

THE BEST SYSTEMS OF INSPECTING.

On small roads where it only requires a car 30 minutes to make a half-trip it is best to have the inspector ride practically from one end of the run to the other. By this method the management can check up the inspector's reports with the conductors' trip slips, and each should tally with the other, except where discrepancies may occur from a conductor missing fares or failing to register them.

On large roads, where it requires three-quarters of an hour to make a half-trip, this may not be the best method, as the railway company would be compelled to employ an enormous number of inspectors. In this case my suggestion would be for the inspector to make 20-minute rides on the lines, thereby securing for the company about eighteen rides per day from each inspector. Should an inspector find any man collecting and failing to register cash fares, the company could make specials of such conductors, and have one or two inspectors do nothing else but ride specials. In these cases the inspectors should ride from one end of the route to the other with these suspected men so that the inspector's reports can check up accurately with the conductors' trip slips.

In my opinion a street railway employing from ten to twenty conductors should have at least one inspection for one week every two months, those employing from twenty to forty conductors should have one week in every month, those with from forty to sixty conductors should have from ten days to two weeks every month, and those employing sixty conductors or over should continue the inspection every day in the year. The reason for this statement can best be shown by taking an illustration, say a road employing from ten to twenty conductors. If a conductor on such a road fails to register an average of one fare on every half-trip, and makes twenty such half-trips a day, he would be taking $30 per month, or $60 in two months. An inspector's services for one week would not cost the railway company over $35 for that length of time, and during this time he could readily check up twenty conductors. The usual number of rides made by an inspector is from ten to twelve, so that by seventy rides he could check the majority of the conductors four times apiece and the others three times each. Should he find only one conductor dishonest out of the twenty the company would be saving at the lowest estimate $25 through this work. This same reasoning can be applied to larger roads, although they are more liable to suffer from dishonest men than the smaller ones.

DEPORTMENT OF MEN IN THE EMPLOY OF RAILWAY COMPANIES

There are a number of irregularities practiced by conductors and motormen in the employ of street railway companies, which, if allowed to continue, may cost the latter considerable money in the way of accidents, etc. I will endeavor to mention a few of them.

1. Conductors failing to flag railroad crossings.
2. Ringing their car ahead from the inside, tending to throw people from the rear platform.
3. Collecting a number of fares at one time before registering.
4. Smoking on the car while on duty.
5. Talking to motormen for any length of time, thereby distracting his attention from his duty.
6. Failing to report broken seats, car floors or windows on the car he is working.
7. Failing to hold trolley rope when rounding curves, which is liable to jump off and break down the overhead wires.

These faults, in my opinion, should be promptly punished by a severe reprimand for the first offense, suspension for the second offense and dismissal for the third, for if the management allows them to continue many accidents may occur from any one. The chief faults of motormen are: Throwing the controller handle from one point to five when starting, tending to throw passengers in the car; disobeyment of slow and stop signals placed along the line; hitting curves and switches too hard, tending to throw the car off the track; talking to passengers or conductor, thereby diverting his mind from his duty; smoking on the car, abuse of current, etc. These irregularities should be dealt with as in the case of conductors.

EXPLOSION WRECKS POWER PLANT AT ST. LOUIS

The Geyer Avenue power house of the St. Louis Transit Company, at Geyer Avenue and Missouri Avenue, was completely wrecked by an explosion Monday evening, Dec. 21, at 5:13 o'clock. Six men were killed and nearly everyone of the thirty employees in and about the boiler room was injured in some way. Seven of the fourteen boilers exploded so rapidly as to render the reports almost simultaneous. The force of the explosion was exerted in all directions, and brick and iron were scattered about for a radius of three squares. Two boilers were hurled east into Missouri Avenue, as shown in the

SCENE OF THE EXPLOSION

accompanying engraving; three others went south into the car sheds, and parts of others were thrown northward through the building. A boiler shell was carried over a row of houses to a vacant lot in front of the McKinley High School, two blocks away, and a steam drum landed in Allen Avenue, having been hurled entirely over the car houses.

Immediately after the explosion a general alarm of fire was turned in, but there was little for the firemen to do beyond extracting the dead and wounded from the debris. A force of 200 men was put to work the next morning to clear away the wreck. Daylight showed the interior of the power house to be a mass of twisted steel, splintered timbers, bricks and mortar. The fly-wheels of the big engines were the only things that were recognizable as having retained a semblance of their former shape. These stood intact, although the shaft was wrenched loose from one of them. For a distance of 50 ft. the chimney was spattered with mud and scarred by flying bricks.

The boilers which exploded were installed when the power house was built in 1891, and were damaged in the cyclone of May 27, 1896, which wrecked the plant. After undergoing repairs they were put in service again. The new boilers which had been added to the plant in the last few months were separated by a wall from the old battery, and were not damaged to any great extent by the explosion.

In order not to inconvenience its patrons the company called into action as soon as possible after the accident the reserve equipment at each of its other plants. The principal call for extra power, however, fell on the central station at Park Avenue and Vanderventer Avenue. In addition, the two stations in the North End, the northern station at Broadway and Salisbury Streets, and the Cass Avenue station, at Prairie Avenue and North Market Street, put additional machinery in operation.

One of those who personally helped in the wreck was A. B. DuPont, second vice-president of the company.

THE EFFECT OF FREQUENT STOPS IN HIGH-SPEED RAILROADING

BY A. H. ARMSTRONG

The growing tendency for steam lines to adopt electricity as a motive power for their local and suburban service excites much interest in the question of the probable effect upon the extensive suburban electric systems now in operation, many of which parallel steam lines. The electric interurban and suburban road is now operating cars having the same weight and speeds as its steam competitor, but usually its cars operate singly, or at most in trains of two cars, and then only at rush hours. So far as the rolling stock is concerned, the electric road can give higher speed and afford greater convenience to the traveling public. The roadbeds of the two systems, however, present a considerable contrast, and in most cases the advantage is on the side of the steam-operated road.

The electric road owes its rapid development and success partly to the fact that it picks up and discharges a passenger in the neighborhood of his destination, and partly owing to the frequent service afforded. The bulk of the traffic is secured, notwithstanding the fact that the schedule speeds in most cases is lower than that of the steam road which the electric road may parallel. Although the steam trains make fewer stops, and, as a rule, have a better roadbed, the steam railroad schedule speed made is not greatly in excess of that provided by the electric roads, owing to the ability of the electrically-propelled car to get away promptly from the station. Should the steam road operate its trains electrically, however, its better roadbed would prove a factor demanding the most serious attention on the part of the present electric road management.

The installation of an electric road in a new territory is often a very serious financial problem, owing to the undetermined patronage and receipts which the road will enjoy. It often happens that the road is installed at a minimum cost, and the roadbed is not all that it should be, being full of curves, heavy grades and, perhaps, running largely over the public highway. Even if private right of way is obtained, sufficient attention is not given to providing a straight track, adapted to high-speed operation. In order to secure franchises it may be necessary to locate stopping places at very frequent intervals, and these, together with sharp curves, often handicap the road at the start for making any high speed between terminals. It is not the intention here to in any way criticise electric roads, but to point out the necessity of greatly improving their roadbeds should they be brought into competition with steam roads when operated, not with steam locomotives, but with electrically-equipped motor cars.

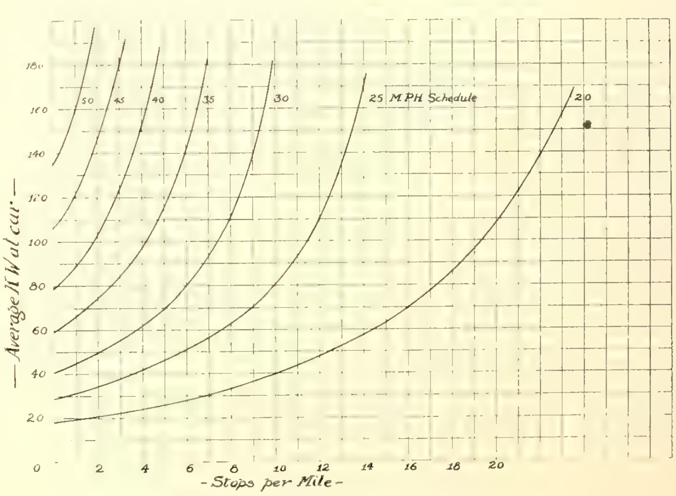
The coal consumption of an electric road is a matter of growing importance and depends largely upon the relation of schedule speed, frequency of stops and alignment of the roadbed. A curve is much more to be avoided in high-speed work than a heavy grade, in fact, a 5 per cent grade of considerable length will not be the source of operating expense that a 12-deg. curve will, unless the latter is placed at a stopping point. In other words, on high-speed passenger roads it is better to go over a hill than around it, if going around it introduces a curve of any considerable degree. Where the road carries freight the grades, of course, will be objectionable, but as dividends of electric roads are earned from passenger receipts rather than freight haulage, the needs of high-speed passenger service must be given first consideration for the present at least.

To take up a specific case, assume a certain road to require a schedule speed of 25 m. p. h., operating 35-ton cars; wanted, the relation between frequency of stops, energy consumption, maximum speed and motor capacity demanded. The following table is made out for an accelerating and braking rate of 1¼ m. p. h. per second, a value sufficiently high for suburban work.

SCHEDULE SPEED 25 MILES PER HOUR

Stops per Mile	KW	Maximum Speed	Total HP Motor Capacity
0	29	25 miles	143
.2	35	29 "	175
.4	44	31 "	186
.6	51	33 "	207
.8	63	37 "	245
1.0	79	43 "	301
1.2	100	51 "	395

This table affords means of very interesting comparisons. The number of stops per mile given is the equivalent number of stops, and includes slow downs required for sharp curves, etc. With .8 of a stop per mile the energy consumption is given as 63 kw per car, while an increase of 50 per cent in the number of stops to 1.2 per mile increases the energy consumption to 100-kw average. A further increase in the number of stops and the maintenance of the same schedule speed would increase the energy consumption of the car at a much greater ratio. This increase in energy for the more frequent stops can be capitalized. The difference in energy consumption between



ENERGY CONSUMPTION FOR 35-TON CAR

.8 stops and 1.2 stops, 37 kw, corresponds to 1.48-kw hours per mile of track per car per day. Assume, 1-hour headway and 18-hour service, there will be thirty-six cars per day operating over this 1-mile section, consuming a total of 53.2-kw hours. At 1 cent per kilowatt-hour this energy amounts to 5 per cent interest on $3,880. In other words, nearly $4,000 per mile of track could be expended to eliminate curves, which would decrease the number of stops per mile 33 per cent.

No consideration has been given to the fact that the motor capacity has increased over 60 per cent, that the generating station has increased a like amount, and the interest on this extra capital investment should be also included in figuring up the cost of making additional slow downs or stops. Also it has been necessary to operate our car at a maximum speed of 50 m. p. h., where 40 sufficed before, and the additional deterioration of rolling stock at the higher speed should also be taken into consideration. Furthermore, a headway of 1 hour only was considered, and many of our suburban roads operate on 30 minutes or even 15 minutes headway during part or whole of the day. When all these influences are considered it becomes evident that any money spent in straightening the track is well invested and will give handsome returns, as shown in reduced operating expenses.

The matter is presented somewhat in detail in order to indicate what the electric road must expect should the steam road, with its straighter track, operate its trains or cars electrically. With the possibilities opened up by single-car operation, frequent service and rapid acceleration provided with electric motors, the steam road will force its electrical competitor to higher schedule speeds in order to retain its share of the traffic. Furthermore, the electric road in nearly all cases has to traverse city streets in order to reach the center of distribution at its terminals, while the steam road has private right of way, thus compelling the electric road still further to better its speed on the suburban sections in order to compete with the electrically-equipped steam road. Any necessity requiring an increase in the schedule speed of many of our suburban roads, especially those having frequent stops and bad alignment, will result in a considerably increased energy demand.

The electric road has built up a residential district in the immediate vicinity of its tracks, calling for additional facilities in the way of more frequent stops. Many of the suburban roads, which, at the time of their installation, made one stop in say, 2 miles, and were able to make a good schedule speed, have, by the very success attending their operation, so built up and developed their traffic that more frequent stops are necessary. As high-speed roads, these systems have defeated their purpose by their own success, in other words, they can no longer be classed as truly high-speed roads, but rather as a high-grade city system. This does not apply to those systems enjoying private right of way, which must constitute a division by themselves. Such roads have more power to regulate their stopping places, but even such systems are being troubled by their inability to make the schedule speed desired, as shown by the rather general adoption of both local and express service over the same lines.

To illustrate the influence of more frequent stops a case has been assumed where a 35-ton car is geared for 45 m. p. h. maximum with an equipment of 300-hp nominal capacity in motors. The following table gives the proper frequency of stops, with varying schedules for the same temperature rise, approximately 60 degs. C. of the motor power. That is, given an equipment operating at 45 m. p. h. maximum speed, the table will show the reduced schedule speed required with increasing number of stops, such as would result from increased popularity of our suburban systems:

45 MILES PER HOUR MAXIMUM SPEED

Schedule	Watt Hours Per Ton Mile	Car Energy	No. of Stops Per Mile
45	67	106	0
40	72	101	.18
35	79	97	.4
30	89	93	.7
25	100	87.5	1.08
20	120	84	1.8

The table shows that a car capable of making, say, 35 m. p. h., with one stop in 2½ miles, would have its schedule speed reduced to 25 m. p. h., should the traffic demand stopping every mile. It is, of course, possible to make somewhat higher schedule speed with one stop per mile than 25 m. p. h., but the increased acceleration required would demand commutation requirements in excess of the capability of the motor.

It would be a novel sight to see the electric road and the steam road change places, as is possible in many cases should the steam road electrically operate its suburban service. With the better facilities at the terminals, with private right of way through the cities to the center of distribution, and, furthermore, with the better and straighter track and fewer stops on the steam lines, they could give speed facilities to the more outlying districts against which the electric road could not compete with its present tracks. The remedy, of course, would be to increase the investment on the electric roadbed, straighten it, increase the radius of what curves are necessary, and purchase right of way through the city, if possible, provided the electric road caters to the long-haul suburban patronage. There are very few railway problems of such assured success as to warrant the very large initial capital investment demanded in such construction, and many electric roads have been able to create a traffic and place themselves on a dividend-paying basis, largely owing to what may be termed the mental inertia of the steam railroad management. That such a period has passed is being evidenced by the large contracts placed by the steam roads for the electrical equipment and extension of their suburban systems. It is not to be expected that the steam roads will continue to ignore the lucrative business of which they can secure a large share, with their good roadbed and terminal facilities, by the additional investment of a comparatively small capital. It will be necessary, therefore, for the electric suburban road to earnestly consider the high-speed possibilities of its line, and the open competition of the steam lines operated electrically will undoubtedly result in a considerable improvement in the straightening of the suburban electric roadbed, double-tracking it and eliminating superfluous and unnecessary stops. Many electric roads now operating could be put on a paying basis by the expenditure of a reasonable amount in bettering the roadbed and proportioning the maximum speed of the cars and the stops to the local requirements of the traffic.

A stop in high-speed railroading is an expensive luxury, and its results may be far reaching, both in the first cost and cost of operating an electric system. Although the initial success of electric roads depended upon the very frequent stops afforded, the scope of such lines has been so extended that stops and fare are the controlling factors, and frequent stops are not conducive to either high speed or low operating expense.

MILEAGE BOOKS FOR INTERURBANS

With the extension of interurban electric roads the necessity for mileage books has been felt, especially in Ohio, where the principal systems extend over a considerable area, and the people patronize these roads freely. In some parts a working agreement has been effected between the several lines, as in Columbus, where the interurban roads radiating from that city have been selling 500-mile books good on any of the roads. Heretofore, these mileage tickets have been put up in the form of books with perforated pages, thirty small tickets to each page. The tickets were so small and the method of handling them so inconvenient for conductors, especially when cars are crowded, that a new form of book has been adopted. The new books are practically the same as those used by steam roads. The mileage is in one strip, the conductor tearing off the required amount, thus keeping his portion all in one piece, which affords a record for the office, and shows the distance traveled.

FEEDER CONDUIT CONSTRUCTION IN BROOKLYN

The Brooklyn Rapid Transit Company has recently had installed by J. G. White & Company an extensive system of underground conduits for high-tension and low-tension feeders. There are from six to twenty-four ducts per line of conduit. Camp vitrified clay ducts are used, mostly of the single type, 3¼ ins. diameter, although part of the system was built of multiple duct, using from two-duct to six-duct sections. The ducts were laid in Portland cement mortar, with burlap joints, and the entire conduit was surrounded with about 4 ins. of Portland cement concrete.

The manholes are located about every 425 ft. of trench, and are of two standard sizes, viz., 4-ft. x 5-ft. x 6-ft. depth and 6-ft. x 7-ft. x 7-ft. depth. The manholes are oval in form, for convenience of handling cables, but of various dimensions to suit the space available. All manholes are covered by short sections of steel rails embedded in concrete filling, and the manhole castings are provided with single cover each.

The low-tension feeder taps, carried to the bridge or elevated structure, consist of single lengths of 3-in. wrought-iron pipe asphalted with a bend of 3-ft. radius, and are fastened to the pillars by wrought-iron clamps. Fig. 1 shows the method of bringing the terminal pipes from a manhole to the elevated railway structure. Fig. 2 illustrates the nesting of twenty pipes carried up a pillar of the new East River Bridge. The special clamps are composed of angle-irons, and spacing rods are between the pipes.

Many obstructions, such as underground pipes, boulders, etc., were encountered. Some of the latter were removed by drilling and feathering, some hoisted out bodily, while others, weighing as much as 15 tons, were lowered by carefully excavating underneath and sinking them out of the way. It was found in many cases that the cost of lowering the boulders was less than hoisting them out of the trench, as in such cases the pavement did not have to be removed to a width greater than the ordinary trench.

On one street the trench was excavated through a solid mass of boulders ranging from 1 ft. in diameter to 8 ft.; but this trench was put through expeditiously without changing the line.

On completion of the conduits the manholes and each duct were rodded and cleaned by drawing through special scrapers and brushes.

Fig. 3 shows a special three-part manhole built at one of the railway sub-stations especially to accommodate a forty-nine-duct line, and with special duct openings connecting all three manholes. This construction permits of a most convenient placing of the cables, although it was partly necessitated on account of an independent high-tension conduit line intersecting this location and the base of the elevated railroad pillar. Twenty-two feeder pipes were brought out of this three-part manhole and carried up the elevated railway column. The construction at this point was particularly difficult on account of obstructions encountered, including large boulders, independent conduit lines, and the footing of the elevated railway column, which required protection.

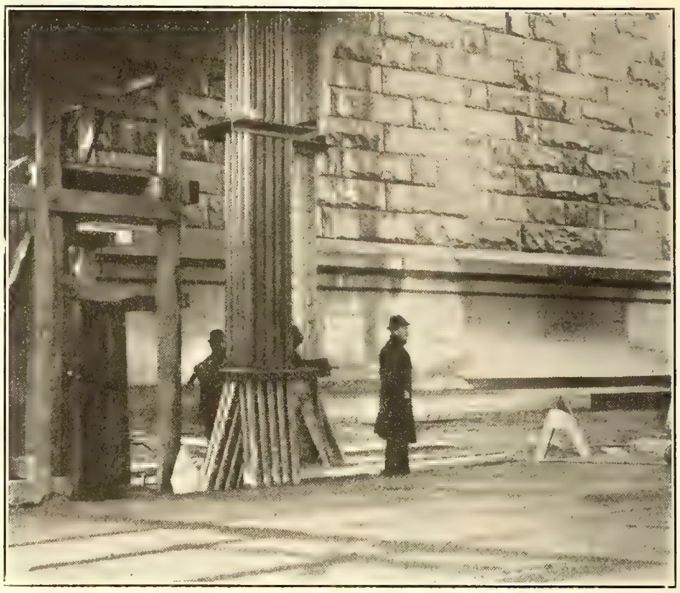


FIG. 2.—TWENTY OUTLET PIPES, RUNNING FROM MANHOLE UP PILLAR OF APPROACH TO NEW EAST RIVER BRIDGE

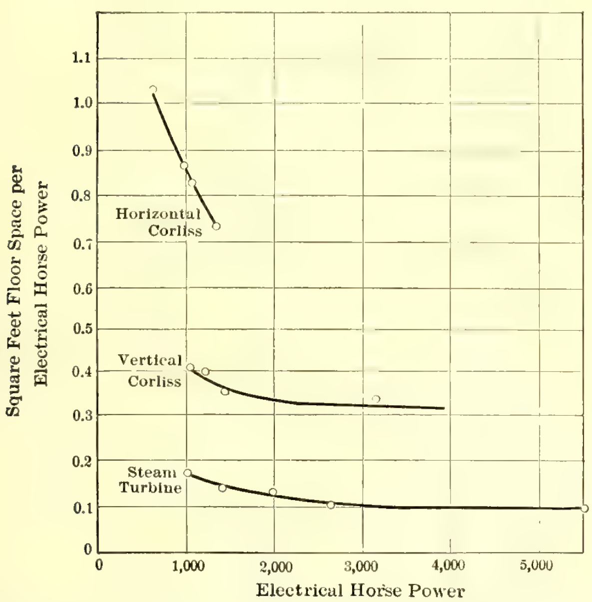
FIG. 1.—OUTLET PIPES, SHOWING METHOD OF ATTACHMENT TO PILLAR

FIG. 3.—TRIPLE MANHOLE FOR DISTRIBUTION OF FORTY-NINE-DUCT LINE AT SUB-STATION

5000-KW WESTINGHOUSE-PARSONS TURBO UNITS

As previously announced in this paper a number of orders have been placed with the Westinghouse Machine Company for 5000 kw units. Among the companies which will use this size of machine are the Pennsylvania Railroad, the Philadelphia Rapid Transit Company, and the Underground Electric Railways Company, Ltd., of London. The work on these machines is now so far completed that detailed particulars of them are available.

The space occupied by the 7500-hp turbine is approximately 27



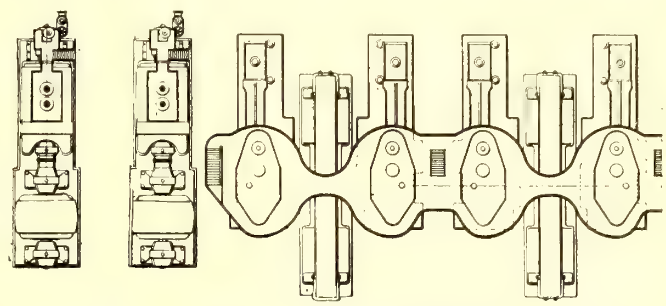
COMPARATIVE FLOOR SPACE OCCUPIED BY 5000-KW TURBINES, VERTICAL AND HORIZONTAL ENGINES

ft. 8 ins. x 13 ft. 3 ins., and the height to the top of the hand railing is 12 ft. This is equivalent to .049 sq. ft. per electric horse-power capacity, or 20.2 hp per square foot of floor area required. For the complete unit a rectangular area of 47 ft. 4 ins. in length and 13 ft. in width is required, which is equivalent to .084 sq. ft. per ehp capacity, or 12 ehp per square foot of floor space. This point of relative economy of space is well illustrated in the cut, which represents the comparative areas occupied by the 5000-kw Manhattan Railway engine-type units and the 5000-kw Westinghouse-Parsons turbine units.

The speeds for the several sizes of turbines manufactured are: For the 5000-kw, 750 r. p. m.; for the 2000-kw unit, 1200 to 1560 r. p. m., and for the 1000-kw unit, 1500 to 1800 r. p. m., depending upon the frequency desired.

The unit rests upon a single bed-plate in two sections, which are secured by shrunk links. To the bed-plate, which is heavily ribbed to secure rigidity, are bolted the pedestals, generator casing and turbine body, but the bed-plate itself is not secured to the foundation by other means than the weight of the unit. Steam and exhaust connections are made beneath the floor level.

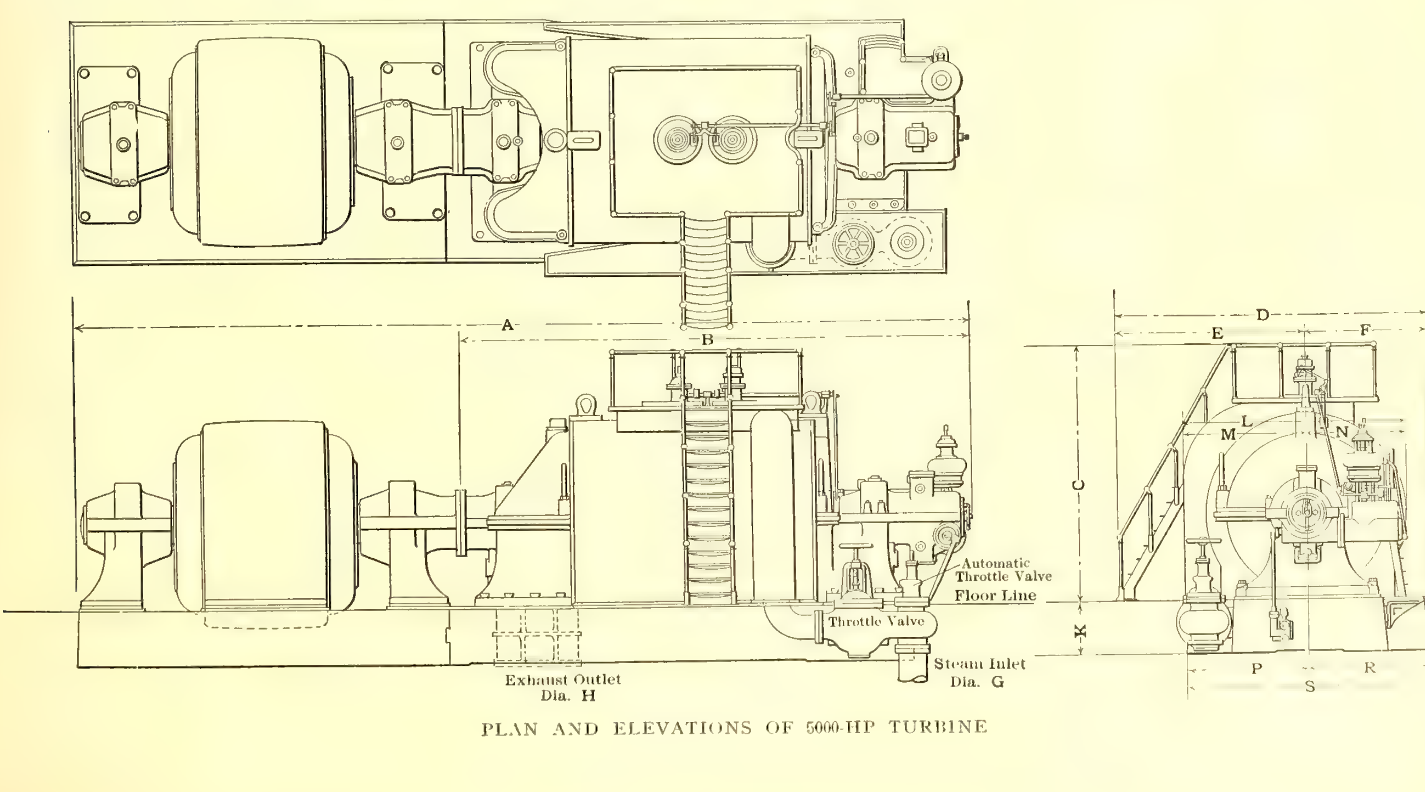
In the smaller machines of this type the cylinder barrel and both journals are cast in a single casting, thus largely minimizing machine work. In the large machine, however, the barrel is cast in two sections, united by links, the outboard



COMPARATIVE SIZES OF TWO TURBINES AND TWO RECIPROCATING ENGINES

section carrying the journal and worm casing, and the inboard section, the journal and exhaust opening, which extends through the bed-plate. As in former types linear expansion and contraction of the turbine are provided for by a sliding foot. The inboard journal pedestal is bolted securely to the bed-plate, but the outboard pedestal is free to slide between parallel machined ways. The main body of the casing is heavily lagged with non-conducting material, secured in place by sheet-steel casings. Leakage of air from the atmosphere into the exhaust spaces of the casing at the entrances of the shaft is prevented by frictionless packing glands.

In shaft construction great rigidity has been secured with minimum use of metal. A central steel quill carries the entire rotating parts, both blades and balance pistons. Hollow forged

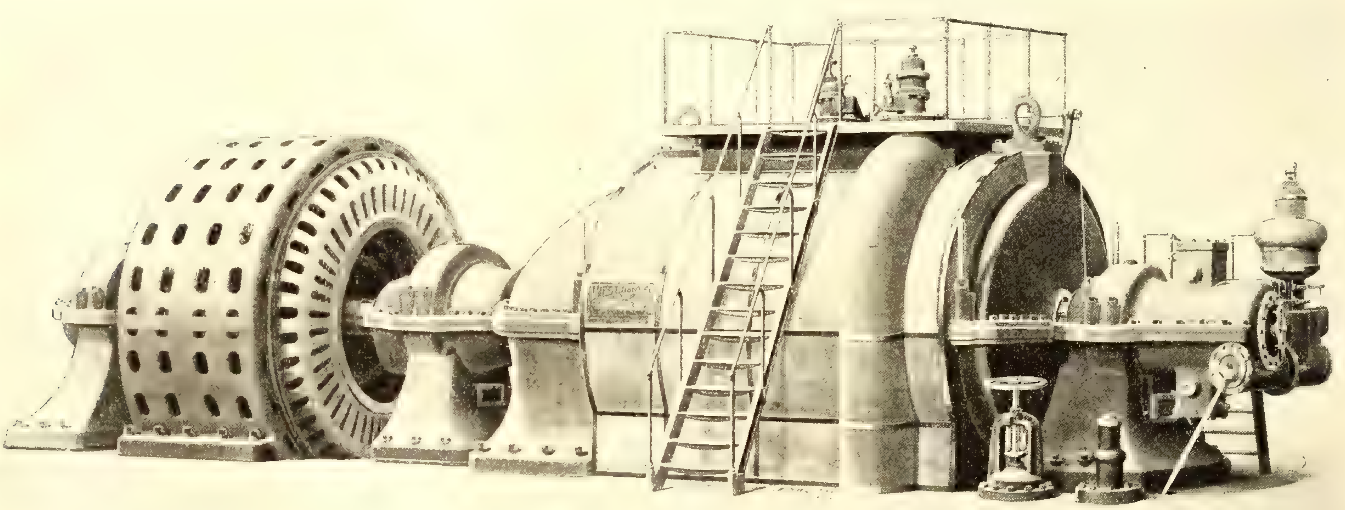


PLAN AND ELEVATIONS OF 5000-HP TURBINE

steel ends are forced into the two ends of this quill, under hydraulic pressure, and are in addition secured by arrow-head links. High-pressure steam is conveyed to all parts of this quill structure in such a manner as to eliminate stresses and consequent distortion, due to highly superheated steam.

Power is transmitted to the generator shaft through a flexible coupling, which is housed partly by the turbine and partly by the generator inboard journal. The coupling is split at the junction of the two shafts, so that by removing one bearing cap and the coupling bolts, either section of the unit may be lifted out without disturbing the adjustment of the remaining section. In the smaller sizes, the engagement surfaces of the coupling consist of the squared or hexagonal ends of the shafts, but in the larger machines a crow-foot sleeve is keyed to each shaft, and the power is transmitted by an outside quill engaging the crows-feet.

The journals in the larger machines are of the solid self-aligning type, similar to that employed in generators and cross-compound engines. The departure from the familiar oil-cushioned journal employed in the small machines is occasioned by the speed reduction secured. The journal shells are babbitt



5000-HP STEAM TURBINE

lined, and are split horizontally, the two halves being united by bolts with shim adjustment. Oil from a central system is introduced at the center under slight pressure, thoroughly flushing all parts. Axial adjustment is provided by metal shims arranged in quarter-box fashion. The diameter of the shaft at the journal of a 5000-kw machine is 15 ins., strikingly small in comparison to the 34-in. shafts required for a cross-compound reciprocating engine of corresponding capacity.

Longitudinal adjustment to preserve proper side clearance is secured by a thrust bearing, located next to the outboard bearing. The bearing is not subjected to longitudinal thrusts from the action of the steam, and is, consequently, of small size.

The two half shells are advanced in opposite directions by graduated set screws, so that the actual running clearances are measured in thousandths of an inch. Once set, these adjustments are permanent, and do not require frequent "taking up."

Steam enters the turbine successively through an automatic quick-closing throttle, hand-throttle, strainer and the main admission valve. A circular port surrounding the entrance to the initial stage conveys this steam to all points, so as to avoid stresses incident to more localized admission of highly superheated steam.

An important feature of the steam distribution system is the provision of a by-pass valve. This valve admits high-pressure steam to the second stage of the turbine on overloads, in order to increase its capacity up to 50 per cent in excess of full-rated load. By properly proportioning the by-pass steam to the overload on the turbine, maximum economy may at all times be secured, together with reserve overload capacity. This results in a slight rise in the economy curve on heavy overloads, resesembling, in some respects, the engine economy curve on loads exceeding that of maximum economy. The turbine, however, only suffers in economy at heavy overloads, while the engine economy decreases progressively from 75 per cent to 80 per cent for full-load capacity.

The main admission valve consists of a double-beat poppet valve operated by a small piston, this in turn being controlled by a small pilot-valve directly actuated by the governor mechanism. The valve admits steam to the turbine in puffs, the duration of which are proportioned by the governor to the load upon the turbine. This intermittent method obviates the throttling of steam to accommodate loading and secures the highest economy by using at all loads steam at boiler pressure.

At the extreme outer end of the turbine shaft is mounted a worm driving a short horizontal cross shaft. This shaft drives at one end the oil pump and at the other the governor through bevel gearing. An eccentric provides the reciprocating motion necessary for the valve mechanism.

The governor is of the fly-ball type, with 90-deg. bell crank ball levers mounted on knife edges and fitted with roller contacts. The governor sleeve and spring is mounted on ball bearings, and adjustment of the spring tension may be made while the turbine is running, thus affording a most simple and convenient means for paralleling alternating-current generators and dividing the load proportionately between them.

At the extreme end of the outboard pedestal is mounted an auxiliary speed-limit governor. It is likewise of the centrifugal type and may be set to release, at any predetermined speed, a small plunger valve which controls, with high-pressure steam, the operation of the quick-closing throttle before mentioned. This is normally held open by means of an over-balanced differential piston. At the moment the speed limit operates, the excess pressure is removed and the throttle closes. This device is employed purely for insuring absolute immunity from accident from excess speeds, due to the possible disablement of the governor mechanism.

Copious lubrication is supplied to all journals by means of a plunger pump driven from the worm shaft. The warm oil returning from the bearings passes through a copper coil cooler

in the bed-plate and thence to a reservoir from which the pump draws its supply. The cooled lubricant is circulated at slight pressure, sufficient to ensure positive flow. At no point is oil under high pressure employed for preventing erosion of rubbing parts, bearing areas being sufficient for supporting the weight of the rotating parts.

GENERATORS

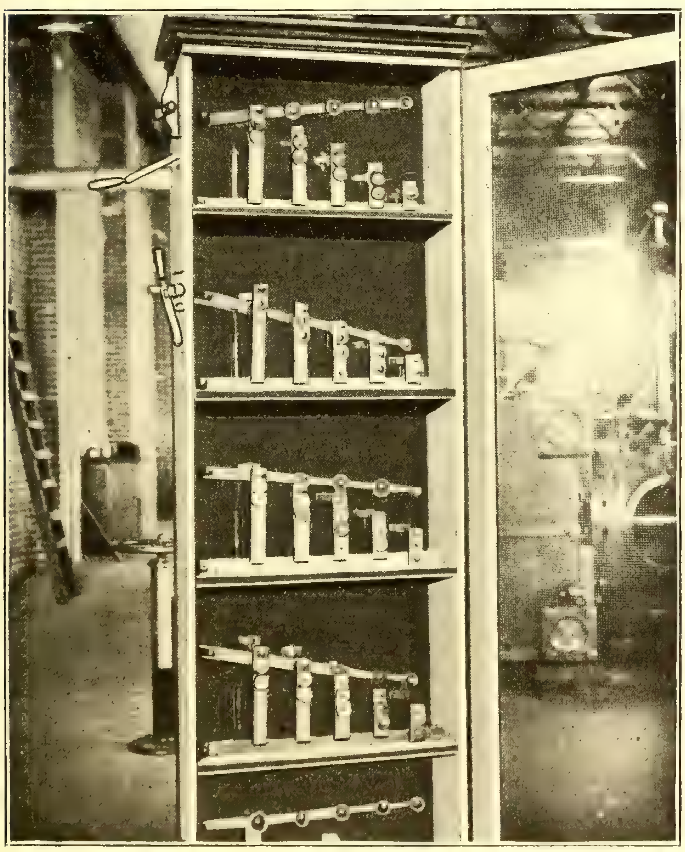
In general construction the 5000-kw turbo-generators conform to those now building for smaller machines. The field or revolving element is built from a solid cylinder of steel, slotted for the reception of the bar windings, and provided with ventilating openings corresponding with openings in the laminations of the stationary element. The generators may be wound for high voltage, if desired, in order to avoid the use of step-up transformers in a system of power transmission at voltages ranging up to 15,000.

HOME-MADE LIGHTNING ARRESTER

COLORADO SPRINGS AND INTERURBAN RAILWAY COMPANY
Colorado Springs, Col., Dec. 10, 1903.

EDITORS STREET RAILWAY JOURNAL:

The accompanying illustration shows a type of lightning arrester that is doing good service for us here at Colorado Springs. The old street car men will recognize it, as it was used on a great many of the first Sprague roads, but a few changes have been made in the arrangement of fuses. The original arrester consisted of four fuses, which caused a great deal of trouble, as one discharge of lightning would often blow all four fuses, owing to the contact arm dropping from one fuse to the other so quickly that the fumes and gases from the



OLD TYPE OF LIGHTNING ARRESTER MODIFIED

copper fuse would short-circuit the next carbon on the step-down of the contact arm.

To overcome this difficulty we have placed on the contact arm a dash-pot working in oil, which, upon the discharge of lightning and the blowing of the fuse, allows the contact arm to drop slowly, using a period of about fifteen seconds before coming in contact with the second fuse, thus doing away with the trouble of blowing all four fuses upon one discharge. We find that frequently after lightning storms all fuses in these arresters have been blown.

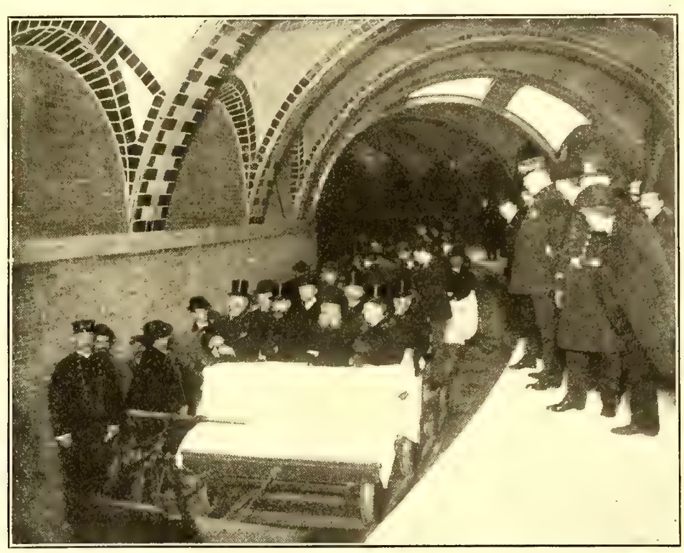
We have, all told, about twenty-six arresters of this type on the line and at places such as the power house and machine shops, where these arresters can be observed, we have never had but one fuse blow at one time on discharge of lightning.

We also use about six Garton arresters to the mile, and all cars are equipped with General Electric type M. D. arresters.

The illustration shows a bank of five of these arresters that has been used at the power house. On the line only single boxes are used. D. L. MACAFFREE, General Manager.

THROUGH THE NEW YORK SUBWAY ON HAND-CARS

Mayor George B. McClellan, of New York, and a party of city officials and invited guests of the Rapid Transit Subway Construction Company made a trip on hand-cars in the New York subway from City Hall up to Manhattan Valley, a distance of more than 6 miles, on the afternoon of Jan. 1. The party met at the City Hall, and started from the loop station at that place at 2 o'clock. Six cars were used, all of which were worked by Italian laborers. Among those who made up the party were Mayor McClellan, John B. McDonald, Comp-



NEW YEAR'S INSPECTION PARTY STARTING FROM CITY HALL STATION FOR TRIP THROUGH SUBWAY

troller Grout, Rapid Transit Commissioner Alexander E. Orr, Vice-President Walter B. Oakman, of the Rapid Transit Construction Company; William Barclay Parsons, President Frederick Underwood, of the Erie Railroad; Chief Engineer S. L. F. Deyo, of the construction company; Andrew Freedman, Alfred Skitt.

Contractor McDonald worked out the details of the trip very thoroughly. Practically the entire route was lighted as it will be when the tunnel is ready for regular passenger service, and at the places where the lights are not yet installed he had stationed a number of Italian laborers with lanterns. The cars were finally run out to the elevated station over Manhattan Street, opposite 129th Street. The framework of this stopping place is up, but no platforms have been laid and the offices and waiting rooms are there only in skeleton. Mr. McDonald ordered a halt here, and the cars were turned back. At 122d Street the passengers alighted and got into 'buses, in which they crossed to Claremont for luncheon. Here toasts were offered by members of the party. Mayor McClellan personally thanked Mr. McDonald for a very pleasant afternoon, for the opportunity of seeing a great work which is now so nearly completed, and in the name of the city wished Mr. McDonald all health, prosperity and happiness, and expressed the hope that as time rolls on the debt which the city owes to Mr. McDonald will ever increase.

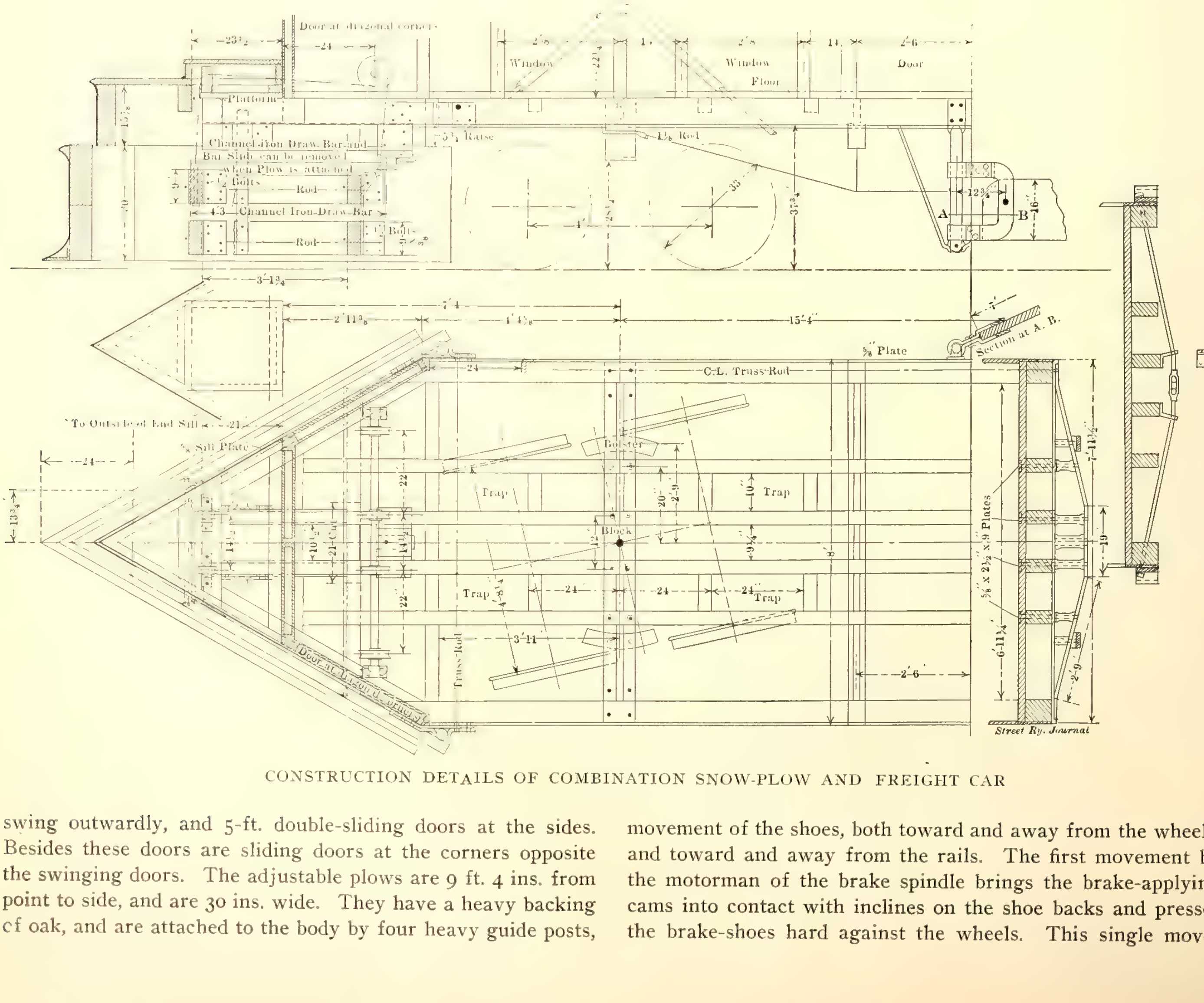
COMBINATION SNOW-PLOW AND FREIGHT CAR

The J. G. Brill Company has delivered the heavy type combination double-end nose snow-plow and freight car, shown in the illustration, to the Olean Street Railway Company, of Olean, N. Y. The car without motors weighs about 25,000 lbs., and is probably the heaviest snow-fighting machine ever put on an electric railway. The builders have furnished combinations of snow-plows and freight cars to several roads, but this is said to be the first car of the kind to have a completely enclosed body. The plow is intended for use on the recently-constructed 5-mile extension to Shingle House, Pa., which is over private right of way, and the nature of the ground tends to render the lines liable to deep snow drifts.

COMBINATION SNOW-PLOW AND FREIGHT CAR

The plows, shear boards and wings are readily removable and the car made ready for freight and locomotive service. To enable long pieces of freight to be handled advantageously, 38-in. doors are provided at diagonally opposite corners, which swing outwardly, and 5-ft. double-sliding doors at the sides. Besides these doors are sliding doors at the corners opposite the swinging doors. The adjustable plows are 9 ft. 4 ins. from point to side, and are 30 ins. wide. They have a heavy backing of oak, and are attached to the body by four heavy guide posts, upon which they are raised vertically by means of stout chains passing over sheaves upon shafts, which are revolved by large horizontal hand wheels geared to the shafts. When the plows are removed, heavy channel-iron draw-bars are installed with bar slides.

The body framing is unusually strong, as reference to the diagram will show. The side sills are 5¾-in. x 7⅞-in. long-leaf yellow pine, plated on the outside with 7-in. x ⅝-in. steel. Tie-rods extend across the car and through the guide plates at the corners to give extra strength at these points. The center and intermediate sills are 3½ ins. x 7⅝ ins., and the end sills 3½ ins. x 7 ins. Besides under truss rods, short upper truss rods are introduced, as shown in the diagram. The wings or levellers are attached to the body by heavy center posts at center of car, securely braced, and are raised vertically instead of at an angle, as in the old style, so that obstacles close to the track may be avoided. These levellers are 7 ft. long. The length of the car over body is 30 ft., and the width over sheathing 8 ft. The car is equipped with sand-boxes, bumpers, draw-bars and roof gongs of the builder's make.

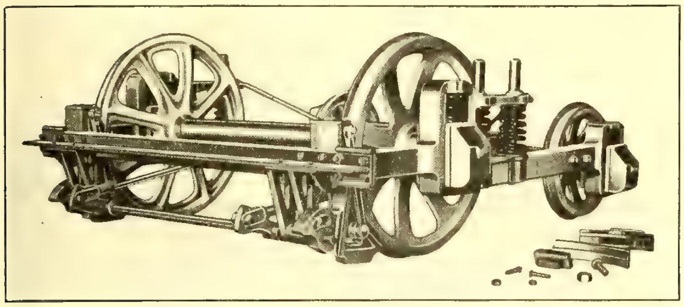


CONSTRUCTION DETAILS OF COMBINATION SNOW-PLOW AND FREIGHT CAR

COMBINED WHEEL AND RAIL-BRAKE

The accompanying illustration shows a new combined wheel and rail brake, as applied to a Brill "Eureka" maximum traction truck. The brake has been placed on the market by John W. Fowler, of Brooklyn, N. Y. The brake-shoes are normally supported by spiral springs, in such a way as to permit the free movement of the shoes, both toward and away from the wheels, and toward and away from the rails. The first movement by the motorman of the brake spindle brings the brake-applying cams into contact with inclines on the shoe backs and presses the brake-shoes hard against the wheels. This single move-

ment will stop a car under ordinary conditions. If, by reason of slippery rails, this initial pressure is not sufficient to overcome the momentum, stop the car and prevent skidding on the rails, or to control the car on a grade, an extra pressure on the brake spindle by the motorman will force the rail-brake at the bottom of shoes into contact with the rails (the wheel-brake still retaining its hold on the wheels), and will bring the car under control. In case of an emergency the wheel-brake and



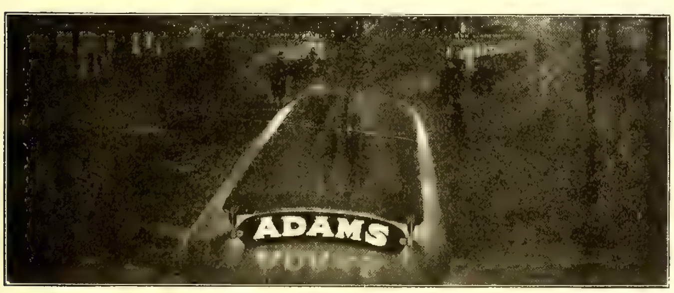
COMBINED WHEEL AND RAIL-BRAKE

the rail-brake can be brought into contact with the wheels and rail immediately. No alterations to standard truck frame are required in adopting this brake. It is only necessary to remove the ordinary brake and attach the new one to operate on the two large wheels.

The wearing parts are easily replaced. The shoe is constructed in sections (shown at right of cut), with chilled face, soft cast-iron or cast-steel shoes, as may be desired.

VISIBLE CAR SIGNS

A frequent source of annoyance to the public is that caused by motormen who fail to stop their cars if hailed within too short a distance. This often occurs on streets over which more than one line is operated, as many people hestitate to signal a car until they are sure that it is the right one. If the car signs are illegible within reasonable stopping distance dissatisfaction with the railway is sure to result. The rapidly-growing custom of street railways to paint their cars a uniform color has



ILLUMINATED CAR SIGN

also emphasized the demand for a more effective car sign than has heretofore been considered necessary.

To meet this need for a car sign that can be read day and night at a considerable distance, the W. R. Garton Company, of Chicago, is making a specialty of the "Visible" car and sub-signs, two types of which are shown in the accompanying illustrations.

These car signs are of the single type. They are made of clear white poplar, the letters being cut out through the wood in a standard bold design. The ends are reinforced with malleable iron straps, forming the hanger catches. Intermediately the boards are braced and prevented from warping by steel straps. The letters are covered with a transparent backing, allowing the light to pass through without glare and showing the lettering plainly at from 200 yds. to 300 yds., corresponding to about two blocks. The signs are thoroughly painted with pure white lead and linseed oil paint, with a black face, showing, day and night, a white letter on a black ground. The hangers on the cars, by which the signs are held, are properly pitched for bolting to the transom roof.

All the signs for a system are made to one standard size, hence any sign may be employed on any car, requiring less than a minute to make the entire change. To attach the sign to the car it is merely dropped into the hangers. To remove, it is

INTERCHANGEABLE SUB-SIGN

simply lifted out. No fastening device of any sort is employed other than the special shape of the hanger and catch, which does not interfere with their ready placing or removal, but prevents rattling or dislodgement. The signs being strongly made, with nothing fragile in their construction, will stand a great deal of handling and wear indefinitely. They may be washed or repainted as easily as the car itself.

The advantages claimed over signs of the roll, box or curtain types, include: a much smaller number of signs required and no mechanism to constantly give trouble; flexibility when new routes are added or old ones changed; require but one-half to one-fifth of the time to change the route; greatly reduce the possibility of running the route with the wrong sign set, and at all times show a strong, bold letter, not possible with the other types. Additionally, in signs in which glass in any form is employed, the item of breakage is a serious one in the operating expense.

Economy and effectiveness in operation are secured through the illumination being entirely furnished from the ordinary interior lighting of the cars. These lights shine through the end and side transom sash, and thence through the sign letters, producing an even diffusion and illumination at no extra expense.

In some cities municipal regulations require the showing of a colored light for different routes. This is provided for in the sign itself by a bulls-eye of glass or translucent material.

Interchangeable sub-signs are also used in addition for indicating special routes and terminals, such as "Through," "Depot," "Parks," etc. These are made of malleable iron, transparently backed, and are readable with facility at about one block distance.

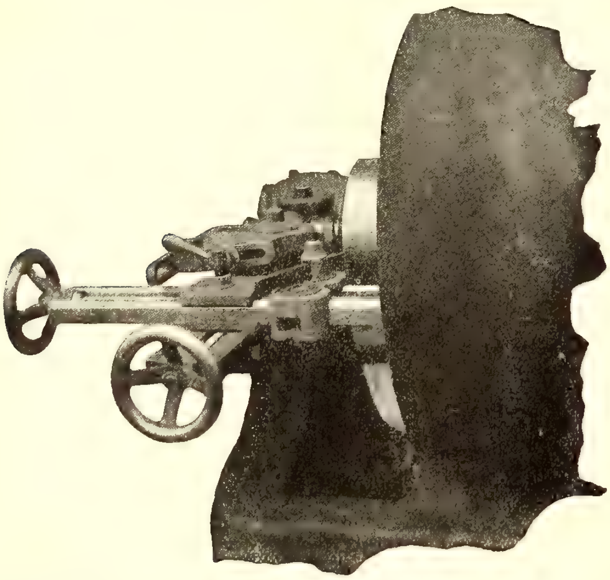
COMMUTATOR TRUING DEVICE

To meet the constantly growing demand for a reliable tool for truing up the commutator of a generator without removing the armature from its bearing, the Akron Electrical Manufacturing Company brought out some time ago the Carr Commutator truing device. This tool is directly attachable to any machine having a removable bearing cap, and it is claimed that it will do work that will compare favorably with that done in a lathe, with the great additional advantage that the armature need not be removed from the machine. The work is done while the shaft is running in its bearings, and, consequently, the face of the commutator runs absolutely true.

In the design of this tool the utmost care has been taken to so distribute the metal as to obtain the utmost rigidity, the stiffest possible sections being employed throughout, with the

result that the fault so common in other devices of this character—namely, lack of rigidity and consequent chattering and gouging in of the tool—has been entirely obviated. So far has this difficulty been overcome, that when the commutator is dressed off, a slight application of No. 00 sandpaper will give a perfectly finished commutator.

As shown in the accompanying illustration a T-shaped clamp is bolted to the machine in place of the bearing cap, set screws



COMMUTATOR TRUING DEVICE ATTACHED TO GENERATOR

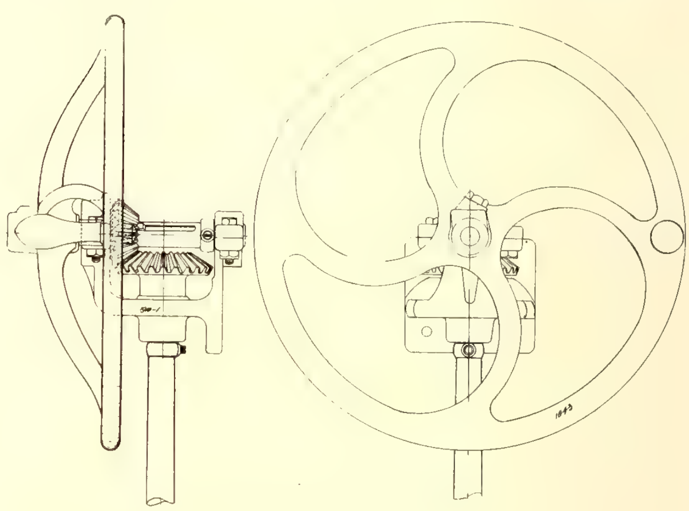
being provided in its lower end to rest against the pedestal and steady the tool. On this piece the tool bar is clamped by means of an ingenious saddle, which allows the bar to move both perpendicular and parallel to the face of the commutator and instantly clamps the two pieces by drawing a lever nut. The bar carries a slide, which in turn carries the tool post; this slide is driven relative to the bar by means of a screw and hand wheel, thus giving the feed. The tool bar is also easily adjusted to any width of commutator up to 12 ins. in this company's type A and to 18 ins. in type B, this adjustment being accomplished by slacking the lever nut and sliding the bar in or out the necessary distance parallel to the commutator. The bar may also be reversed by slacking the lever nut and removing the top half of the saddle. This, with the double tool post socket, makes it possible to use the device on either side of the machine, depending on the more convenient direction of commutator rotation. The adjustment of the tool at right angles to the face of the commutator is also accomplished by hand wheel and screw operation on the saddle, it being first necessary to slacken the lever nut slightly. In operating the device this nut should always be drawn tight, but when it is desired to face the end or leads of a commutator, this nut may be slackened enough to allow the requisite movement. At the extreme outer end of the tool bar a threaded rod is screwed in, and intended to be screwed down to a solid support, acting as a jack to steady the tool at the extreme limit of its cut. A center is attached to the device by means of adjustable brackets, to prevent end motion in the commutator while being turned.

The tool is adjusted to the desired cut by means of the cross-feed. This cut should invariably be light, several light cuts being taken in preference to one heavy one. The feed should also be slow, as a smoother job is thus obtained. For the best work a commutator speed of from 200 ft. to 250 ft. per minute is recommended, and in case of large machines this can generally be obtained by slowing the source of power, and also often with small sizes. A crank for attachment to the pulley is provided, so the machine can be operated by hand if necessary, but it is desirable to use the power drive owing to its more uniform speed.

This device is built in two sizes: Type A, operative on commutators up to and including 20 ins. in diameter and 12-in. face; type B, adapted to commutators up to and including 48 ins. in diameter and 18-in. face. However, the design of the generator enters largely into the range of the tool, and in some cases it will be considerably in excess of the above figures.

VERTICAL BRAKE HAND WHEEL

A vertical hand wheel for hand brakes, bevel geared to the regular brake staff, is one of the regular features of the vestibule cars supplied by the St. Louis Car Company, unless otherwise specified. This hand wheel is of such shape that it takes up very little room in the vestibule, and the handle extends no farther than the hub of the wheel, owing to a dish in the latter. Of course, on heavy cars where air brakes are used, the hand brake is only used in an emergency, and for this reason it is



VERTICAL BRAKE HAND-WHEEL

especially desirable that it should not permanently take up much space on the platform. In this case, there is no sacrifice of efficiency by adopting a form of brake occupying but little room, because the vertical wheel brake is practically as easy to operate as the ordinary horizontal brake staff used on open cars. Indeed, in some respects, it is more effective in action than the ordinary brake handle. It can be rapidly revolved to take up brake slack, and after the slack is taken up, the motorman can pull up on the rim of the wheel next to him and get a very effective purchase, as he has only to brace against the floor without altering his usual position. There is also less likelihood of passengers or motormen being injured with a flying brake handle where this type is used in place of the horizontal style.

COMPETITION BETWEEN STEAM AND ELECTRIC LINES IN OHIO

The Cincinnati, Hamilton & Dayton Railway (steam) has started a rate war against the Western Ohio Railway, the Dayton & Troy Electric Railway, and the Cincinnati, Dayton & Toledo Traction Company, which parallel its line between Lima and Cincinnati, Ohio. The steam railroad has cut its round-trip rates to all of the towns in this district, and is also selling round-trip tickets, good for two persons, going one way. The electric railways more than held their own during the recent holiday excursion business, despite the fact that in some cases the steam rates were lower.

NEW CARS FOR THE EAST ST. LOUIS & SUBURBAN RAILWAY

The East St. Louis & Suburban Railway Company has lately received from the American Car Company, St. Louis, six fine cars, which have some interesting features. The platforms have an entrance from one side only, and the steel dashers are brought around to the corner posts. Substantial portable vestibules enclose the platforms except at the entrances, and gates hinged to the car bodies close the entrances. The platform steps are 17⅝ ins. from the rail heads, and from step to platform is 14 ins. The platforms are 4 ft. 6 ins. from the end panel over the crown pieces. The seats are upholstered in spring cane, and are placed longitudinally. The interiors are finished in cherry with ceilings of birch. Besides electroliers at intervals along the center of the monitor deck, single lights are placed along the upper window rails. The upper window sashes are stationary, and the lower arranged to drop into pockets, which are covered with flaps. The length of the cars over the end panels is 26 ft., and over the crown pieces, 35 ft.; width over sills, 7 ft. 9 ins., and over the posts at belt, 8 ft. 2½ ins.; from center to center of posts, 2 ft. 9 ins. The side posts are 2¼ ins. thick, and the corner posts 3¾ ins.; sweep of posts, 2½ ins.; size of side sill, 4¾ ins. x 7 ins.; end sills, 3¾ ins. x 7 ins. The cars are equipped with brake handles, folding gates, sand-boxes, alarm gongs, angle-iron bumpers and other specialties of Brill manufacture. The cars are mounted on Brill 27-G trucks, having 4-ft. wheel base, 33-in. wheels, and equipped with 38-hp motors.


ONE OF THE NEW CARS FOR THE EAST ST. LOUIS & SUBURBAN RAILWAY


INTERIOR OF EAST ST. LOUIS & SUBURBAN RAILWAY CAR

CREOSOTED TIMBER

In the STREET RAILWAY JOURNAL of May 30, 1903, an abstract was published of a paper by Dr. Herman von Schrenk on "The Use of Timber by Railroads and Its Relation to Forestry." After citing numerous foreign experiments in timber preservation, he concluded that short-lived, porous timber well repaid the cost of proper preservative treatment, and that creosoting usually gave the best results.

It is interesting to note in connection with this well-known government expert's opinion of creosoting, that that method has been for a long time extensively applied by the Wyckoff Pipe & Creosoting Company, Inc., whose offices are at Stamford, Conn., and works at Portsmouth, Va. This company has been creosoting timber since 1881, and as many of its installations have been in successful use for fifteen years to twenty years, it has had every opportunity to study and apply the best methods for each kind of timber as used for wire and cable conduits, poles, cross-arms, railroad ties, wharf and bridge timbers, etc. Among the company's important customers are the Bell Telephone Companies, who purchase from it millions of feet of conduit every year. Only recently several carloads of creosoted timber were shipped to one of the largest railroad systems in the United States.

The method applied by this company in preserving wood is to first subject the timber to superheated system to draw out the sap, after which creosote is forced into the wood under high pressure. This method has proven so satisfactory that the company is prepared to guarantee that its creosoted timber will never rot. It should be noted that as creosoted timber is an excellent insulator it is doubly valuable on third-rail systems and other electrical installations.

Several weeks ago the company received a number of pieces of conduit from the Bell Telephone Company, of Philadelphia, with the statement that it was obliged to take up some of the Wyckoff conduit, laid fifteen years ago, on account of the subway now being built by the Philadelphia Rapid Transit Company. The Bell Company wrote that every piece was found to be in a perfect state of preservation, and that even the small tenons were as sound as the day they were laid. The United States Department of Agriculture has asked for a piece of this conduit, to be placed on exhibition in Washington, and has also made a request for two pieces to be sent to St. Louis.

A UNIQUE CAR HOUSE AND SHOP

The Columbus, Delaware & Marion Railway Company has completed a unique car house and shop at Stratford. The building has been erected as an addition to the power house at that point, and is constructed of blue sandstone, which was quarried on the company's own property. The building has nine tracks, each with a capacity of two cars. The first and second tracks are for repair work and contain pits. The third track is the paint track, while the remaining tracks are used for storage. In the rear, on the left, is the machine shop, and on the right, the carpenter shop. The second floor is utilized for the store room and the electrical repair department. A crane has been arranged to lift motors, armatures and other heavy parts from the first floor below, and convey them to any point in the electrical repair room. The equipment of the shop is the same as was used in the old shop, which was described in the article on the Columbus, Delaware & Marion Railway in the STREET RAILWAY JOURNAL last year.

FINANCIAL INTELLIGENCE

WALL STREET, Jan. 6, 1904.

The Money Market

The three principal features in the money market during the last fortnight have been a heavy expansion in bank loans, a recovery in foreign exchange and continued arrivals of currency from the interior. The bank loan increase, amounting to $30,000,000, is explained principally by the shifting of loans from the trust companies to the banks, consequent upon the desire of the former to strengthen their position as far as is possible at the end of the year. A further cause is the large investment in exchange drafts by local bankers, which means essentially that we are lending Europe a part of the sums due to American merchants in the foreign trade. Purchases of these drafts on a large scale account in large measure also for the rise in sterling rates. It still seems doubtful, however, whether exchange has recovered sufficiently to shut off gold imports, and at this writing there are reports that more of the precious metal has been engaged in London for shipment to this country. In spite of a decline of nearly $5,000,000 during the last two weeks in the surplus reserve, the banking condition is considerably stronger than the average for this period in former years. This fact is reflected in the comparatively low rates for money which have prevailed in face of the usual extremely large requirements at the outset of the new year. In the first week of January, a year ago, call money on the Stock Exchange averaged somewhat above 11 per cent, while 15 per cent was occasionally reached. During the past week the highest figure touched was 9 per cent, and the great bulk of the loans made were at 6 per cent and under. Time money, which commanded 6 per cent last year, is now ruling at from 5 to 5½, and mercantile discounts are accepted on a correspondingly lower basis. Altogether, the new year starts with a pleasing prospect of an easy money market for some time to come. Leaving aside the possibility of additional gold importations, the movement of domestic currency inward from the interior promises to continue in volume sufficient to add heavily to local resources during the next six weeks. The treasury will have its usual large disbursements to make in the course of this month, for pensions and other extraordinary purposes, and a steady credit is thereby assured the banks from this quarter. One single possibility to interfere with this satisfactory outlook, is, that the railroads and industrial corporations, which have new capital to raise, may feel that the time has arrived to make applications at the loan counter. These corporate borrowings, it will be remembered, bore very severely upon surplus bank resources, both in 1901 and 1902, and the suggestion that they may be repeated now cannot but be viewed with some uneasiness. On the other hand, it may be said that demands for ordinarily speculative purposes are comparatively light, and that less money is required in general trade than in any of the previous seasons.

The Stock Market

There have been few features in the general stock market of the last two weeks. Trading has been active enough, considering the holidays, but it has been confined entirely to professional operators, who have manipulated the market to suit themselves. Speculative operations, on the whole, have favored the side of rising prices first, because outside conditions are generally favorable, and second, because the course of events on the Stock Exchange itself has shown that there is very little desire among real holders of stocks to sell. The most important influence working against the market has been the fear of hostilities between Russia and Japan, which has depressed financial sentiment abroad, and caused some rather heavy selling for foreign account on this side of the water. With the exception of the war possibilities, outside developments have been generally encouraging to owners of securities. The steady tendency toward relaxation in the money market, and the exceedingly favorable position of foreign exchange have been related already. Railroad earnings, except in the case of the anthracite coal roads, have held up extremely well, and in many cases are, in fact, showing a larger proportion of net earnings increases than they were a year, or two years ago. What between easy money and heavy earnings expansion it is hard to see how the feeling can be anything but optimistic so far as the Western railroad shares are concerned, and this, indeed, is the general view now taken on the Stock Exchange. In the industrial shares, and in some of the railroads, where traffic receipts are falling behind, there may be room for more misgivings. Yesterday's very poor showing of the Steel Corporation illustrates the vicissitudes which holders of industrial companies' shares must expect. But for the market as a whole, the present position is distinctly sound, and while there may be no good reason to expect much advance in prices, there is even less ground to look for much of a decline.

The publication yesterday of the Brooklyn Rapid Transit earnings, showing a heavy increase for the half year, brings out one reason, at least, for the recent advance in the stock. Professional opinion otherwise is rather mixed as to the speculative position in the stock. One set of observers think they see evidence of quiet unloading by the "political pool," which took such an active part in the recent advance; another set insist that the stock is being firmly held by the larger interests, for higher prices. Manhattan Elevated and Metropolitan Street Railway shares have both shown considerable independent strength during the past fortnight. Earnings of the Manhattan for the December quarter are said, by people likely to know, to break all records.

Philadelphia

The principal movement in the recent dealings in the Philadelphia traction group has been the advance on heavy trading in the Philadelphia Company issues. The common moved up from 39 to 42; then, with the dividend off, sold from 41½ down to 40⅜. The preferred meanwhile, which for some time has kept inactive around 43, rose to 46. There is no explanation for this advance, except that the recent earnings of the company's properties have been favorable. It has looked simply as if a pool had been formed, taking advantage of general market conditions, to bid up the stock. Philadelphia Rapid Transit, a week ago, fell to 7¾—the lowest ever reached. Since then, however, it has recovered, selling yesterday at 8½, after going as high as 9. Union Traction has been steady between 45⅝ and 46, and Philadelphia Traction has also held firm between 97 and 97⅞. American Railways, on light transactions, rose from 43⅛ to 44½, and then reacted to 44. Philadelphia Electric advanced from 5¾ to 6 3-16, but later lost nearly all its gain. Purchase of a hundred shares of Consolidated Traction of New Jersey raised the stock from 64½ to 66½, but an odd lot sold afterwards at 65½. Union Traction of Indiana sold at 35; this completes the list of the two week's trading.

Chicago

Two stocks only have shown any semblance of activity in the Chicago market, during the period under review. These are South Side Elevated, which sold down from 95 to 94, and Lake Street Elevated receipts, which advanced from 1⅞ to 2¼. It is understood that the South Side management in issuing its $7,000,000 new stock, to pay for its extensions, will arrange to have the new shares paid for in three equal installments, running over, perhaps, two years. In that event the stock would not be issued until it had all been paid for, and the new lines built. No interference with present dividends would be necessary under this plan, because the new extensions would be earning a revenue before dividends would be called for on the new stock. The motive for the buying of Lake Street securities probably lies in the fact that the reorganization scheme has now become operative, and the worst that can happen is known. Other sales in the Chicago traction group comprise Union Traction common from 6 up to 7, then down to 6⅝ (the stock sold as high as 7⅝ in New York), Union Traction preferred from 27 to 30, City Railway from 166 to 162, Lake Street stock at 2, Metropolitan common at 17, and Metropolitan preferred at 52.

Other Traction Securities

Rumors of a dividend increase—which, however, are wholly unconfirmed—have been used as an excuse to bid up North American shares rather sharply, on the New York Stock Exchange. A professional speculative party announces privately that it is very bullish on the stock. The local curb dealings, so far as the traction specialties are concerned, hardly deserve much notice. Interborough Rapid Transit, which a fortnight ago sold as low as 90⅜, advanced to 93, and then dropped back to 92½. The only other trades recorded are a hundred shares of St. Louis Transit at 11¾, Washington Traction preferred at 46 and Chesapeake Traction 5s at 90½. In Boston the market has been extremely dull. Elevated shares ranged between 140 and 140¾. Massachusetts Electric common was bid up from 18 to 20¼, but transactions in the stock were

too small to be of any significance, and the quotation yielded subsequently to 19. Massachusetts Electric preferred sold at 75¾ and 76, West End common between 89 and 89½, and the preferred between 110 and 108. The regularly active Baltimore securities have varied but little. United Railways stock is a trifle lower at 8½. The income bonds have not gone above 56¾, nor below 56½, while the general mortgage 4s, after selling at 91⅝, weakened to 91¼. Other sales for the two weeks' period comprise Atlanta Consolidated Street Railway 5s at 105½, Anacostia & Potomac 5s at 90, Norfolk Street Railway 5s at 107¾, Newport News & Old Point Comfort 5s at 97¼, Central Street Railway 5s at 112¼ and Charleston Consolidated Street Railway 5s at 102.

There was practically nothing doing in tractions in the Ohio financial centers last week. At Cincinnati, the Cincinnati Street Railway stock advanced to 134 on sales of about 300 shares. A small lot of Detroit United sold at 69. A block of Miami & Erie canal bonds changed hands at 40, which is purely a gamble, as the company is in bad shape financially, and its future depends wholly upon the action of the Legislature in granting the canal company additional privileges. A block of Northern Ohio consolidated 5s sold at par, an advance over previous figures. At Columbus, Columbus Railway & Light common continued in demand, and several hundred shares sold from 33 to 34⅛, which is a high mark. The old Columbus Railway common sold at 85⅜, also an advance. At Cleveland, the only transaction during the week was a lot of Northern Ohio Traction & Light at 13¼, a slight decline.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with two weeks ago:

	Closing Bid	
	Dec. 21	Jan. 5
American Railways	43	43½
Aurora, Elgin & Chicago (preferred)	a55	a55
Boston Elevated	140	140
Brooklyn Rapid Transit	50⅞	49⅛
Chicago City	160	160
Chicago Union Traction (common)	5½	6½
Chicago Union Traction (preferred)	25½	28
Cleveland Electric	65½	65
Consolidated Traction of New Jersey	64	..
Consolidated Traction of New Jersey 5s	105½	105½
Detroit United	68	66½
Elgin, Aurora & Southern	a38	a32
Lake Shore Electric	—	—
Lake Street Elevated	2	1¾
Manhattan Railway	141¼	142½
Massachusetts Electric Cos. (common)	18½	19½
Massachusetts Electric Cos. (preferred)	75	75¼
Metropolitan Elevated, Chicago (common)	16	17
Metropolitan Elevated, Chicago (preferred)	51	51
Metropolitan Street	122¼	122¼
Metropolitan Securities	—	88
New Orleans Railways (common)	10⅛	10
New Orleans Railways (preferred)	30½	30½
New Orleans Railways 4½s	80	80
North American	75½	83½
Northern Ohio Traction & Light	13¼	13¼
Philadelphia Company (common)	39	40¾
Philadelphia Rapid Transit	8½	8¼
Philadelphia Traction	96	97
St. Louis Transit (common)	11½	13
South Side Elevated (Chicago)	90¼	92¼
Third Avenue	112	119
Twin City, Minneapolis (common)	91½	91
Union Traction (Philadelphia)	45½	45
United Railways, St. Louis (preferred)	55	55
West End (common)	89	89½
West End (preferred)	110	109½

a Asked.

Iron and Steel

It cannot be said that a decrease in the Steel Corporation's earnings, even as large as the one reported yesterday, had not been expected, both by Wall Street men and by authorities in the iron trade. How much of a shock it will be to the outside public remains to be seen. The optimistic reading of the situation is that the "pauper period" in the iron industry was witnessed at its extreme in the four months ending with December, and that a gradual improvement, both in earnings and in profits, will be witnessed from now on. The important question to be answered in the immediate future is whether the recent price reductions have been sufficient to induce liberal buying for long-term requirements, or whether consumers, not feeling entirely satisfied that the reaction is over, will content theselves with buying from hand to mouth. Quotations are as follows: Bessemer pig iron $14.50, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper, 12½ cents, tin 28¾ cents, lead 4¼ cents, and spelter 5 cents.

POWER IN BALTIMORE

It is stated from Baltimore, Md., that the completion of the great project for the electrical development of the falls of the Susquehanna River, on the Niagara plan, is now assured by the fact that Anthony N. Brady, of New York, and associates have taken over $1,000,000 stock in the United Electric & Power Company, of Baltimore, controlling the lighting of that city. Plans for the power plant at Conowingo, on the Susquehanna, have been completed, and routes for the cables to Baltimore, Havre de Grace, Elkton and other towns in Maryland, Southern Pennsylvania and Delaware have been laid out. There will soon be a number of changes in the directorate of the United Electric Light & Power Company. The new interests in the company have tendered the presidency to S. Davies Warfield, president of the Continental Trust Company, who conducted the negotiations with Mr. Brady. There are now five vacancies in the board of directors, and Mr. Brady, with three of his associates, will fill four of these. Mr. Brady will also become a member of the executive committee of the company, which will be increased from five to seven members. The present executive committee is composed of S. Davies Warfield, William T. Dixon, Thomas J. Hayward and Francis E. Waters. The dissolution of the syndicate holding the $2,000,000 common stock of the United Electric Light & Power Company, and owning the Mount Washington Electric Light & Power Company, will mean a distribution of these securities to the new owners. The investment of the New York interests in the Susquehanna project will probably be $10,000,000. It is proposed the works can be completed in 1905 to supply 40,000 hp to Baltimore.

ELECTRIC RAILWAY PLANS FOR THE NEW EAST RIVER BRIDGE

With the completion of the Williamsburg bridge the question of granting concessions for street railway lines comes up, and many plans are now under consideration for the utilization of this new means of relief for Brooklyn Bridge. It has been proposed to give the surface railroad companies of both the great boroughs right of way over the new bridge, one on the north and the other on the south roadway. The plan is to give to the Brooklyn Rapid Transit Company the right of way over the south roadway and let its cars run over the bridge to a terminal station and loop at the Manhattan end, thence back to Brooklyn; and to give to the Interurban Street Railway Company a similar franchise over the north roadway, with the condition of a terminal station and loop at the Brooklyn end of the bridge.

The advantages claimed for this plan are set forth under five heads.

1. The evening crowds would enjoy the same advantages as the morning crowds. In the morning riders from remote points in Brooklyn would remain on the Brooklyn Rapid Transit cars and diverge in Manhattan, as they do now on the Brooklyn Bridge. In the evening the riders could cross the bridge on the Interurban cars and diverge in Brooklyn. This, it is claimed, would greatly decrease the crowding at the terminals.

2. By reason of the Interurban lines reaching Brooklyn persons who live within walking distance of the Brooklyn terminal, and there are many thousands, would have to pay but one fare and would save 10 cents a day in carfare.

3. Commissioner Lindenthal has stated that 450 cars an hour can be operated on tracks which are not blocked by trucks and wagons. The maximum for Brooklyn Bridge is 275 an hour. There would be no deprivation to Brooklynites to have two of the four trolley tracks given to the Interurban Street Railway Company.

4. In case of a serious breakdown, blockade or strike on either line the other line would maintain the steady service so essential to the welfare of both boroughs.

5. All the advantages of a railroad monopoly of the bridge would still obtain. The advantages mentioned would be supplementary and additional.

NEW RULES OF THE ROAD FOR NEW YORK CITY

On Dec. 8, 1903, the committee on law and legislation of the Board of Aldermen of the city of New York presented for the consideration of that body an ordinance entitled "Rules of the Road," the said ordinance being a substitute for the one referred to the committee on April 28, 1903. The revised ordinance was passed by the Board of Aldermen on Dec. 8, and approved by the mayor on Dec. 14, after section 15, article 1, had been amended at his suggestion by the Board, namely, to continue giving north and southbound travel the right of way. The most important feature of the new ordinance is that requiring cars to stop on the near side of the street, before reaching crosswalk, when discharging or taking passengers. This rule has been in force on the lines of the Brooklyn Rapid Transit Company (Brooklyn Borough) since Jan. 1, 1904, and will become effective on the lines of the Interurban Railway Company (Manhattan Borough) beginning Jan. 17, 1904.

The Police Department has published and distributed an abstract of the new ordinance, covering the rules for driving, and guide signs have been placed at all important crossings.

The new ordinance as approved on Dec. 14 is given herewith:

An Ordinance in Relation to the Rules of the Road.

Be it Ordained by the Board of Aldermen of The City of New York as follows:

Article I.—Rules of the Road.

Section 1. Vehicles Keeping to the Right—Vehicles shall keep to the right, and as near the right hand curb as possible.

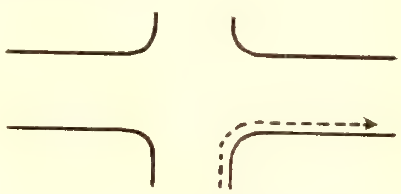
Sec. 2. Vehicles Meeting—Vehicles meeting shall pass each other to the right.

Sec. 3. Vehicles Overtaking Others—Vehicles overtaking others shall, in passing, keep to the left.

Sec. 4. Turning and Starting—The driver or person having charge of any vehicle, before turning the corner of any street, or turning out or starting from or stopping at the curb line of any street, shall first see that there is sufficient space free from other vehicles, so that such turn, stop or start may be safely made, and shall then give a plainly visible or audible signal.

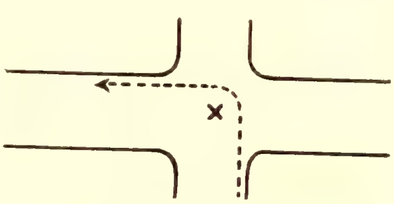
Sec. 5. Turning to the Right Into Another Street—A vehicle turning to the right into another street shall turn the corner as near to the curb as practicable.

THUS:



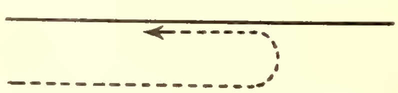
Sec. 6. Turning to the Left Into Another Street—A vehicle turning to the left into another street shall pass to the right of and beyond the center of the street intersection before turning.

THUS:



Sec. 7. Crossing Streets—A vehicle crossing from one side of the street to the other shall do so by turning to the left so as to head in the same direction as the traffic on that side of the street.

THUS:



Sec. 8. Stopping at Curb—No vehicle shall stop with its left side to the curb.

Sec. 9. Driving, Backing, etc., on Sidewalks—It shall not be lawful for any public cartman, or for any person driving or having charge of any public cart, wagon or other vehicle, to drive or back any such public cart or any other cart, wagon or other vehicle, onto the sidewalk of any of the streets of said city, except as hereinafter provided, or to stop any such cart, or any other vehicle, on any of the crosswalks or intersection of streets so as to obstruct or hinder the travel along such crosswalks or intersection of streets, or to place any such carts or other vehicles crosswise of any streets of said city, except to load thereon or unload therefrom; but in no case shall it be lawful for any person to permit such cart or other vehicle to remain so crosswise of any street for a longer period than may be actually necessary for such purpose; but it shall be lawful for the owner or occupant of any store, warehouse or building in any street or avenue in which the rails of any railroad company are laid so close to the curbstones as to prevent the owners or occupants from keeping any such cart or other vehicle in the carriageway in front of his place of business without interference with the passing cars of any such railroad company to occupy with such cart or other vehicle during business hours so much of the sidewalk as may be necessary for such cart or other vehicle; provided that sufficient space be retained for the passage of pedestrians between the cart or other vehicle so permitted to occupy such portion of the sidewalk and the stoop or front of every such store, warehouse or other building. In no case shall it be lawful to place any such carts, wagons, or other vehicles, crosswise of the carriageway on Broadway or Fifth Avenue, south of Fifty-Ninth Street, or on Park Row, nor shall any such cart, wagon or other vehicle be permitted to remain in front of any premises on said Broadway or Fifth Avenue, south of Fifty-Ninth Street, or on Park Row, unless placed in close proximity to the curb, with the side of such cart, wagon or other vehicle parallel therewith.

Sec. 10. In no case shall a vehicle remain backed up to the curb, excepting when actually loading or unloading.

Sec. 11. Stopping Close to the Curb Line—Unless in an emergency or to allow another vehicle (as provided in sections 16, 17 and 18) or pedestrian to cross its path, no vehicle shall stop in any public street or highway of this city, except close to the curb line.

Sec. 12. Obstructing Crossings—No vehicle shall stop, for the purpose of taking or setting down a passenger or loading or unloading freight, or for any other purpose except in case of accident or other emergency, or when directed to stop by the police, in such a way as to obstruct any street or crossing.

Sec. 13. Stopping Near Corners—No vehicles shall stop or stand within the intersection of any street, nor within ten feet of a street corner.

Sec. 14. Surface Cars Taking On or Discharging Passengers—Surface cars shall stop only on the near side of the street, and before reaching crosswalk, to discharge or take on passengers.

Sec. 15. Right of Way—On all public streets and highways of the city, all vehicles in (an easterly) a northerly or (westerly) southern direction, shall have the right of way over any vehicle going in (a northerly) an easterly or (southerly) westerly direction.

Sec. 16. Right of Way of Certain Vehicles—The officers and men of the Fire Department and Fire Patrol, with their fire apparatus of all kinds, when going to, or on duty, at or returning from a fire, and all ambulances, and the officers and men and vehicles of the Police Department, and all physicians who have a police permit (as hereinafter provided) shall have the right of way in any street and through any procession, except over vehicles carrying the United States mail. The Police Department is hereby empowered to issue, upon application therefor, a permit for such right of way to any duly registered physician, which permit shall not be transferable.

Sec. 17. Right of Way of Cars—Subject to the preceding section of this article, surface cars running on tracks laid in the streets especially for their use shall have the right of way along such tracks, between cross streets, over all vehicles moving in the same direction at a less rate of speed than ten miles an hour; and the driver of any vehicle proceeding upon the track in front of a surface car shall turn out as soon as possible upon signal by the motorman or driver of the car.

Sec. 18. Signal in Slowing Up or Stopping—In slowing up or stopping, a signal shall always be given to those behind by raising the whip or hand vertically.

Sec. 19. Signal for Automobile—Every person driving an automobile or motor vehicle shall, at the request or signal by putting up the hand, from a person driving or riding a restive horse or horses, or driving domestic animals, cause the automobile to immediately stop, and to remain stationary as long as may be necessary to allow said horses or domestic animals to pass.

Sec. 20. Slowly Moving Vehicles—Vehicles moving slowly shall keep as close as possible to the curb line on the right, so as to allow faster moving vehicles free passage on the left.

Article II.—Speed.

Section 1. Speed of Vehicles—The following rates of speed through the streets of the city shall not be exceeded, that is:

Eight miles an hour by bicycles, tricycles, velocipedes and motor vehicles, however propelled, or by passenger and other vehicles drawn by horses or other animals, except that in portions of the city not built up, where the buildings are at least one hundred feet apart, a speed of fifteen mile an hour may be maintained.

Sec. 2. Exceptions—Nothing in this article shall apply to the apparatus and wagons of the Fire and Police Departments, the Fire Patrol, ambulances, emergency repair wagons of street railroads, and vehicles carrying the United States mail.

Sec. 3. Excessive Speed Prohibited—No person riding, driving or in charge of any vehicle on any street, avenue, pathway, or driveway in the city shall drive the same at a speed greater than reasonable and proper, having regard to the traffic and use of the highways, or so as to endanger the life or limb or any person.

Sec. 4. Speed in Crossing Streets and Turning—No vehicle shall cross any street or avenue running north and south, or make any turn at a speed rate exceeding one-half its legal speed limit.

Article III.—Lights.

Section 1. Lights—Each and every vehicle using the public streets or highways of this city, except vehicles of licensed truckmen, shall show, between one hour after sunset and one hour before sunrise, a light or lights, so placed as to be seen from the front and each side; if dash lantern is carried, it shall be placed on the left-hand side; such light or lights to be of sufficient illuminating power to be visible at a distance of two hundred feet; said light or lights shall show white in front, but may be colored on the sides, excepting licensed truckmen. Every automobile shall exhibit during the same period two lamps showing white lights visible at a distance of three hundred feet in the direction toward which the automobile is proceeding, and shall also exhibit a red light, visible in the reverse direction. The lamps shall be so placed as to be free from obstruction to light from other parts of said automobile. In the Borough of The Bronx, excepting south of Tremont Avenue and One Hunderd and Seventy-Seventh Street east of Jerome Avenue and west of the Bronx River, and in the Boroughs of Richmond and Queens, and in the Twenty-sixth, Thirtieth, Thirty-first and Thirty-second Wards of the Borough of Brooklyn, every car or other vehicle between said hours, while moving on, along or standing upon the portion of streets in said boroughs or parts of boroughs, shall also carry a light or lights of such illuminating power as to be plainly visible two hundred feet, both ahead and behind said car or vehicle.

Sec. 2. Exceptions—But this section shall not apply to any equestrian, or to any animal led or driven, not attached to any vehicle, nor to the rider of a bicycle, tricycle or similar vehicle, whose light has become extinguished, or who is necessarily absent from his home without a light, when going at a pace not exceeding six miles an hour, when a clearly audible signal is given as often as thirty feet are passed over.

Article IV.—Improper Use of Streets.

Section 1. Coasting Forbidden to Bicyclists—No bicycle shall be allowed to proceed in any street of the city by inertia or momentum, with the feet of the rider removed from the pedals.

Sec. 2. Trick Riding Forbidden—No rider of a bicycle shall remove both hands from the handle-bars, or practice any trick or fancy riding in any street.

Sec. 3. Carrying Children on Bicycles—No bicyclist in the city of New York shall carry upon his bicycle any child under the age of five years.

Sec. 4. Ages of Drivers—Drivers or persons in charge of vehicles other than licensed vehicles shall not be less than sixteen years of age, unless provided with a permit from the Police Department.

Sec. 5. Riding on Backs of Vehicles—No person shall ride upon the back of any vehicle without the consent of the driver, and when so riding no part of the person's body must protrude beyond the limits of the vehicle.

Sec. 6. "Cruising" by Hacks, Etc., Forbidden—No public or private hack while awaiting employment by passengers, shall stand in or upon any public street or place other than at or upon public or private hackstands, respectively, designated by the Board of Aldermen; nor shall any hackman seek employment by repeatedly and persistently driving his hack to and fro in a short space before, or by otherwise interfering with proper and orderly access to, or egress from, any theatre, hall, hotel, public resort, railway or ferry station, or other place of public gathering, but any hackman may solicit employment by driving through any public street or place without stops other than those due to obstruction of traffic, and at such speed as not to interrupt or impede traffic, and may pass and repass before any theatre, hall, hotel, public resort, railway or ferry station or other place of public gathering, provided that after passing such public place he shall not turn and repass until he shall have gone a distance of two blocks beyond such place.

Article V.—Use of Sidewalks.

Section 1. Driving on Sidewalks—Except as provided in this article, no horse or vehicle shall be driven, backed, led or allowed to stand on any sidewalk which has been curbed, except that wares or merchandise in process of loading and unloading, shipment, or being received from shipment, may be transferred from trucks or other vehicles over the sidewalk by the use of skids, or by backing up trucks on the sidewalks in so doing, provided a passageway be kept open within the stoop line of buildings for the free passage of pedestrians.

Sec. 2. Leading Bicycles—Riders of bicycles, when dismounted, may lead their bicycles along the sidewalk in single file, and bicycles may be allowed to stand on the sidewalk, provided they are within the stoop line and cause no obstruction.

Sec. 3. Riding on Sidewalks—Bicycles may be ridden on the sidewalks of any street in the suburbs of the city, the roadway of which is not reasonably rideable for such vehicles.

Sec. 4. Driving Across Sidewalks—Nothing contained in this article shall prevent the riding or driving of horse or vehicles from private property directly across the sidewalks of any street to the roadway, or from the roadway back to such private property.

Article VI.—General Rule Covering the Use of Streets.

Section 1. Reasonable Care to be Used—Nothing contained herein or omitted herefrom shall be construed or held to relieve any person using, or traveling, or being upon any street, for any purpose whatever, from exercising all reasonable care to avoid or prevent injury through collision with all other persons and vehicles.

Sec. 2. Traffic Not to be Obstructed—No vehicle shall be allowed to remain upon or be driven through any street of the city of New York so as wilfully to blockade or obstruct the traffic of that street.

No vehicle shall be so overloaded that the horse or horses are unable to draw it.

Article VII.—Powers of Police Department.

Section 1. Police Department to Regulate Traffic—The Police Department shall have all powers and duties in relation to the management of the vehicular traffic.

Sec. 2. Police Department to See That Ordinances Are Posted —The Police Department shall see that these ordinances are posted in all public stables and at the hacks, cab and truck stands, and shall keep copies of them at all of its stations and issue them on application.

Article VIII.—Definitions.

Section 1. Definitions of Terms Used Herein—The following terms, whenever used herein, except as otherwise specifically indicated, shall be defined to have, and shall be held to include each of the meanings herein below respectively set forth, and any such term used in the singular number shall be held to include the plural.

Street—Every avenue, boulevard, highway, roadway, cartway, lane, alley, strip, path, square and place used by or laid out for the use of vehicles.

Roadway—That portion of any street which is included between the curbs or curb-lines thereof and is designed for the use of vehicles.

Curb—The lateral boundaries of that portion of a street designed for the use of vehicles, whether marked by curbstones or not so marked.

Vehicles—Every wagon, carriage, omnibus, sleigh, push-cart, bicycle, tricycle and other conveyance (except baby carriages), in whatever manner or by whatever force or power the same may be driven, ridden or propelled, which is or may be used for or adapted to pleasure riding or the transportation of passengers, baggage or merchandise upon the street; and every draught and riding animal, whether driven, ridden or led, excepting that an animal or animals attached to any vehicle shall, with such vehicle, constitute one vehicle.

Article IX.—Penalties for Violations.

Section 1. Penalties for Violations—Any person violating any provision or regulation hereof shall be deemed guilty of a misdemeanor, and upon conviction thereof by any Magistrate, either upon confession of the party or by competent testimony, may be fined for such offense any sum not less than one dollar and not exceeding ten dollars, and in default of payment of such fine may be committed to prison by such Magistrate until the same be paid; but such imprisonment shall not exceed ten days.

FIRE DELAYS ACCOUNTANTS' REPORT

Secretary W. B. Brockway, of the Street Railway Accountants' Association, recently prepared for publication a pamphlet containing the standard classification of accounts and standard form of operating report of the association, and to add to its practical usefulness appended to the pamphlet a number of blank pages for notes. Unfortunately the pamphlet was being made ready for the press last week at the composing rooms of McIlroy & Emmet, 106 Liberty Street, New York, which were destroyed by fire, and the type, plates and original copy of the pamphlet were completely destroyed. Mr. Brockway has companions in his misery, however, as the same fire destroyed a considerable part of the current transactions of the American Institute of Electrical Engineers. He has, however, started anew on his work, and expects to issue the pamphlet soon, but its publication will be delayed some time by the untoward accident.

99-YEAR ACT ARGUMENTS IN CHICAGO

Jan. 16 has been set as the date when arguments before Judge Grosscup on the validity of the 99-year act in extending Chicago Street Railway franchises will be heard before Judge Grosscup. David T. Watson, of Pittsburg, has been retained as special attorney for the city of Chicago.

THE THREE-CENT FARE SITUATION IN CLEVELAND

Mayor Tom L. Johnson and the advocates of 3-cent fare street railways have had their inning in Cleveland during the past two weeks. Apparently every effort is being made to rush through franchise grants before the talked-of legislation placing the granting of all street railway franchises and similar matters in the hands of a State railway commission can be enacted in the State Legislature, which is now in session. While the mayor and his cohorts seem to have things their own way just at present, there is every indication that the legislation mentioned will be put through by the present Legislature, thus taking out of the hands of biased City Councils the right to pass ordinances calculated to injure the business and credit of established and reputable street railway companies.

The Rhodes Avenue franchise extension ordinance for an extension of the Forest City Street Railway, the 3-cent fare line, through Rhode Avenue to Detroit Street, thus enabling it to use the so-called free territory and reach the Public Square, was put through the Council a few nights ago in a manner which was questionable, to say the least. The old company has been fighting this grant for many months, and at each session of the Council it was enabled to present revocations of a sufficient number of consents of property owners to render it necessary for the 3-cent fare company to go over the ground again and secure more consents before it could secure the franchise legally. Before the last meeting the Johnson Councilmen held a caucus, with the result that when the meeting was called, the regular order of business was suspended and the franchise matter was acted upon at once and the ordinance passed without a dissenting vote. The revocations, which were in the form of a communication to the Council, were read later, but were without force as the franchise had already been granted.

An ordinance has been introduced in the Council to fix the rate of fare on street railways operating within a certain area of the city at three cents. This ordinance will affect several companies whose rate of fare is not stipulated in the old grants, thus fixing a low fare zone in the central portion of the city.

The question of the expiration of certain franchises held by the Cleveland Electric Railway will be brought to an issue by another ordinance introduced before the City Council. The proposed ordinance grants to the Forest City Railway Company, the 3-cent fare company, the right to operate on Central Avenue and Quincy Street, which constitute two of the leading lines to the East End now operated by the old company. The city claims the franchises for these lines expire March 22, 1905. Another ordinance provides for a belt line traversing portions of Broadway, Woodland, Wilson and Kinsman Streets, all of which are occupied and operated by the old company. The city claims that these grants expire Sept. 20, 1904. The ordinances provide for three-cent fares with transfers, and provide that the city may purchase the property at any time, the price to be fixed by a board of arbitration. There has long been a controversy between the city and the company over the expiration of the above mentioned franchises. The company claims that some of them do not expire until 1913, and that none of them expire before 1908; certain extensions having been secured, it is claimed, at the time the company secured the right to substitute electricity for horse power.

IMPORTANT FRANCHISE GRANTS IN NEW YORK

The Aldermen of New York have approved the report of the railroad committee granting a franchise to the Hudson & Manhattan Railroad Company, and the application of the Long Island Traction Company for a franchise for twenty-five years to operate various electric railways, aggregating about 16 miles, in Queens.

The Hudson & Manhattan Railroad Company is the company of which W. G. McAdoo is president, and which is tunneling the North River between Jersey City and Cortlandt Street, New York. The Rapid Transit Commission approved the scheme several weeks ago. There was no opposition to the committee's report.

The franchise granted to the Long Island Traction Company means the construction in the spring of a comprehensive extension of that company's system in Queens and Nassau, connecting the outlying sections with Brooklyn. For the franchise during the first five years the company must pay an annual rental equal to 3 per cent of its annual gross receipts, and during the remaining twenty years a sum equal to 5 per cent of its annual gross receipts. The Board of Estimate and Apportionment may, by giving a year's notice, require the company to change its system from an overhead to an underground system. The rate of fare is not to be more than 5 cents. The company must build 10 miles by July 1, 1904, and all unbuilt parts on July 1, 1905, are to be forfeited.

NEW LINES BETWEEN MINNEAPOLIS AND ST. PAUL

Vice-President C. G. Goodrich, of the Twin City Rapid Transit Company, of Minneapolis and St. Paul, announces that arrangements have been made to build a line from Minneapolis to Fort Snelling, which is southeast of Minneapolis, on the south side of the Mississippi River. This will be an extension of the present line to Minnehaha. Nothing remains but to secure the approval of the government officers to the plans which have been submitted. When a bridge has been completed across the Mississippi River near Fort Snelling, this line will be joined to the line from St. Paul, making another interurban line between Minneapolis and St. Paul by way of Fort Snelling. Another new interurban line is planned between Minneapolis and St. Paul, which will join the Selby Avenue line in St. Paul, crossing the Lake Street bridge, following Lake Street to Cedar Avenue in Minneapolis, Cedar Avenue to Thirty-first Street, and connecting with the present Thirty-first Street line. This will give St. Paul people a chance to go direct to the lakes without going through the down town district of Minneapolis. The building of this line is dependent upon the granting of the right of way by the Councils of Minneapolis and St. Paul. The company has in operation already two interurban lines between the two cities. Fifty new cars are being constructed, and these, with the new power plant which is to be put in operation soon will enable the company to give greatly improved service.

IMPROVEMENTS ON THE LACKAWANNA & WYOMING VALLEY RAILWAY

Work will be commenced before long on the cutting of a tunnel three-fourths of a mile long in South Scranton, Pa., by the Lackawanna & Wyoming Valley Electric Railway Company, which will remove a grade of 200 ft. to the mile and shorten the distance between Scranton and Wilkesbarre from 19½ to 18½ miles, and enable better time to be made. A roadbed has been graded to the tunnel entrance on either side and some track laid and ballasted. When all these improvements are completed the company expects to cover the distance between the two cities in 20 minutes. About 100,000 tons of broken stone ballast have been used on the new line and the 40 bridges over roadways, railroad track, etc., are all of steel. With the completion of the tunnel, four of the eight grade crossings between Scranton and Pittston will have been eliminated. New cars have been ordered for the road, to be used after the tunnel is completed, which will have a speed of sixty-five miles an hour. They are to be equipped with the multiple-unit system of control. The cost of the road, equipment and right of way between Wilkesbarre and Scranton, is much greater than has been stated, the total cost being nearly $5,000,000. There is some speculation as to whether the improvements will end with the present work. The Carbondale branch will be built during the present summer and will cost nearly $2,000,000. Work will be commenced on this line shortly. It is said that the road will be extended to Nanticoke.

THE PUBLIC WAITING STATION IN CLEVELAND

It seems quite probable that the project of erecting a waiting station on the Public Square, in Cleveland, for the use of the interurban roads, will miscarry. As outlined in a recent issue of STREET RAILWAY JOURNAL, the city company and the interurbans secured permission from the Board of Public Service to erect the stations, and plans were completed for the building. Later certain Councilmen demanded that an ordinance granting such a franchise be put through the City Council. The companies had agreed to install public toilet rooms in the station, and maintain their portion of the building, but when the Council Committee insisted on amending the plans to the extent that the railroads must maintain the toilet rooms and supply towels, soap and other accessories, the railway companies felt justified in making objections. Now certain Councilmen who are advocating 3-cent fare lines, have started an agitation to defeat the measure on the ground that the city should not grant any further rights of any kind to the old company. As a result, the city is likely to lose a handsome shelter house for the Public Square, which the railways offered to turn over without cost. The railroads, however, will not drop the plan of building a downtown station, and it is quite probable that the different roads will be asked slightly to increase the amount they have already guaranteed, which will enable them to build a very creditable station of their own on some downtown street. There would be considerable advantage in this plan, for, while it would be necessary to buy real estate, the building would be owned by the companies, and certain privileges could be let out, from which an income could be derived, an advantage which would have been impossible under the other plan.

RAIL WELDING BY THE THERMIT PROCESS

E. Stütz has been appointed American representative of the Goldschmidt Thermit rail-welding process which has been exploited in Germany to a considerable extent, and hopes before long to be able to supply apparatus and material for rail-welding. This can be done now for small pipe and other repairs for which thermit is used. Mr. Stütz will deliver a lecture on the process at the Franklin Institute, in Philadelphia, on Jan. 20, and at the Massachusetts Institute of Technology, in Boston, Feb. 26.

TRACTION COMPETITION IN INDIANA

At points along the Big Four Railroad in Indiana where there is competition with the traction companies, General Passenger Agent Lynch says that all loss of revenue through local traction competition is being more than made up by the increased revenue derived from through business. "In many ways," says Mr. Lynch, "the traction companies are proving excellent feeders."

A vigorous protest is being entered against the rates charged by the Indianapolis Northern Traction Company on its line between Kokomo and Tipton, which has just been opened for business. In the original franchise it was stipulated the rate should not exceed 1½ cents per mile, but the company is now collecting 2 cents and 3 cents per mile for short distances. A flaw is said to have developed in the franchise of the company, and while the commissioners are willing to pass a new grant, they stoutly maintain that no privileges will be given the company until a rate of not more than 1½ cents per mile is agreed to.

A rate war between the steam railroad and the Evansville & Princeton Traction Company, operating between Princeton and Evansville, is now on.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED DEC. 22, 1903

747,343. Elastic Wheel; Karl O. Ahlquist, Rugby, England. App. filed June 19, 1903. Comprises a hub having a central annular flange, a rim and annular spring side-plates, by which the rim and hub are connected, the connection between the hub and side-plates being made by means of ball and socket bearings.

747,370. Railway Car Appliance; Andrew J. Brislin, Brooklyn, N. Y. App. filed April 20, 1903. A belt adapted to be buckled about the motorman is attached to an alarm circuit, so that in case he becomes disabled and falls, an alarm will be given.

747,371. Trolley Wheel; Herbert W. Brockett, Hamden, Conn. App. filed June 23, 1903. The wheel is flanked by two discs of greater diameter than the wheel, whereby the wheel is retained upon the wire.

747,378. Brake Apparatus; Philip J. Conboy, Hamilton, Ohio. App. filed Aug. 17, 1903. Details of mechanism for winding up the brake chain.

747,410. Brake; Josiah B. Gaston, Rock Springs, Wyom. App. filed April 14, 1903. The brake has two leverages, and is adapted to be changed from one to the other by raising or lowering the staff.

747,470. Support for Electrical Conductors; Robert Orr and John Morrison, New York, N. Y. App. filed Jan. 9, 1903. A trolley clip, consisting of two connected members, each member being provided with a wedge-shape groove and a wedge-shaped, wire-gripping clip or clamp, adapted to be secured in the groove.

747,477. Rail Insulator; Leonard M. Randolph, Newark, N. J. App. filed May 4, 1903. A non-porous insulating covering for rails, consisting of varnish residue, and an absorbent substance laid around the rail and pressed into intimate contact therewith.

747,489. Electric Car; Myron Rounds, Boston, Mass. App. filed June 13, 1903. A car having raised floor-sections over the trucks and vertically adjustable seats at each end of each of the raised sections.

747,501. Automatic Railway Switch; Horace W. Summers, Elyria, and Charles R. Summers, Norwalk, Ohio. App. filed April 30, 1903. Details of a combined automatic and manually operated switch.

747,537. Electrical Switch; George J. Crossland, Mobile, Ala. App. filed July 12, 1902. Details of a circuit closer for operating an electro-magnetic railway switch.

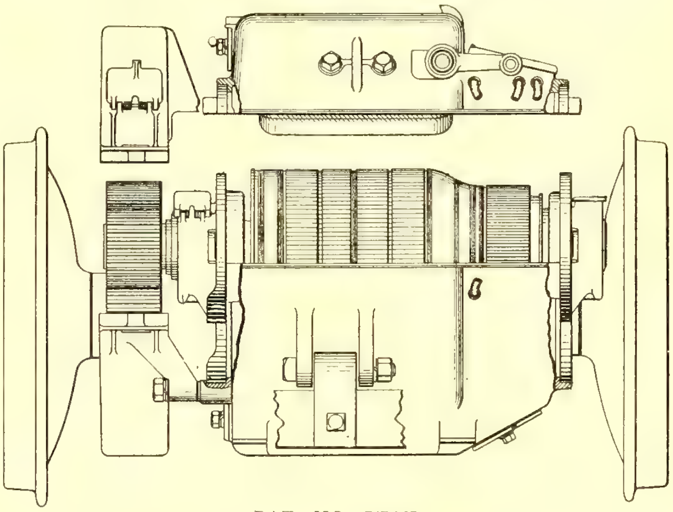
747,539. Track-Sanding Apparatus; John J. Dolan, Jr., Baltimore, Md. App. filed March 4, 1903. A track-sanding device, provided with a sand-inlet and a fluid pressure inlet, and also having a sand outlet which is interposed between the two inlets.

747,596. Apparatus for Removing Ice from Track or Conductor Rails of Railroads; Patrick B. Delany, South Orange, N. J. App. filed March 2, 1903. A wheel having a notched periphery is pressed into engagement with the rail to crush the ice, and is followed by a brush or scraper.

747,607. Trolley Pole; Jonah R. Hollis, Brockton, Mass. App. filed Nov. 7, 1902. The trolley harp is so mounted as to permit the wheel to swing laterally.

747,655. Car Replacer; Ezra Showalter, Massillon, Ohio. App. filed April 29, 1903. Details.

747,765. Railway Motor; Edward D. Priest, Schenectady, N. Y. App. filed Sept. 16, 1902. Details of construction of a split frame for car motors, whereby the advantages of a box frame are also obtained.



PAT. NO. 747,765

747,774. Switch; Isaac B. Ritter, Philadelphia, Pa. App. filed July 8, 1903. Details.

747,795. Automatic Apparatus for Controlling and Operating the Points of Electric Railways or Tramway; Thomas B. Stewart, William H. Turner and Rowland E. Dixon, Leeds, England. App. filed April 1, 1902. Details.

747,796. Apparatus for Controlling and Operating the Points of Electric Railway or Tramway; Thomas B. Stewart, William H. Turner and Rowland E. Dixon, Leeds, England. App. filed March 6, 1903. Details.

747,847. Street Railway Switching Mechanism; Walter J. Bell, Los Angeles. App. filed May 7, 1903. Hydraulic pistons for moving the switch, which are locked and released by an electro-magnetic latch.

747,885. Switch-Operating Mechanism; Oliver D. Hunt, Columbus, Ohio. App. filed March 21, 1903. Details.

747,886. Switch-Operating Mechanism; Oliver D. Hunt, Columbus, Ohio. App. filed March 21, 1903. Details.

747,912. Brake-Shoe; Joseph D. Gallagher, Glenridge, N. J. App. filed Feb. 24, 1903. A brake-shoe comprising a back or body portion consisting of a partly worn brake-shoe and a wearing sole cast upon the face thereof.

UNITED STATES PATENTS ISSUED DEC. 29, 1903

747,955. Railway Frog; Edward B. Entwisle, Johnstown, Pa. App. filed June 5, 1902. Relates to a novel construcion of the wing rails.

747,956. Spring Switch; Edward B. Entwisle and Frank G. Wertz, Johnstown, Pa. App. filed Dec. 22, 1902. A reversibly-acting spring on a rod connected to the switch tongue and actuating means connected to the rod.

747,957. Car Seat; Francis K. Fassett, St. Louis, Mo. App. filed Jan. 28, 1903. Details of construction of a "walk-over" seat.

747,983. Car Wheel; George S. Kyle, Chambersburg, Pa. App. filed Aug. 4, 1903. The wheel has a detachable brake ring attached to its inner side.

748,098. System For Controlling Fluid Pressure; Edward D. Priest, Schenectady, N. Y. App. filed May 21, 1903. When a train stops, the air pump is automatically cut out by the controller, thereby avoiding annoyance to passengers by the operation of the pump.

748,106. Brake Head; Wiliam D. Sargent, New York, N. Y. App. filed June 8, 1903. A cast brake-head has attaching lugs of malleable metal embedded therein and running around the eye in the head.

748,195. Self-Adjusting Car Fender; Alexander O. Lamson, Bridgeport, Conn. App. filed Mar. 12, 1903. The fender is always maintained at substantially the same distance from the rails regardless of any tipping or tilting of the car.

748,210. Sand-Car; Atlas F. McConnell, Nashville, Tenn. App. filed May 1, 1903. Funnels mounted in the car truck and through which sand is fed to the center of the rail, sand being fed to the funnel by valve-regulated openings in the car platform.

748,220. Separable Brake-Block and Shoe; William D. Sargent, New York, N. Y. App. filed June 10, 1903. A combined brake-shoe made in separable parts and the two parts being attached by means of a malleable eye-lug between them.

748,268. Magnetic Contact Box For Electric Tramways; Alfredo Diatto, Turin, Italy. App. filed Apr. 8, 1902. A magnetic field is established when the contact in the box is moved and Foucault currents opposing the movements of the field are at the same time created with the object of preventing the formation of an arc between the various parts of the apparatus.

748,322. Trolley Device; Ralph P. Tisch and Robert Kissinger, Hebron, Ohio. App. filed May 23, 1903. The wheel is mounted on cone bearings having threaded shanks by which they can be set up to compensate for the wear.

748,345. Switch Operating Device; Joseph E. Campbell, Pittsburg, Pa. App. filed Sept. 15, 1903. Details of a switch lever attached to a car.

748,422. Trolley; Walter J. Rowley, Allegheny, Pa. . App. filed May 7, 1903. Opening and closing levers adapted to retain the wire within the groove of the wheel.

748,441. Trolley; Thomas F. Varley, Lowellville, O. App. filed Aug. 14, 1903. Pivoted guards extending above the trolley wheel on each side to retain the wire and counterweighted to yield when they strike an obstruction.

748,508. Switch Operating Apparatus for Tramway or Other Cars; Albert King, Nottingham, England. App. filed June 10, 1903. Apparatus by means of which, when a lever in the top of a car is thrown, it will engage with mechanism overhead to throw the switch.

748,557. Electrically Controlled Railway Switch; Frederick T. Kitt, Denver, Colo. App. filed Mar. 4, 1903. Details.

PERSONAL MENTION

MR. C. F. DREW, general manager of the Coal Belt Electric Railway, of Marion, Ill., died very suddenly in his room at a hotel at Harrisburg, Ill., Dec. 28.

MR. GEO. H. EARLE, Jr., of Philadelphia, has been elected a director of the Philadelphia Company, of Pittsburg, to succeed the late Mr. William L. Elkins.

MR. THOMAS JENKINS has been appointed superintendent of the Marion Railway, Light & Power Company's street railway system at Marion, Ohio, and division superintendent of the Columbus, Delaware & Marion Railway, which is owned by the same interests. Mr. R. A. Amann, formerly superintendent of the Marion system, has been made master mechanic of the Columbus, Delaware & Marion Railway.

MR. W. A. BIXBY, manager of the Decatur Traction & Light Company, of Decatur, Ill., and other interests of the McKinley syndicate, has assumed the management of syndicates at Quincy, Ill.

MR. DAVID R. POWELL, who built at Joplin, Mo., the electric railway which finally became the nucleus of the system of the South West Missouri Electric Railway Company, died in St. Louis a few days ago of heart failure.

MR. PALMER WARDMAN, for several years master mechanic of the Cleveland, Painesville & Eastern Railway Company, has been appointed general superintendent of the Pennsylvania & Ohio Railway, with headquarters at Ashtabula, Ohio.

MR. T. F. MANVILLE, president of the H. W. Johns-Manville Company, New York, started for the West on Dec. 22, and before returning to New York will visit the company's Milwaukee, Chicago, St. Louis and New Orleans branches.

MR. FRED. D. SAMPSON, who has held the position of engineer and superintendent for the past nine years, has resigned his connection with Charlotte Electric Railway, Light & Power Company, and will be associated with the D. A. Tompkins Company, of Charlotte, N. C., in the capacity of engineer.

MR. N. B. RHOADS, who has been connected with the Savannah Electric Company, of Savannah, Ga., for about two years, and who was formerly with the Richmond Traction Company, Richmond, Va., has been appointed superintendent of Transportation of the Savannah Electric Company. Mr. Rhoads' appointment took effect Jan. 1.

MR. B. F. VERMAN, for thirty years a prominent citizen of Lorain, Ohio, died at his home a few days ago. He built the Lorain Street Railway system and later sold a portion of his holdings to Mr. Tom L. Johnson, although he held a part interest up to the time of his death. Mr. Verman was formerly Mayor of Lorain.

MR. S. M. MANIFOLD, late general superintendent of the Western Maryland Railroad Company, has assumed charge of the management of the York County Traction Company's system at York, Pa., and will have charge of the building of several important lines the coming summer.

MR. W. P. COSPER has accepted a position as salesman for the Garton-Daniels Company, of Keokuk, Ia. Mr. Cosper will give special attention to pushing the automotoneer, and will also look after lightning-arrester sales. Mr. Cosper has a large acquaintance among street railway companies, having for some years been Western representative for the Consolidated Car Heating Company. Recently he has been in the sales department of Fairbanks, Morse & Company, Chicago.

MR. W. S. MONTGOMERY, who for the past five years has been connected with the Conover Condenser Manufacturing Company, of Jersey City, N. J., as its secretary and sales manager, severed his connection with that company on Jan. 1, 1904, to assume the management of the Payne Engineering Company, of New York City, which is the selling agent of the Payne Company, of Elmira, N. Y., builders of simple and compound automatic engines. The Payne Company has removed to new offices in the Havemeyer Building, New York.

MR. DAVID J. EVANS has severed his connection with the Chicago office of the Lorain Steel Company and resigned his position of secretary-treasurer of the North American Railway Construction Company, and has taken an office at No. 1564 Monadnock Building, Chicago, where he will handle railway supplies, iron and steel. Mr. Evans has been connected with the Chicago office of the Lorain Steel Company and its predecessor, the Johnson Company, since early in 1893, having had charge of the business for the past three years, during the sojourn in Colorado of Mr. A. S. Littlefield, the Western sales agent.

SEVERAL CHANGES have taken place in the management of the Eastern Ohio Traction Company. Mr. R. L. Andrews, general manager, has resigned to devote his time exclusively to the work of the Youngstown & Southern Railway Company, of which he has been general manager since the proposition was started some months ago. The duties of general manager of the Eastern Ohio Company have been assumed by Mr. George T. Bishop, president of the company. Mr. James J. Doyle has been appointed superintendent of the Cleveland & Eastern division with headquarters at Gates Mills, and Mr. Lawrence O'Toole has been appointed superintendent of the Cleveland & Garrettsville division with headquarters at Chagrin Falls. Mr. James A. Currie, secretary and treasurer of the company, has assumed the duties of purchasing agent.

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, JANUARY 16, 1904. No. 3

Published Every Saturday by the

McGRAW PUBLISHING COMPANY

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: 929 Chestnut Street.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York,"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Canada and Mexico......................$4.00 per annum

Single copies, first issue of each month, 25 cents; other issues, 10 cents.

To all Countries outside of the United States, Canada and Mexico.... { $6.00 / £1-5s / M 25 / Fr. 31 }

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Uniformity of Shop Records

The executive committee of the American Railway Mechanical and Electrical Association, at its recent meeting in Cleveland, laid plans to have the subject of shop records well discussed at the next convention. As one of the members of the committee put it, "most of our members are keeping some kind of records as to the mileage of various parts, costs of repair materials and cost of shop labor for different repairs, but no two of us are keeping our records in the same way, so that it is seldom that they are worth anything for comparison. What we need is to get some uniform system of keeping these records, so that we can compare figures with each other to advantage." At first thought, this is a subject which should come under the jurisdiction of the accountants rather than of the master mechanics. Further consideration will show, however, that the subject is one which could very properly and profitably be taken up in detail by the Mechanics' Association. Not only in actual practice are these records kept for his direct information, but usually all the work is done in the shop, under the personal direction of the master mechanic. Further than this it was suggested that the accountants, in their systems, have interested themselves only in the costs of various items, while the master mechanic requires a large amount of additional information in order properly to secure the best economical results. He must be acquainted, for example, with the mileage he is obtaining from wheels and other wearing parts as well as the cost per wheel, and he must know the amount of labor put into rewinding an armature, as well as the total finished cost, in order to see where reductions can be made. It is, therefore, entirely in order that the master mechanics take up this subject, although it is not unlikely that a little later the mechanical and accountants' associations can work together in this matter to their mutual advantage.

Very closely allied with this subject is that of piece-work in repair shops which are of such size as to permit men to work continuously for some time on one operation. A change to piece-work after the shop has been run on a time basis usually gives some very startling results, both in the reduction of the cost of performing certain operations and in the amount of work each man turns out. It is very seldom that such a change does not result after a few months in some astoundingly high wages to rapid workmen performing very simple operations. In an informal discussion of the matter at the recent committee meeting, it seemed to be the consensus of opinion of the master mechanics who had enjoyed the most experience with piece-work, that the most desirable plan is a premium system, where employees are paid by the hour, as is usual, but given a premium above their regular wages for work in excess of a certain amount. This should produce a large increase in output per man, while at the same time not resulting in such absurdly high wages as sometimes follow the introduction of the piece-work system. Excessive wages are likely to be a source of dissatisfaction among other employees who cannot be put on piece-work and whose rate per hour is fixed.

Track Work and the Master Mechanics

In commenting, as we have above, on one of the directions in which the efforts of the American Railway Mechanical and Electrical Association will be directed, it seems suitable to refer to another subject which has been more or less discussed in connection with the proposed work of the association, and that is the subject of track.

There has been, undoubtedly, considerable disappointment among some managers and other railway men because of the positive stand taken by the master mechanics against the admission to their organization of engineers and others engaged in building and maintaining track and roadbed, and their equally determined opposition to the consideration of papers dealing exclusively with this feature of railway work. The subject has come up several times at committee meetings, and it was also discussed at the Saratoga Convention, but on all occasions every suggestion of this kind has been voted down. In justification of their action the master mechanics point to their convention last September, at which they held so many busy sessions without completely exhausting the subjects brought up for discussion. They have more than enough to do, they say, in giving proper study and scrutiny to the subjects which rightly

come before them under their present organization, and they protest that it would be bad policy to take on additional departments when such action would, of necessity, require them to neglect or discard some of the work now in hand.

It is greatly to be regretted that those engaged in track construction do not represent sufficient strength numerically to support an organization of their own, at which subjects pertaining to this important department could be discussed by experts for the improvement of others. No doubt there would be no desire on their part, under such conditions, to seek admission to the mechanical association, and yet it is questionable whether it would not be advantageous for all concerned if these departments were brought closer together. The work of each is important to the other, and has a direct bearing upon the results secured. This is the view of the subject that was taken by a prominent street railway man the other day, who suggested that, if necessary, an additional day could be had for the consideration of track problems, or that one day might be taken out of those now allotted other subjects and devoted to track work. Any plan that will bring the representatives of different departments together in earnest discussion of subjects in which both are interested, and which may vitally affect the general operating results, is commendable. We have frequently urged upon the companies and the associations the necessity for devoting more attention to track work, and to the serious problems which yet remain to be solved in this department. We regard it as one of the most important branches of electric railway work, and we take this occasion to renew with emphasis our warning against the apparent indifference which marks the attitude of many companies toward this subject.

The Right of Way in Chicago

The blocking of street car traffic unnecessarily by teamsters is an unmitigated public nuisance in many cities, although, in a few, public sentiment, supporting the efforts of the street railway company, has done much to stamp out this evil. Mr. Ely and Mr. Beggs described, at the Saratoga convention, the excellent results secured in Buffalo and Milwaukee by a systematic campaign among the principal owners of the trucks and drays which use the streets, and the efforts of the New York officials toward a solution of the problem seem now to be bearing fruit. The new "rules of the road" in New York, which now bear the authority of an ordinance and which are intended to reduce the unnecessary delays to street traffic from the interference with each other of the vehicles on the street, were published in our last issue, and will, it is thought, effect some reform in this direction.

From our own observation, as well as the testimony of others, there seems to be no city in which there is more delay of this kind than in Chicago. The Arnold report on the street railway situation in Chicago showed what enormous improvements could easily be made by vigorous action on the part of the police. This report in itself should have been sufficient to rouse the Mayor to action, but nothing has come of these excellent recommendations, and, judging from present appearances and experience, nothing is liable to be done under the present administration.

City officials were given another opportunity to really accomplish something at once for the benefit of transportation conditions, independently of any questions of franchise extension or increase of number of cars in service, when a committee of six aldermen from the West Side, last week, met General Manager Roach and the receivers of the Chicago Union Traction Company and asked for better service. The schedules for train service on the West Side lines were immediately produced, and the Aldermen admitted that they would be satisfactory if they could be adhered to. Mr. Roach is reported to have said: "It is not the fault of the gripmen or motormen that delays occur. Where our schedules are disturbed the cause may be traced in nearly every instance to teamsters who block the right of way. It is useless to appeal to the police; the lax enforcement of the law by policemen can be seen at every corner." The Aldermen, realizing that this was the case, immediately promised to allow the company to swear in a number of special policemen, with power to arrest obstructing teamsters. Like all other moves for the improvement of transportation facilities in Chicago, however, this was blocked in the city's legal department, and so the matter has come to naught. How long this blocking of the wheels of progress in Chicago will continue remains to be seen. There is some indication that the public is waking up to a realization of the true condition of affairs and the causes leading to the present inconveniences imposed upon the patrons of these lines, but although the daily press has advocated vigorous measures for relief, it is too much to expect that the Harrison administration will make such a radical departure as to favor any proposition which will aid the transportation companies in giving the people the service the city deserves and desires.

Open Cars or Semi-Convertible?

At least one of the large car builders, and probably many others, who have heretofore furnished a large number of open cars at this season for electric railways, have noticed the marked disinclination on the part of operating companies at the present time to place orders for this class of equipment. This condition is explained in most cases by the placing of orders for semi-convertible cars, which seem to be growing in popularity. This is particularly true, it is said, of the companies which are operating suburban extensions of city lines and interurban roads. Formerly the open car was considered a great inducement to the traveling public, especially on scenic routes and through the rural districts, but it is claimed by many managers that the semi-convertible car offers all of the advantage which an open car possesses and does not have some of the disadvantages, especially where high-speeds are maintained. It is generally admitted that the open car will always be popular on the surface lines for city traffic, and as far as the public is concerned it is probable that it will be equally popular on suburban extensions where only a moderate rate of speed is allowable, but for interurban work the semi-convertible is undoubtedly preferable for many reasons.

Some managers of small companies explain their preference for the semi-convertible car on the ground that it will halve their investment, as it will not be necessary to have a duplicate set of cars, but we do not think that there is much in this argument. On every properly conducted road the equipment is thoroughly overhauled at least once a year, and where a double equipment is used, the open cars can be thoroughly repaired and painted or varnished in winter, and the closed car equipment can be put in shape during the summer months. A complete equipment of semi-convertible cars would undoubtedly reduce the necessary number of bodies somewhat, as a full six months is not required to carry out all of the necessary repair work. But a 50 per cent reduction is entirely too large as an estimate.

Against this reduction in equipment must be weighed the lower cost, greater seating capacity and greater popularity of the open car for slow speed service. We by no means agree with those who consider the open car will go out of use. The semi-convertible car undoubtedly has a very large field, and we regard its introduction as probably the greatest single improvement in the street railway industry which has occurred during the last five years. But it should not be regarded as a perfect substitute for the open car, especially where the pleasure traffic is a considerable feature of the business done.

Lessons From Steam Railroad Practice

The interesting paper by Mr. Armstrong, which we published last week, put in convenient form for reference the serious conditions involved in a schedule with frequent stops. It is a paper which will bear re-reading by every progressive electric railway man. But the very fact that such a paper needed to be written emphasizes the necessity for a thorough study of steam railroad practice by anyone who wishes to have a firm grasp of the principles of modern transportation. Steam railroad practice in either construction or operation cannot be adopted bodily, but most of the mistakes made in the past and now being made on electric railways, come from lack of recognition of certain fundamentals in steam railroad work. When railroading was begun nearly seventy years ago there were no precedents to follow; everything had to be learned by experience, and it was a hard and costly teacher. Gradually the lessons were hammered home, and they have not been forgotten. But, as we have many times pointed out, electric railroading is an evolution from the tramway, an evolution vastly rapid, but still moving by gradual steps so smoothly that its full significance has not yet been completely grasped. The single matter of the effect of stops upon schedule time has needed much elucidation in order to appear in its true importance, and yet the general results of investigations, like Mr. Armstrong's and those which have gone before, have been long well understood by those engaged in general railway work. Steam suburban service has over and over again disclosed the limitation imposed by frequent stations, and the difficulty has been met by the institution of express service, precisely as it had been before on long lines, and just as it is being met now by electric roads. There is a difference of degree in the conditions, since electric motors, particularly with multiple-unit control, can force a greater acceleration than is possible with ordinary steam locomotives, but the general situation is not different.

Indeed, the constants of the case are less changed by the substitution of a new motive power than might at first thought be supposed. For although by multiple motors the possible acceleration can be pushed up to 3 m. p. h. to 4 m. p. h. per second, so that a relatively fast schedule can be maintained in spite of frequent stops, yet such acceleration is neither safe nor desirable, and the practical values come down to half these figures, or less, as indicated in Mr. Armstrong's tables. Similarly the effect of the nature of the roadbed, including grades and curves, upon feasible schedule speeds, have been well understood in general railroading, and enormous sums of money have been spent in straightening, levelling and ballasting the tracks, with most beneficial results, both physical and economical. To be sure, the electric road, so long as it conducts only a passenger traffic, feels the effect of grades relatively less than an ordinary railroad, which, again, is a difference of degree rather than kind. It is equally true, that owing to the ability to secure rapid acceleration, short short-radius curves with long tangents cause less delay on an electric road than the longer long-radius curves usual in steam railroad location. The effect, however, of quickened schedule on the size of locomotive required, the coal to be burned, and the maintenance cost of the roadbed has been well understood on steam roads, and in changing motive power to electricity, as Mr. Armstrong suggests, these roads have very material advantages. In fact, the ordinary steam suburban system has in these particulars what even the best and most modern electric lines seldom approximate and still more rarely reach. Similarly in long runs few interurban lines even remotely approach in the character, location, and independence of the roadway the conditions common on steam railways. And no better guide can be followed in the evolution of fast electric lines than the ordinary well-operated railroad. This fact is now begining to be realized, but it has taken an indefinite amount of bitter and costly experience to enforce it. The larger interurban lines, as we have often remarked, are in effect ordinary railways, save in the matter of motive power, and must be operated in a similar manner.

It would not be difficult to multiply instances indefinitely of the idea which we are trying to express: Thus, steam railroads years ago learned that it is unwise to run trains on a single-track road without a complete and effective system of train despatching and signals. On interurban lines scores of accidents have resulted from failing to take to heart this lesson which was ready at hand. Steam roads learned a quarter century ago the value of air brakes on fast-running trains, but it has been a long struggle, happily now successful, to get them into fairly general use on fast electric cars, which need them all the more on account of the frequent service attempted.

We call attention to these things, not in any fault-finding spirit, but to point the moral that rapid transit is rapid transit irrespective of the motive power, and that the wise electric railway man should take the utmost advantage of the experience for which his rivals have paid dearly in years gone by. It is always a pleasant thing to let the other fellow foot the bills, and in this case the advantages are obvious. Almost every time an electric railway man tries some specious simplification of railroad practice it turns out to be a thing which had been tried and failed years ago. Undoubtedly, railroading admits of improvements, but past experience cannot safely be disregarded. Roads which are distinctively of the nature of tramways stand on a different basis, and to a considerable extent have to pay the cost of their own evolution. They have ample troubles of their own, but not the same troubles as the high-speed interurban roads. Lines clearly belonging to either class have the way marked out for them very clearly, but there are roads in transitional stages upon which serious mistakes are peculiarly liable to be made. These constitute the real problem of electric railroading as such, and to them particular attention ought to be directed. They are neither tramways nor railroads at the present time, and while they may eventually gravitate toward one class or the other, they are and may long remain in a condition to which neither railroad precedents nor tramway precedents fully apply. To such roads our present remarks do not apply, but to the rest we would urgently commend the study of what has gone before.

ELECTRIC INTERURBAN IN WESTERN NEW YORK

The opening of the western division of the Rochester & Eastern Rapid Railway, between Rochester and Canandaigua, recently, was a notable event in electric railroading in Western New York, as it added another to the growing list of competitors of the established steam roads of that section. Early in the spring construction will be resumed east of Canandaigua, and the line completed to Geneva as soon as possible. Work was in progress on this section when the weather made it necessary to discontinue operations for the winter, but considerable headway had been made, and it is now expected that the entire road will be completed and in operation within six months.

ROUTE FOLLOWED BY ROCHESTER & EASTERN RAPID RAILWAY

The route followed is shown on the accompanying map. It is more direct than the New York Central, and it takes in all the important points touched by the steam line. The distance from Rochester to Canandaigua, by the electric line, is 26.85 miles, to Geneva 43.30 miles, and by the New York Central 29 miles and 52 miles, respectively. It should be mentioned in this connection that the cars of the Rochester & Eastern enter the city of Rochester over the tracks of the local railway, and thus enjoy a considerable advantage, as they penetrate the heart of the retail business district, while the New York Central station is about 10 minutes ride from this part of the city. The distances given, therefore, include for the Rochester & Eastern 2¼ miles within the city which the electric cars travel, and which enables passengers to reach the more important business houses or to connect with local lines for any part of the city. The country traversed is very thickly populated, there are many fair-sized villages along the line besides Canandaigua and Geneva, and all of this section has long been tributary to Rochester. The population of the district served, exclusive of Rochester, exceeds 50,000, and those familiar with local conditions assume that the road will receive considerable patronage from that terminal; in fact, judging from present indications, the contributing population of the Flower City will form an important factor in the earning capacity of the property. By taking into consideration the districts indirectly served, including those beyond Geneva, and also the city of Rochester, the total population from which the company can reasonably expect to draw patronage is about 300,000. The amount of public travel through the region traversed is indicated by the fact that the New York Central runs twenty-two passenger trains a day through the village of Canandaigua, six of them starting from Canandaigua. At present the electric line is operating on an hourly schedule, and the carrying capacity is very severely taxed. During the summer additional facilities will be offered as the line touches Canandaigua Lake and Seneca Lake, and has connection with Cayuga Lake, all of which are popular resorts for Western New Yorkers. Canandaigua Lake is a beautiful sheet of water 16 miles long, traversed by steamboats, and is the main artery of travel for business and pleasure during the season of naviga-

TYPICAL SCENES ALONG INTERURBAN LINE—THROUGH RUGGED COUNTRY NEAR CROSSMAN'S POND

tion. There are 450 summer cottages on its shores, and the population of the principal points, about 10,000, is, in a fair sense, almost directly tributary to the Rochester & Eastern Railway, as the travel landing at the foot of the lake would have the city of Rochester as its natural objective point. Seneca Lake is 46 miles long, with a line of fine steamers running from Watkin's Glen at its head to Geneva at its foot, and with an electric line running from Watkin's to the city of Elmira. The population indirectly tributary by way of the Geneva, Waterloo, Seneca Falls & Cayuga Lake Electric Railway, which runs from Geneva through the places named to Cayuga Lake, 50 miles long, lying parallel with Seneca Lake, and having the city of Ithaca and Cornell University at its head, aggregates not less than 100,000. It is simply referred to here, but is not included in the estimate of the contributing population mentioned elsewhere. The road itself passes

TRACK AND OVERHEAD WORK NEAR VICTOR

through a very attractive country, as will be apreciated by an inspection of the accompanying views, and for this reason it will command patronage from those riding for pleasure alone.

THE ROUTE

Starting at the "Four Corners" in the center of the city of Rochester, the line runs easterly over the tracks of the Rochester Railway Company to the present easterly city limits on Monroe Avenue, where its own right of way and tracks begin. From the city limits to the hamlet known as the "Twelve Corners," the line is located upon the northerly side of Monroe Avenue, which is an improved, macadamized roadway. A short distance east of the "Twelve Corners" the private right of way begins. It is from 66 ft. to 100 ft. wide, providing throughout for double tracks, and this private right of way continues without interruption, except for a short distance near and in the village of Pittsford, the hamlet of Bushnell's Basin, the village of Canandaigua and the city of Geneva, until it reaches Seneca Lake, the eastern terminus of the road according to the present plans. A map of the route is herewith presented.

A short distance west of Pittsford the line passes over the Erie Canal on a through, pin-connected, steel-truss bridge, 123 ft. long, on concrete abutments. Near this point it passes under the tracks of the New York Central Railroad by concrete undercrossing, with complete natural drainage. It also passes under the steel bridge of the West Shore Railway, over Main

LINE CONSTRUCTION NEAR WOODS

Street in Pittsford, and through the center of the village of Pittsford, and from this point a branch or spur line will be built to the prosperous village of Fairport, about 4 miles to the northeast. From Pittsford the main line passes easterly through the famous Shetland Pony Farm, and then through the village of Victor and East Victor, on private right of way to Canandaigua, the county seat of Ontario County, where it traverses Main Street, through its entire length, to the foot of Canandaigua Lake, where the power house, shops and car house are located. In the village of Canandaigua the line operates over the tracks of the Ontario Light & Traction Com-

ELECTRIC LINE PARALLELING AUBURN BRANCH OF NEW YORK CENTRAL

pany, which have been entirely rebuilt and relaid with new 73-lb., first quality girder rail. The line has also been provided with new overhead equipment for this purpose. The local company is owned and controlled by the owners of the Rochester & Eastern, but the latter has also its own franchises through the village.

From Canandaigua the line will pass, when completed, due east, entirely on private right of way, through Dunkel's Corners, Seneca Castle and the towns of Hopewell and Seneca,

to the city of Geneva, which it enters on Castle Street and penetrates to the foot of Seneca Lake.

The total mileage of the system, including the branch to Fairport, but not the distance of 2¼ miles within the city of Rochester, is 49.3 miles.

ROADBED CONSTRUCTION

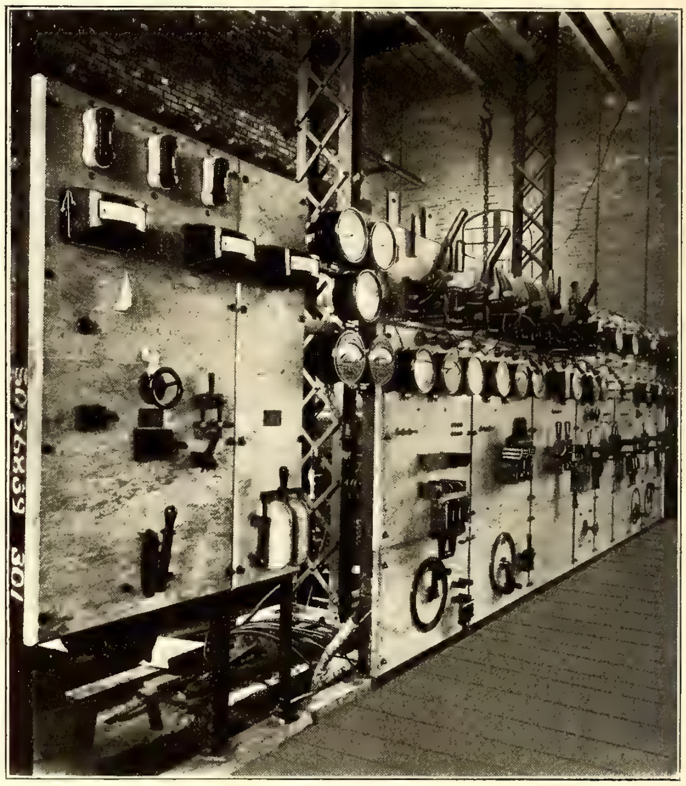
The road is built for the most part on a private right of way, averaging 66 ft. wide, which was bought outright at a cost approximating $100,000. The exceptions are as follows:

From Rochester city limits the road runs along the north side of Monroe Avenue for about 2½ miles, and in the village of Pittsford it traverses Main Street for 600 ft.; at Bushnell's Basin about a mile of the public highway is used, but through the village of Victor the road is exclusively on private right of way. In Canandaigua 2 miles of Main Street is traversed, and in Geneva about 2 miles in Castle Street to the lake front. All the rest of the line is on private right of way.

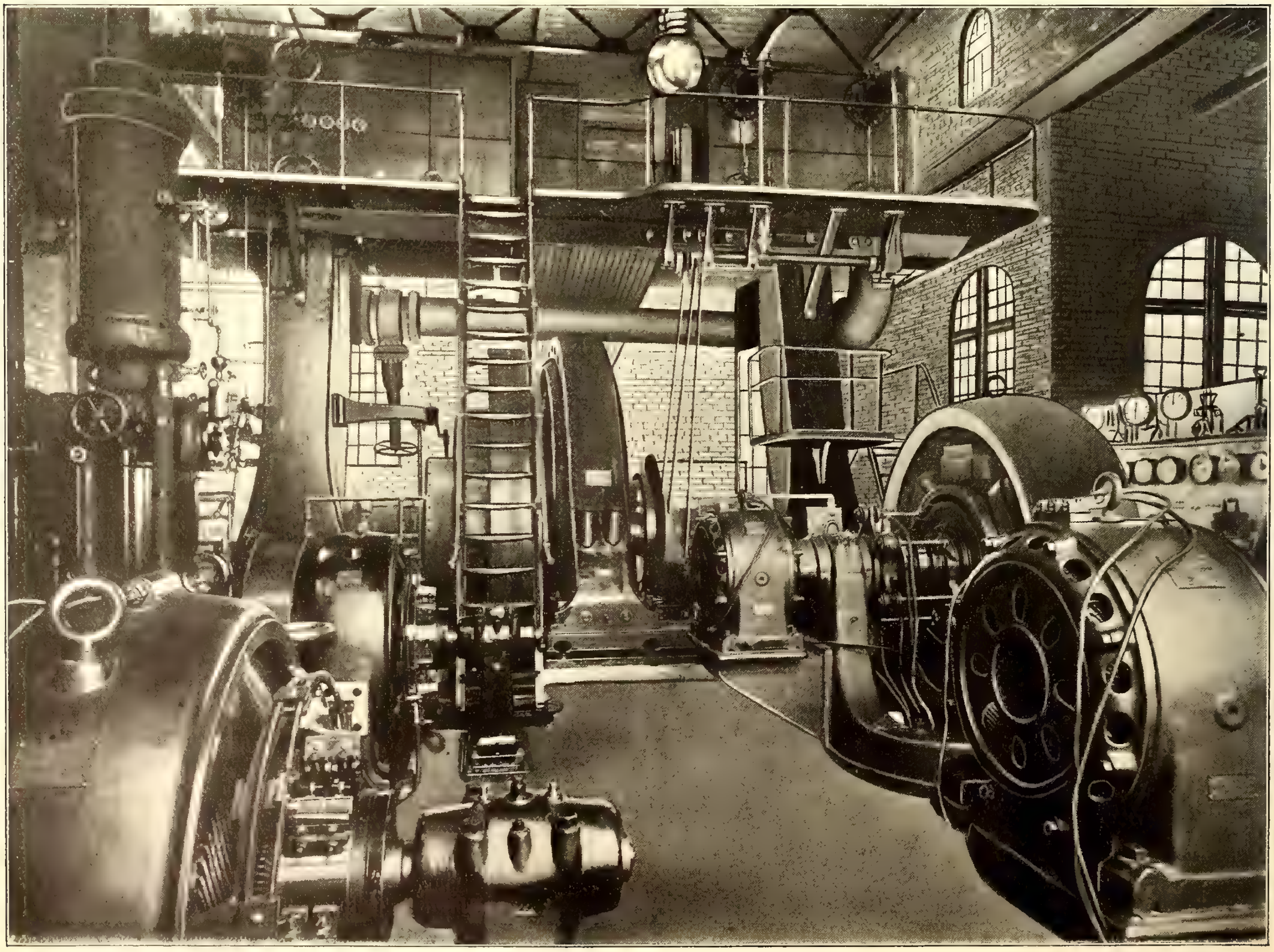
The track is of 70-lb., first quality steel T-rail, with six-bolt splice bars, all of A. S. C. E. standard. It is laid on ties 8 ft. long, of cedar on tangents, yellow pine and white oak on curves, yellow pine on bridges and white oak at switches. They are spaced 2640 per mile, and 14-in. center on bridges. Steel guard rails have been laid on all bridges, curves and outside of switches. "Protected" rail-bonds of 000 capacity, with 8-in. ¾ terminals, expanded in hand-drilled holes with a hydraulic expander, are used.

The road is ballasted throughout with first quality gravel, a minimum of 6 ins. beneath ties being maintained. This material is secured from pits owned by the company, which aggregate 13 acres, and are located at several accessible points along the road. It is estimated that they contain sufficient gravel to supply the road with ballast for many years.

Bridges were built of steel on concrete abutments, there being sixteen between Rochester and Geneva, excluding those for steam railroad crossings. Two of the bridges are 123 ft. long, pin-connected and with steel trusses. There are five rail-



SWITCHBOARD IN MAIN POWER HOUSE



ENGINE ROOM IN MAIN POWER HOUSE, SHOWING DIRECT-CONNECTED GENERATOR, EXCITERS AND ROTARIES

road crossings with a separation of grades, and with steel bridges on concrete abutments. All bridges are designed for a rolling load, consisting of a train with 20,000 lbs. per axle, on a 6-ft., 3-in. wheel base, 26 ft. center to center of trucks, and a dead load of 800 lbs. per lineal foot, with an impact of 80 per cent.

All culverts of over 4-ft. openings in the clear are of concrete arch type, and those of less than 4 ft. are of extra heavy cast-iron culvert pipe. Drains are of extra heavy vitrified fire-clay sewer pipe.

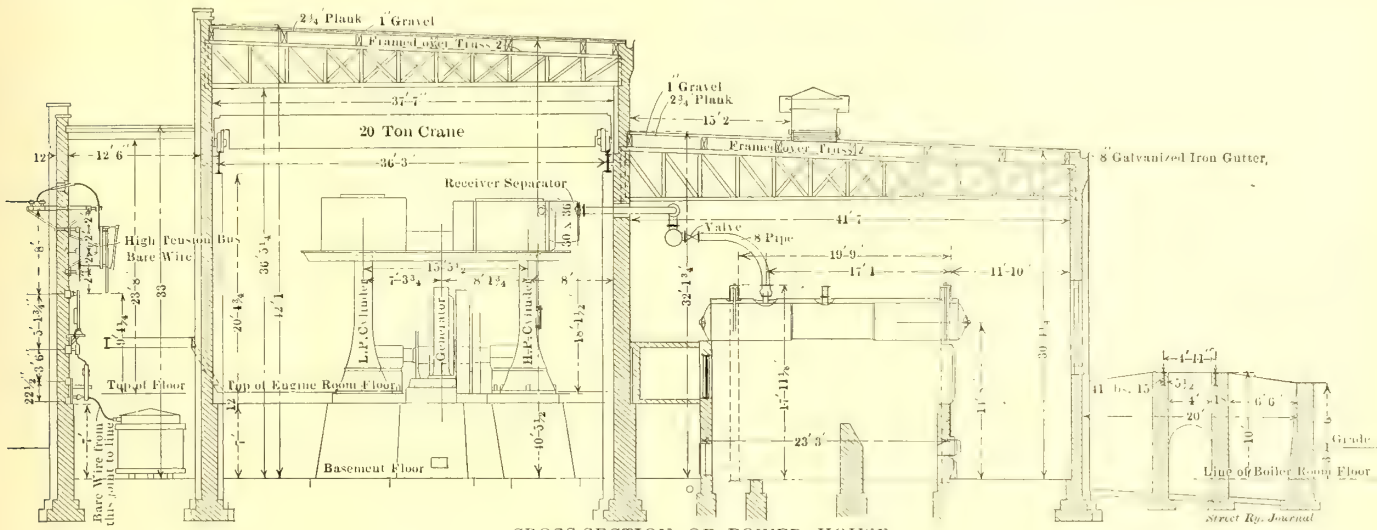
OVERHEAD EQUIPMENT

The pole line comprises cedar poles of 7-in. top, 30 ft. to 50 ft. high. Extra heavy yellow pine cross-arms and galvanized iron braces are used.

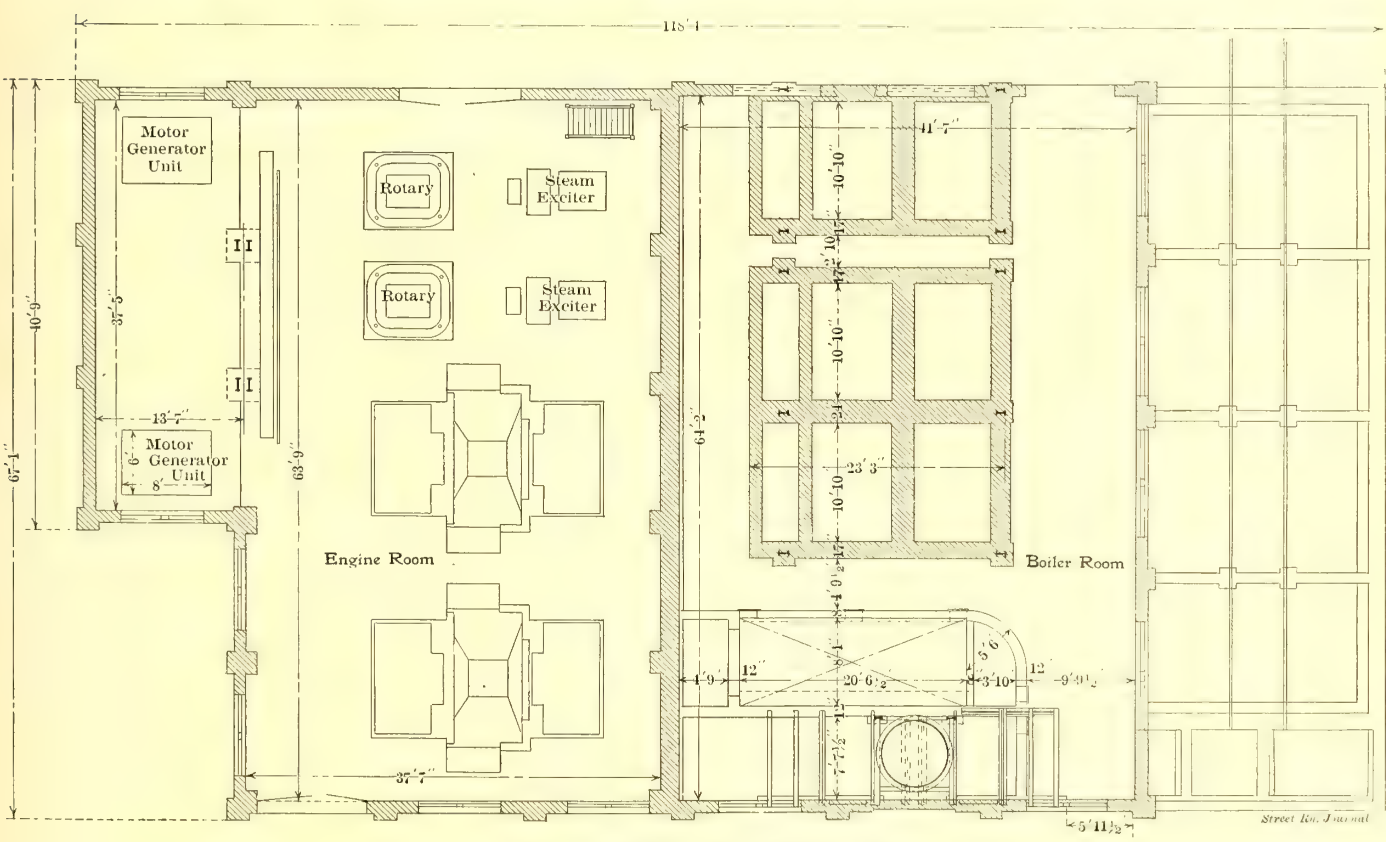
The transmission line is of stranded aluminum conductors, carried on Locke 40,000-volt glass insulators, with extra long paraffined oak pins and special galvanized ridge iron, while the feeder line is also of stranded aluminum, equivalent to 500,000 circ. mil and 400,000 circ. mil copper.

Trolley wire, of 0000 General Electric grooved copper type, carried on extra heavy 8-ft. 6-in. over-support, flexible brackets, with Ohio Brass hangers and clamps, were installed. The trolley is tapped to the feeder line every half mile. The distributing system is designed for 450-amp. transmission each way from each sub-station.

A telephone line of No. 12 copper circuit is carried on brackets with porcelain insulators. Span-wire construction was adopted in villages where necessary, and in these instances 5-16-in. galvanized stranded span-wire was used. The several types of construction are illustrated in the accompanying line views.



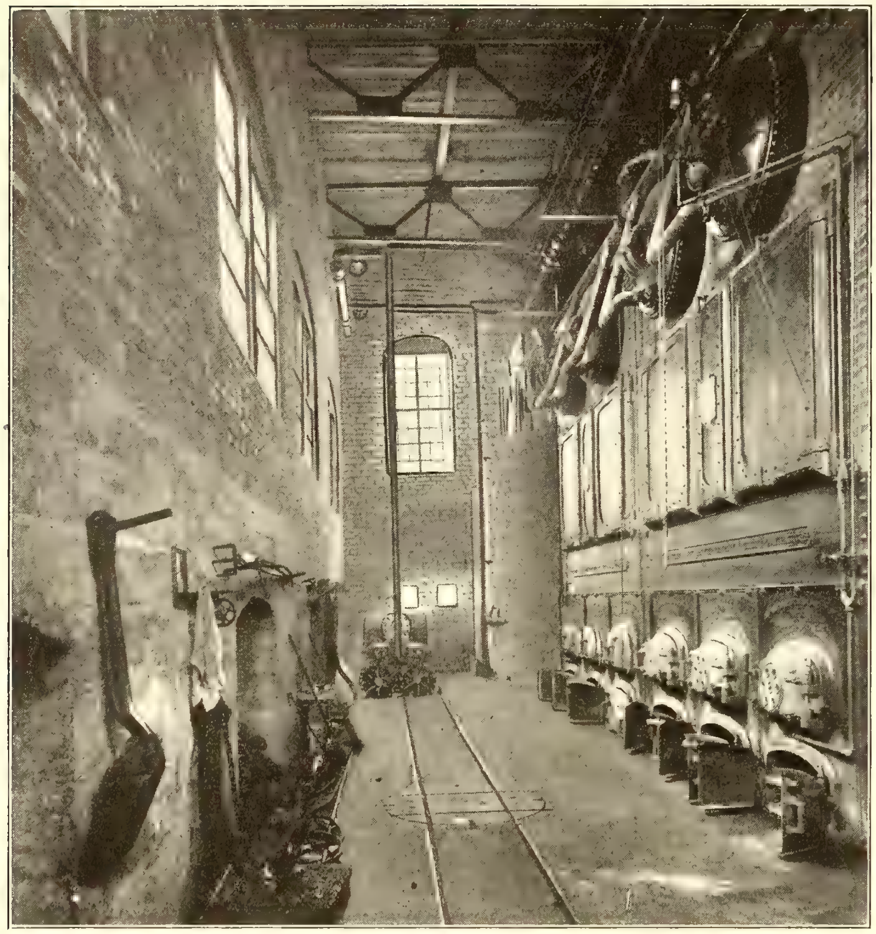
CROSS-SECTION OF POWER HOUSE



PLAN OF ENGINE AND BOILER ROOM

POWER HOUSE

The main power house is at the foot of Main Street in the village of Canandaigua. It is 117 ft. 8 ins. x 65 ft. 9 ins. x 44 ft. extreme height, and is divided into two parts by an 18-in. party wall, the north section consisting of an engine room, 38 ft. 7 ins. x 65 ft. 9 ins., with a wing 15 ft. 6 ins. x 39 ft. 5 in., used for a transformer tower and an entrance for



BOILER ROOM

walls are of pressed brick laid in Lehigh Portland cement mortar and average 18 ins. thick. The floors are of steel and concrete throughout, and the roof is of four-ply felt with tar and gravel filling, and is supported on steel roof trusses.

In the engine room are two Williams' vertical cross-compound engines, 22-in. and 43-in. x 32-in. stroke cylinders. One of these is shown in the accompanying cut. The nominal rating, at 150 r. p. m., with 150 lbs. initial pressure and exhausting into a pressure of 2½ lbs. (abs.), is 1050 ihp. These engines were built by the Quincy Engine Works, of Quincy, Ill. They are direct-connected with two 650-kw alternators of the revolving field type, operating at 150 r. p. m. These generators, together with the other electrical apparatus for the power house, were furnished by the Westinghouse Electric & Manufacturing Company. There are two rotary converters, from alternating current to direct current, of 300-kw capacity, at 500 r. p. m., and four 500-kw transformers have been placed in the basement of the transformer tower to reduce the voltage of the alternating current for these rotaries.

For exciting the main generators there are two Westinghouse compound, automatic engines, the cylinders of which are 9-in. and 15-in. x 9-in. stroke. They are directly connected with two 37½-kw, 125-volt direct-current generators.

the electric wires into the building, while the south part comprises a boiler room, 42 ft. 7 ins. x 65 ft. 9 in., with a concrete coal-bin extension 21 ft. 6 ins. x 65 ft. 9 ins.

The foundations of the building are all of concrete, made of crushed stone, sand and Lehigh Portland cement, while the

One 9-in. panel switchboard in the main power house is illustrated herewith. It is composed of two generator panels with rheostats, one transformer panel, two rotary converter panels for alternating current, with fuse panel underneath, two rotary converter panels for direct current, one direct-current two-circuit feeder panel, and one double-

MAIN POWER PLANT, CAR HOUSE AND REPAIR SHOPS

exciter panel. To aid in the installation of heavy machinery, and in the handling of all heavy parts during inspection and repairs, a 20-ton, hand-power, riveted plate girder, traveling crane, with trolley attachment, has been provided. This crane has a 36-ft. 3-in. span and 22-ft. lift, and travels on runways in the walls lengthwise of the building.

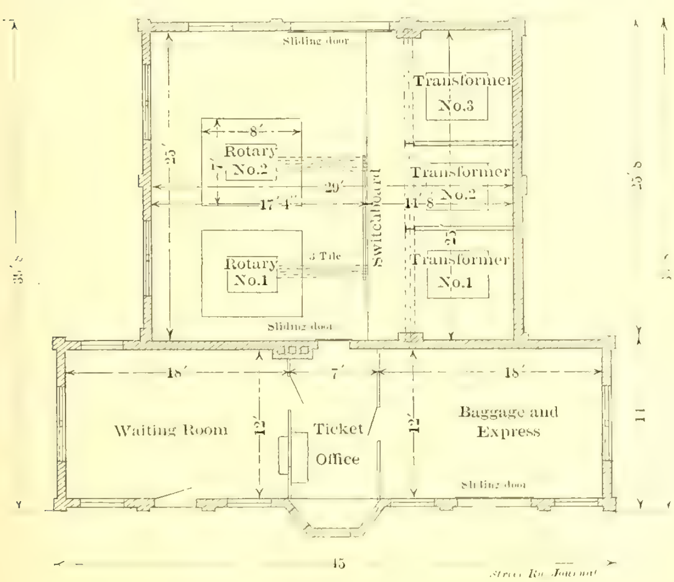
The equipment of the boiler room comprises 1124 hp, of Cahall horizontal, sectional, water-tube boilers, with 11,240 sq. ft. of heating surface and 227.43 sq. ft. of grate surface, arranged to be set as three boilers in 1½ batteries. The headers throughout are of flowed steel. The boilers will carry, if desired, 225 lbs. steam pressure.

A feed-water heater of the horizontal water-tube type, 36 ins. x 14 ft. 6 ins., has been provided, as has also a green fuel economizer, containing thirty-two sections of ten tubes, each tube 9 ft. long by 4 9-16 ins. diameter, giving a total heating surface of 3840 sq. ft. Two fans, 85 ins. in diameter, full-housed, using 40,000 cu. ft. of air per minute, at 250 r. p. m., are employed as blowers. They are driven by two simple, vertical engines of 16 hp each, with cylinders 8 ins. in diameter by 8-in. stroke. The condensing apparatus consists of one 24-in. elevated cone condenser of the jet type, having sufficient capacity to condense 60,000 lbs. of exhaust steam per hour, one rotative dry vacuum pump, and one horizontal duplex direct-acting circulating pump. Two 8-in. horizontal receiver separators and two 4-in. vertical receiver separators are employed. There are two boiler feed pumps of the outside-packed double plunger type, one duplex fire pump, of the plunger and ring pattern, having a capacity of 600 gals. per minute at piston speed of 100 ft., or steam pressure of 125 lbs., and one duplex, high-pressure, automatic pump and receiver.

The stack is of ⅜-in. iron, 5 ft. 9 ins. diameter and 24 ft. long.

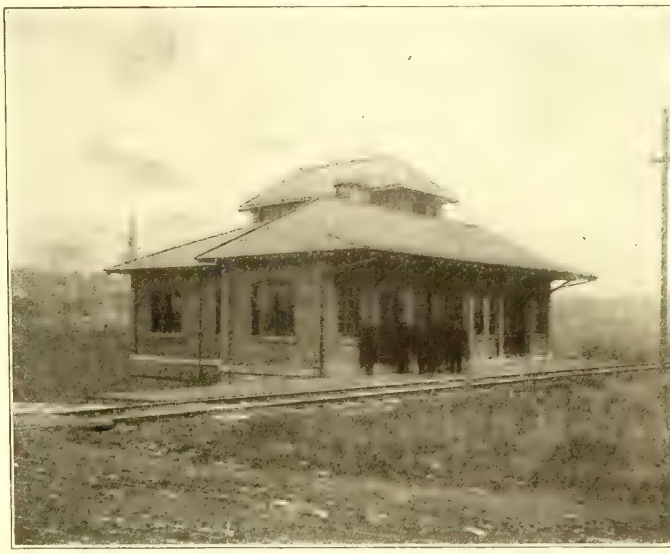
SUB-STATIONS

There are three sub-stations on the line of the road, one at Pittsford, another at Victor, and the third at Seneca Castle. Owing to their location in villages they have been designed to answer for passenger and freight stations as well as electrical distribution stations. These stations are all built with concrete foundations for both buildings and machinery, and the walls are of brick with natural cement mortar. The roofs are of slate. Each station is 39 ft. 8 ins. wide by 45 ft. long over all. The height of the station part proper is 15 ft. 8 ins., and of the transformer tower 29 ft. Each contains a waiting room, 18 ft. x 12 ft.; a baggage room, 18 ft. x 12 ft.; a ticket office, 14 ft. 6 ins. x 7 ft.; a rotary converter room, 20 ft. 6 ins. x 25 ft., and a transformer tower for the entrance of the electrical wires, 8 ft. x 25 ft. Views of the several stations, together with a plan and cross-section, illustrating the principal features, will be found among the illustrations.



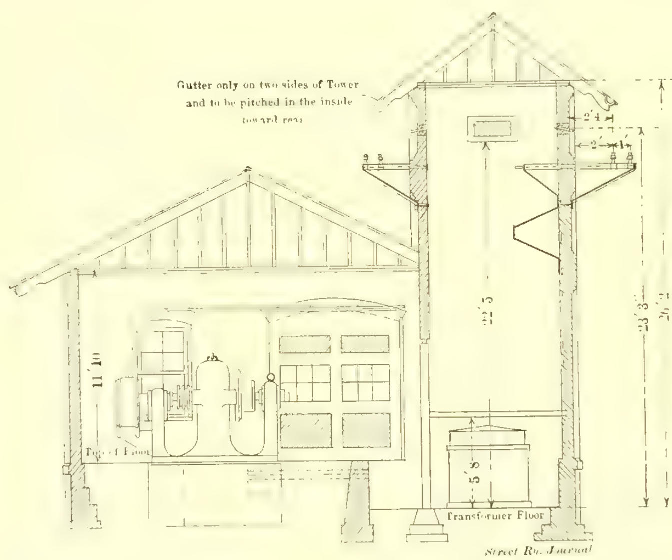
PLAN OF VICTOR SUB-STATION

The Pittsford and Seneca Castle stations contain two 300-kw rotary converters, three 200-kw static transformers, three fuse switches and circuit breakers for 20,000 volts, three lightning arresters with choke coils, and one switchboard, consisting of


VICTOR SUB-STATION, EXPRESS AND PASSENGER DEPOT

two alternating-current rotary converter panels, one direct-current rotary converter panel, and one double feeder panel.

The Victor station has been laid out for the same machinery, but until contemplated extensions are made there will be installed one 300-kw rotary converter, three 200-kw transformers, three choke coils, six fuse switches, and three lightning arresters. The switchboard comprises one alternating-



CROSS-SECTION THROUGH TOWER AND ROTARY ROOM OF SENECA CASTLE SUB-STATION

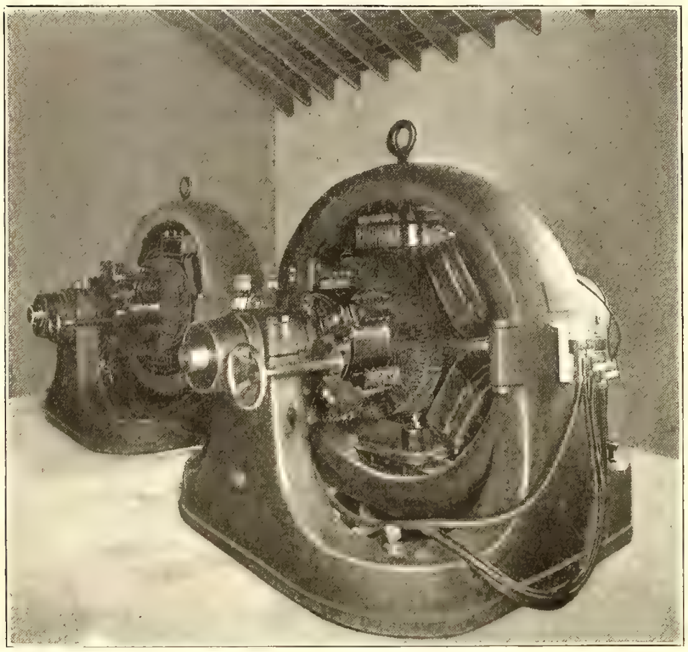
current rotary converter panel, one direct-current rotary converter panel, and one direct-current feeder panel.

PASSENGER STATIONS

Ample accommodations have been provided for passenger traffic along the line, and as the patronage increases additional stations will be provided. Those already erected are of neat design, and are constructed of brick or wood. They are located at all points where needed. By reference to the plan of the Victor sub-station, which may be accepted as typical of the others, there are passenger waiting rooms and express and freight offices connected with each sub-station, the latter being made of brick with slate roofs.

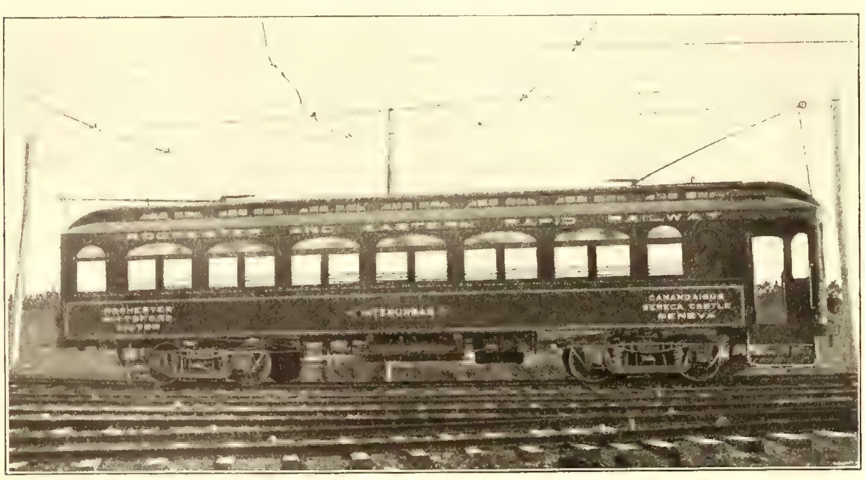
ROLLING STOCK

The car equipment at present comprises six 52-ft. passenger coaches, furnished by the John Stephenson Company, of Elizabeth, N. J. They are of the most modern type, being double vestibuled and finished in mahogany, with smoking compartment and toilet rooms, water coolers and electric heaters. Each coach is equipped with a telephone set, and the cars are



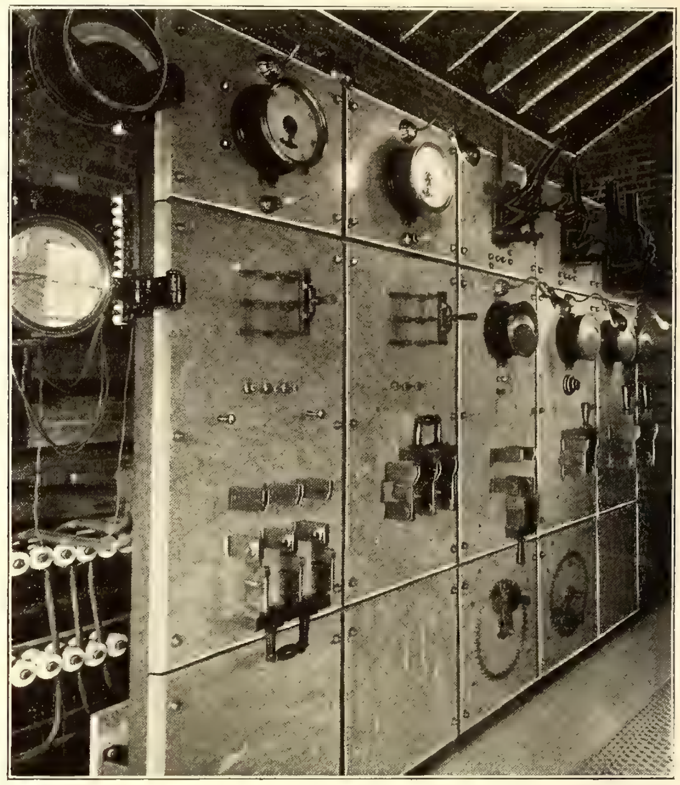
ROTARIES IN PITTSFORD SUB-STATION

all furnished with electric lights and headlights. The accompanying illustrations give a fair idea of their exterior and interior appearance. They are of standard steam railroad construction throughout, being heavily built after designs especially adopted for high-speed interurban service. The length of the car body over corner posts is 40 ft., while the extreme length over the buffers is 52 ft. The length of the vestibule is 4 ft. 6 ins., and the length of the rear platform is



STANDARD PASSENGER COACH

5 ft. The extreme width of the car is 8 ft. 6 ins., and the height from the under side of the sills to the top of the roof is 9 ft. The interior finish and furnishings are attractive and comfortable throughout, the appointments of the regular passenger and smoking compartments, of course, differing somewhat. In the former the seats are of the Hale & Kilburn walk-over type, upholstered in crimson plush, with high backs and head rolls, the cushions being 34 ins. long and 17 ins. wide. In the smoker the same type of seat is used, but the finish is in white woven rattan. Extending the entire length of the car are parcel racks. The cars have Stanwood steel steps and vestibule trap doors of the Zimmerman type. When the vestibule is closed in



SWITCHBOARD IN PITTSFORD SUB-STATION

and this trap door is in position, it rests upon two angle-irons fastened securely on each side of the door step, about 1½ ins. below the floor level, so that the door will be on a level with the vestibule floor, and in reality form a part of it, as it will extend out over the step to the vestibule door, thus making a continuous flooring for the entire enclosure. It is not hinged at the back, but when it is desired to remove it so that the steps may be used for admitting passengers, it is raised and swung

LOOKING THROUGH SMOKING COMPARTMENT

back as if hung on hinges from the vestibule flooring, and allowed to drop into a longitudinal pocket provided at the back of the step. It can be replaced by pulling it up and out of the pocket and letting it down upon the angle-iron rests. A pin at the rear of the step holds it securely in position and prevents the motion of the car from jarring it out of place.

The M. C. B. trucks for passenger cars are extra heavy even for high-speed, and have 5½-in. axles and steel-tired wheels. Westinghouse straight-air brakes are provided with a motor-driven air pump on each equipment. The electrical features

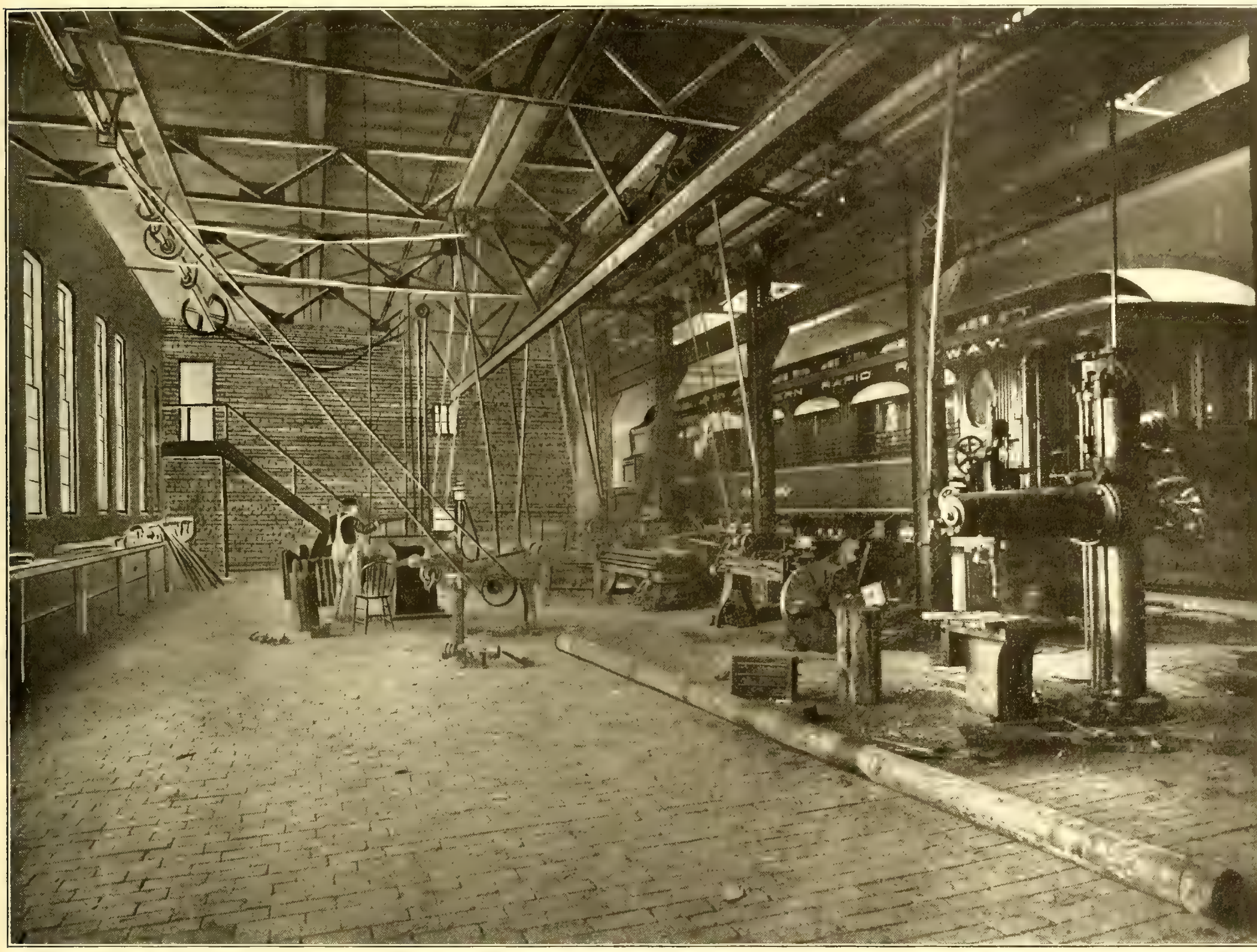
are simple, comprising four-motor equipments, General Electric No. 73, with L-4 control and General Electric No. 74, with type-N train control, and solid gears on axles being adopted.

Eight additional passenger coaches, six of them 45 ft. long, for summer traffic, are under order, and all are of similar type and finish to those now in use. They will have four General Electric No. 74 motors and type-M control.

There are also two 50-ft. express cars and one 36-ft. construction and repair car. A Ruggles double-action, high-speed snow-plow, built by the Peckham Manufacturing Company, completes the equipment.

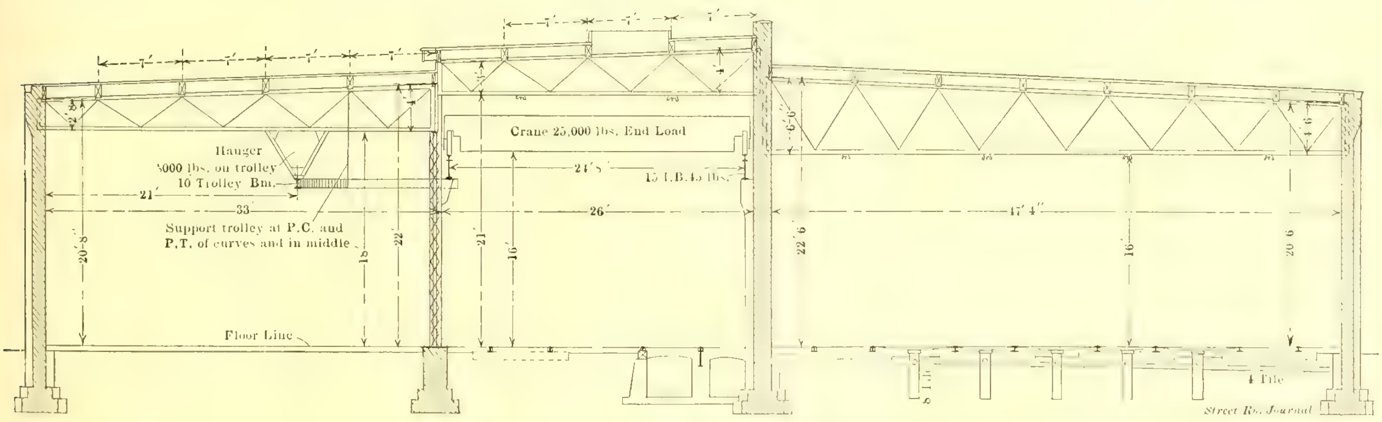
CAR HOUSE AND SHOPS

The building occupied as a car house and shops is 169 ft. 6 ins. x 109 ft. 10 ins. x 27 ft. 4 ins. extreme height, and is located near the main power house. The foundations are of concrete throughout like the power house, and the walls, averaging 12 ins. in thickness, are laid up in pressed brick. Steel beams, channels and columns are used throughout for support. The roof is of four-ply wool felt with tar and gravel filling, and is supported on steel roof trusses.

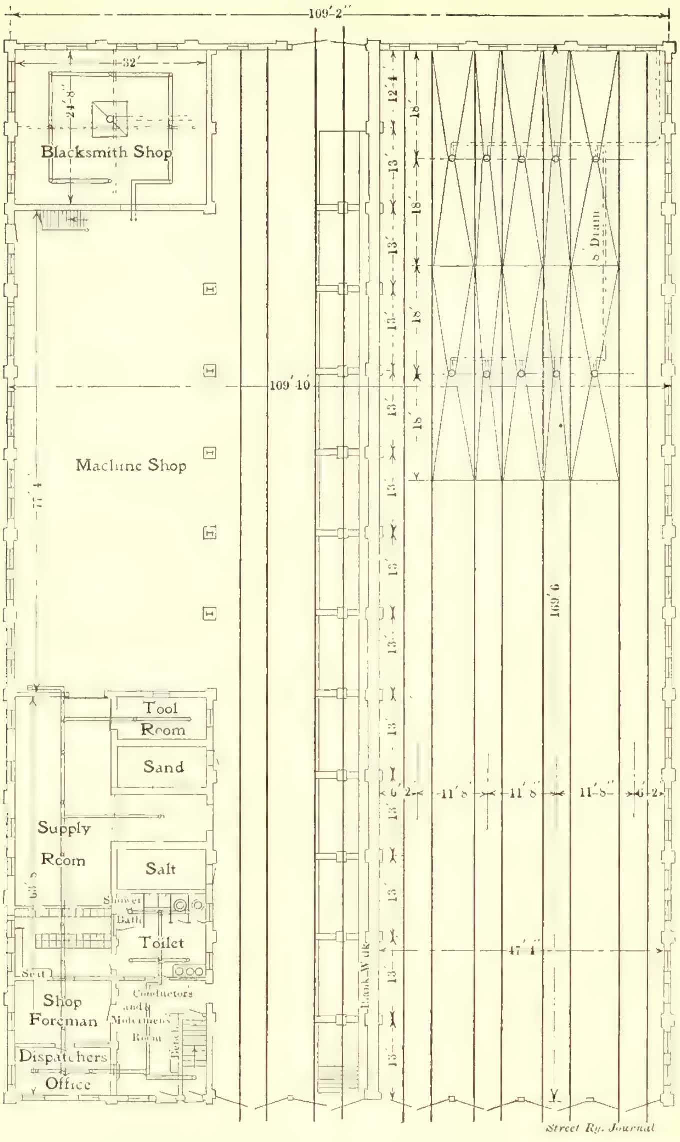


REPAIR SHOP

This structure is divided by a party wall into the car storage side, 48 ft. 4 ins. x 169 ft. 6 ins., and the shop side 60 ft. x 169 ft. 6 ins. The former contains four tracks, and has a capacity for storing twelve large cars 50 ft. to 55 ft. long. The latter is devoted to repair shops and general supply and office rooms. There are two tracks running through this part of the building. One of these leads direct to the shop proper, where the repair work will be done, and the other runs over an inspection pit



CROSS-SECTION OF REPAIR SHOP AND CAR HOUSE



PLAN OF OFFICES, SHOPS AND CAR HOUSE

156 ft. 6 ins. x 8 ft. 10 ins. x 4 ft. 3½ ins. deep, constructed of concrete.

On runways above the inspection pit there are two hand-power traveling cranes of 10-ton capacity each, with a span of 24 ft. 8 ins. and a lift of 16 ft. These are used for raising the car bodies from the trucks, and for other heavy work in connection with car and motor repairs.

In the northeast corner of the shop side is a space 24 ft. 8 ins. x 32 ft., enclosed by a brick party wall. The ground floor room of this space is used for a blacksmith shop, and is equipped with a forge and complete assortment of tools for this work. The second story, directly above the space occupied as a blacksmith shop, is used as an armature winding room. The armatures are hoisted from the shop floor and carried into the armature room on traveling hoists.

In the northwest corner of the shop side is a space 63 ft. 8 ins. x 32 ft., likewise separated from the rest of the shop by a party wall. The ground floor of this space is devoted to supply and store rooms, employees' waiting room and wash room, shop foreman's office and train despatcher's room, while the second story is occupied by the general offices of the company. There are five commodious office rooms, a general auditing room, two wash rooms and a cloak room, all opening from a main ante-room. These offices are finished in yellow pine, natural wood, throughout. A fire-proof vault and a large voucher room are connected to the general auditing room.

The equipment of the shop is operated by a 15-hp compound-wound, direct-current motor. The tools used in the shop were furnished by the Niles-Bement-Pond Company, and include one each of the following machines: Twelve-inch x 6 ft. Niles engine lathe, compound rest, 22-in. x 14-ft. Niles engine lathe compound rest, 16-in. shaper, 14-in. Washburn drill, 36-in. x 4-in. grindstone, 20-in. Whitney water-tool grinder. No. 1 Niles 100-ton hydrostatic wheel press, 16-in. x 8-ft. pattern-maker's lathe, No. 4 power-hack saw. There is also the usual equipment of drills, chucks, vises, anvils and miscellaneous tools, together with shafting and belting to complete the installation.

OPERATION

Although the road has been in operation only a comparatively short time its patronage is much greater than was anticipated by the projectors. This is due in part, no doubt, to the cheap fare as compared with the steam road, the frequency of the service and the convenience of being able to board or alight from a car at the point nearest the passenger's destination; but a large measure of the immediate success of the enterprise must be attributed to the business-like methods employed, which inspired confidence in the management. From the beginning everything has worked smoothly, and it has been evident that the operation of the road was in the hands of

ROCHESTER & EASTERN RAPID RAILWAY COMPANY.

TIME TABLE NO. 4.

IN EFFECT 12.01 A. M. DECEMBER 2, 1903.

READ UP. FIRST-CLASS. WESTBOUND. DAILY. | EASTBOUND. DAILY. FIRST-CLASS. READ DOWN.

†29a	35	33	31	*29	27	25	23	21	19	17	15	13	11	9	7	5	3	*1	Distance from Car Barn	STATIONS.	Distance from Cobbs Hill	2	4	6	8	10	12	14	16	18	20	22	24	*26	28	30	32	34	36	†26a
PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	AM	AM	AM	AM	AM	AM		ARRIVE / DEPART		AM	AM	AM	AM	AM	AM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM
8 26	11 26	10 26	9 26	8 02	7 26	6 26	5 26	4 26	3 26	2 26	1 26	12 26	11 26	10 26	9 26	8 26	7 26	6 26		Rochester		6 30	7 30	8 30	9 30	10 30	11 30	12 30	1 30	2 30	3 30	4 30	5 30	6 30	7 30	8 30	9 30	10 30	11 30	6 30
8 11	11 11	10 11	9 11	7 47	7 11	6 11	5 11	4 11	3 11	2 11	1 11	12 11	11 11	10 11	9 11	8 11	7 11	6 11	24 60	Cobbs Hill	0	6 45	7 45	8 45	9 45	10 45	11 45	12 45	1 45	2 45	3 45	4 45	5 45	6 45	7 45	8 45	9 45	10 45	11 45	6 45
8 10	11 10	10 10	9 10	7 46	7 10	6 10	5 10	4 10	3 10	2 10	1 10	12 10	11 10	10 10	9 10	8 10	7 10	6 10	21 26	Y No. 1	34	6 46	7 46	8 46	9 46	10 46	11 46	12 46	1 46	2 46	3 46	4 46	5 46	6 46	7 46	8 46	9 46	10 46	11 46	6 46
8 00	11 00	10 00	9 00	7 45	7 00	6 00	5 00	4 00	3 00	2 00	1 00	12 00	11 00	10 00	9 00	8 00	7 00	6 00		Siding No. 4		6 56	7 56	8 56	9 56	10 56	11 56	12 56	1 56	2 56	3 56	4 56	5 56	6 56	7 56	8 56	9 56	10 56	11 56	6 56
7 59	**10 59**	**9 59**	**8 59**	7 34	**6 59**	**5 59**	**4 59**	**3 59**	**2 59**	**1 59**	**12 59**	**11 59**	**10 59**	**9 59**	**8 59**	**7 59**	**6 59**	5 59	20 04	Pittsford—Siding No. 5	4 76	**6 59**	**7 59**	**8 59**	**9 59**	**10 59**	**11 59**	**12 59**	**1 59**	**2 59**	**3 59**	**4 59**	**5 59**	**6 59**	**7 59**	**8 59**	**9 59**	**10 59**	11 59	**6 59**
7 54	10 54	9 54	8 54	7 29	6 54	5 54	4 54	3 54	2 54	1 54	12 54	11 54	10 54	9 54	8 54	7 54	6 54	5 54	18 17	Switch No. 7	6 43	7 03	8 03	9 03	10 03	11 03	12 03	1 03	2 03	3 03	4 03	5 03	6 03	7 03	8 03	9 03	10 03	11 03	12 03	7 03
7 51	10 51	9 51	8 51	7 26	6 51	5 51	4 51	3 51	2 51	1 51	12 51	11 51	10 51	9 51	8 51	7 51	6 51	5 51	16 98	Bushnells Basin—Switch No. 8	7 62	7 07	8 07	9 07	10 07	11 07	12 07	1 07	2 07	3 07	4 07	5 07	6 07	7 07	8 07	9 07	10 07	11 07	12 07	7 07
7 42	10 42	9 42	8 42	**7 18**	6 42	5 42	4 42	3 42	2 42	1 42	12 42	11 42	10 42	9 42	8 42	7 42	6 42	5 42	13 01	Fishers—Siding No. 12	11 69	7 16	8 16	9 16	10 16	11 16	12 16	1 16	2 16	3 16	4 16	5 16	6 16	**7 18**	8 16	9 16	10 16	11 16	12 16	7 16
7 37	10 37	9 37	8 37	7 13	6 37	5 37	4 37	3 37	2 37	1 37	12 37	11 37	10 37	9 37	8 37	7 37	6 37	5 37	10 36	Switch No. 14	14 24	7 21	8 21	9 21	10 21	11 21	12 21	1 21	2 21	3 21	4 21	5 21	6 21	7 23	8 21	9 21	10 21	11 21	12 21	7 21
7 36	10 36	9 36	8 36	7 12	6 36	5 36	4 36	3 36	2 36	1 36	12 36	11 36	10 36	9 36	8 36	7 36	6 36	5 36	10 19	Victor	14 50	7 23	8 23	9 23	10 23	11 23	12 23	1 23	2 23	3 23	4 23	5 23	6 23	7 25	8 23	9 23	10 23	11 23	12 23	7 23
7 33	10 33	9 33	8 33		6 33	5 33	4 33	3 33	2 33	1 33	12 33	11 33	10 33	9 33	8 33	7 33	6 33	5 33	8 68	East Victor	15 92	7 25	8 25	9 25	10 25	11 25	12 25	1 25	2 25	3 25	4 25	5 25	6 25	7 28	8 25	9 25	10 25	11 25	12 25	7 25
7 30	10 30	9 30	8 30		6 30	5 30	4 30	3 30	2 30	1 30	12 30	11 30	10 30	9 30	8 30	7 30	6 30	5 30	7 75	Mertensia	16 65	7 28	8 28	9 28	10 28	11 28	12 28	1 28	2 28	3 28	4 28	5 28	6 28	7 31	8 28	9 28	10 28	11 28	12 28	7 28
7 29	**10 29**	**9 29**	**8 29**	7 06	**6 29**	**5 29**	**4 29**	**3 29**	**2 29**	**1 29**	**12 29**	**11 29**	**10 29**	**9 29**	**8 29**	**7 29**	6 29	5 29	7 20	Switch No. 17	17 40	**7 29**	**8 29**	**9 29**	**10 29**	**11 29**	**12 29**	**1 29**	**2 29**	**3 29**	**4 29**	**5 29**	**6 29**	7 33	**8 29**	**9 29**	**10 29**	11 30	12 30	**7 29**
7 27	10 27	9 27	8 27	7 04	6 27	5 27	4 27	3 27	2 27	1 27	12 27	11 27	10 27	9 27	8 27	7 27	6 27	5 27	6 74	Hathaways	17 86	7 31	8 31	9 31	10 31	11 31	12 31	1 31	2 31	3 31	4 31	5 31	6 31	7 34	8 31	9 31	10 31	11 31	12 31	7 31
7 26	10 26	9 26	8 26	7 01	6 26	5 26	4 26	3 26	2 26	1 26	12 26	11 26	10 26	9 26	8 26	7 26	6 26	5 26	6 51	Siding No. 18	18 09	7 32	8 32	9 32	10 32	11 32	12 32	1 32	2 32	3 32	4 32	5 32	6 32	7 35	8 32	9 32	10 32	11 32	12 32	7 32
7 18	10 18	9 18	8 18		6 18	5 18	4 18	3 18	2 18	1 18	12 18	11 18	10 18	9 18	8 18	7 18	6 18	5 18	4 42	Padelfords	20 16	7 39	8 39	9 39	10 39	11 39	12 39	1 39	2 39	3 39	4 39	5 39	6 39	7 41	8 39	9 39	10 37	11 37	12 37	7 37
7 10	10 10	9 10	8 10		6 10	5 10	4 10	3 10	2 10	1 10	12 10	11 10	10 10	9 10	8 10	7 10	6 10	5 10	1 40	Orphan Asylum	23 20	7 46	8 46	9 46	10 46	11 46	12 46	1 46	2 46	3 46	4 46	5 46	6 46	7 46	8 46	9 46	10 43	11 43	12 43	7 43
7 09	10 09	9 09	8 09	**6 48**	6 09	5 09	4 09	3 09	2 09	1 09	12 09	11 09	10 09	9 09	8 09	7 09	6 09	5 09		McKechnie Siding		7 48	8 48	9 48	10 48	11 48	12 48	1 48	2 48	3 48	4 48	5 48	**6 48**	7 49	8 48	9 48	10 44	11 44	12 44	7 44
7 06	10 06	9 06	8 06	—	6 06	5 06	4 06	3 06	2 06	1 06	12 06	11 06	10 06	9 06	8 06	7 06	6 06	5 06		Mechanic Street		7 50	8 50	9 50	10 50	11 50	12 50	1 50	2 50	3 50	4 50	5 50	6 50	7 50	8 50	9 50	......	......	......	7 50
7 03	10 03	9 03	8 03		6 03	5 03	4 03	3 03	2 03	1 03	12 03	11 03	10 03	9 03	8 03	7 03	6 03	5 03	...	Court House Siding		7 52	8 52	9 52	10 52	11 52	12 52	1 52	2 52	3 52	4 52	5 52	6 52	7 52	8 52	9 52	......	......	......	7 52
7 00	10 00	9 00	8 00	6 45	6 00	5 00	4 00	3 00	2 00	1 00	12 00	11 00	10 00	9 00	8 00	7 00	6 00	5 00	0	Canandaigua	24 60	7 55	8 55	9 55	10 55	11 55	12 55	1 55	2 55	3 55	4 55	5 55	6 55	7 55	8 55	9 55	10 50	11 50	12 50	7 55
																				Phelps Street Y																				
																6 50	5 50	4 50		DEPART Car Barn ARRIVE																	11 00	12 00	1 00	
PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	NOON	AM	AM	AM	AM	AM	AM				AM	AM	AM	AM	AM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	AM	AM	PM
†29a	35	33	31	*29	27	25	23	21	19	17	15	13	11	9	7	5	3	*1				2	4	6	8	10	12	14	16	18	20	22	24	*26	28	30	32	34	36	†26a

This Time Table is for the information of employees only, and the Company reserves the right to vary therefrom as circumstances may require. *Daily except Sunday. †Sunday Only.
Trains in either direction have no superior right over trains in opposite direction, but will meet trains as per Time Table, unless otherwise ordered by the Despatcher.
Heavy figures denote regular meeting points. Small figures appearing above show number of opposing train. Work trains must clear all regular trains by 5 minutes
Train 29 stops only at Canandaigua, Hathaways, Victor, Fishers, Bushnells Basin, Palmyra Road, Pittsford, and all regular stops west of Pittsford.

J. H. PARDEE, GENERAL MANAGER. W. R. W. GRIFFIN, OPERATING SUPERINTENDENT. W. G. PARK, CHIEF TRAIN DESPATCHER.

SCHEDULE BETWEEN ROCHESTER AND CANANDAIGUA

experienced railroad men. The cars are run at regular intervals, and a schedule for all important points has been arranged, so that those at intermediate stopping places can estimate closely the time a car will pass in either direction. The latest time-table is reproduced on page 98.

Cash fare and ticket-rate sheets are also given, showing mileage and fare between Rochester and any point on the line now in operation. The basis of cash-fare rates is 2 cents per mile, and of ticket rates 1½ cents per mile. No tickets of any kind are sold by conductors except 100-mile books, for the accommodation of patrons to points at which there are no ticket offices. Mileage books are issued on the following terms: One thousand-mile book, at 1.2 cents, $12.00; 500-mile book, at

CASH FARES

MILEAGE

Rochester	05	05	.05	10	10	10	15	20	20	.20	25	25	25	25	25	.25	30	30	35	35	35	35	40	40	45	45	45	50	50	55	1
3	Cobbs Hill	05	.05	.05	05	05	10	15	15	15	20	.20	20	20	20	20	.25	25	30	30	30	30	35	35	40	40	40	45	45	50	2
4	1	[illegible]	05	05	05	05	10	15	15	15	20	20	20	20	20	20	.25	.25	30	30	30	30	35	35	40	40	40	45	.45	50	3
4	1	1	[illegible]	05	05	.05	10	15	15	15	20	.20	20	20	20	20	25	.25	30	30	30	30	35	.35	40	40	40	45	45	50	4
5	2	1	1	[illegible]	.05	.05	.05	10	10	10	.15	.15	15	15	20	20	20	25	25	25	.25	30	30	35	35	40	40	40	45	45	5
6	3	3	2	2	[illegible]	05	05	10	10	10	15	.15	.15	15	15	20	20	20	25	25	25	30	30	30	.35	35	35	40	40	45	6
7	4	3	3	2	1	[illegible]	05	05	10	10	.15	15	15	15	15	15	20	.20	25	25	25	25	30	30	35	35	35	.40	40	45	7
8	5	5	4	4	3	2	[illegible]	05	05	10	.10	10	10	10	10	15	15	20	20	20	20	25	25	25	30	30	30	35	35	40	8
9	6	6	6	5	4	3	2	[illegible]	05	05	05	10	10	10	10	.10	.10	15	15	.15	20	20	20	.25	25	30	30	30	35	40	9
10	7	7	7	6	5	4	3	2	[illegible]	05	05	05	05	.05	10	10	10	10	15	15	15	20	.20	20	25	25	.25	30	35	35	10
11	8	8	7	7	6	5	4	2	1	[illegible]	05	05	05	05	05	10	10	10	.15	.15	15	20	20	20	25	25	25	30	30	.35	11
12	9	8	8	7	6	5	4	3	2	1	[illegible]	.05	05	05	05	05	10	10	15	15	15	15	.20	20	20	25	25	30	30	35	12
12	9	9	9	8	7	6	5	3	2	2	1	[illegible]	05	05	05	.05	05	10	10	10	.10	.15	15	20	20	25	25	.25	30	30	13
13	10	9	9	8	7	6	5	4	3	2	2	1	[illegible]	05	05	05	.05	10	10	10	10	15	.15	20	20	20	20	25	30	30	14
13	10	9	9	9	8	7	6	4	3	3	2	1	1	[illegible]	05	05	05	05	10	10	10	15	.15	.15	20	20	.20	25	.25	30	15
14	11	10	10	9	8	7	6	5	4	3	3	2	1	1	[illegible]	05	05	.05	10	10	10	10	.15	15	20	.20	20	25	25	30	16
14	11	11	10	10	9	8	7	5	4	4	3	2	2	2	1	[illegible]	.05	.05	10	10	10	.10	.15	15	20	20	20	25	25	30	17
15	12	12	11	11	10	9	8	6	5	4	4	3	3	2	2	1	[illegible]	.05	05	05	10	10	10	15	15	15	15	20	25	25	18
16	13	13	12	12	11	10	9	7	6	6	5	4	4	3	3	2	2	[illegible]	05	05	.05	10	10	10	.15	15	15	20	20	.25	19
18	15	14	14	13	12	11	10	9	8	7	7	6	5	5	4	4	3	2	[illegible]	05	05	05	05	10	10	.10	10	15	15	20	20
18	15	15	14	14	13	12	10	9	8	7	7	6	6	5	5	4	3	2	1	[illegible]	05	05	05	10	10	10	10	15	.15	20	21
19	16	15	15	14	13	12	11	10	9	8	8	7	6	6	6	5	4	3	2	1	[illegible]	05	05	05	10	10	10	15	15	20	22
19	16	16	16	15	14	13	12	10	9	9	8	7	7	7	6	6	5	4	2	2	1	[illegible]	.05	05	10	.10	10	15	15	20	23
20	17	17	17	16	15	14	13	11	10	10	9	8	8	8	7	7	6	5	3	3	2	1	[illegible]	05	05	05	.10	10	10	15	24
21	18	18	18	17	16	15	14	12	11	11	10	9	9	9	8	8	7	6	4	4	3	2	1	[illegible]	05	05	05	10	10	.15	25
22	19	19	19	18	17	16	15	14	12	12	11	10	10	10	9	9	8	7	5	5	4	4	3	1	[illegible]	05	05	05	10	10	26
23	20	20	19	19	18	17	16	14	13	13	12	11	11	10	10	9	9	7	6	6	5	4	3	2	1	[illegible]	05	05	10	.10	27
24	21	20	20	19	18	17	16	15	14	13	13	12	11	11	10	10	9	8	6	6	5	5	4	3	2	1	[illegible]	05	05	10	28
25	22	22	22	21	20	19	18	16	15	15	14	13	13	13	12	12	11	10	8	8	7	6	6	4	3	3	2	[illegible]	.05	10	29
27	24	23	23	22	21	20	19	18	17	16	16	15	14	14	13	13	12	11	9	9	8	8	7	6	5	4	4	2	[illegible]	.05	30
28	25	25	24	24	23	22	20	19	18	17	17	16	16	15	15	14	13	12	11	10	10	9	8	7	6	5	5	3	2	Canandaigua	31

Street Ry. Journal

MILEAGE AND CASH FARES OVER PRESENT LINE

1.3 cents, $6.50; 100-mile book, at 1½ cents, $1.50. Monthly commutation tickets, entitling the holder to fifty-four rides, are sold for points between Victor and Canandaigua, and similar tickets for those attending school are issued at special rate.

Accompanying the rate sheets here mentioned, which is shown on this page, the company has issued the following instructions to conductors: "Punch date in cover of each mileage book sold. Detach agent's stub when book is sold and auditor's check when first coupons are detached, and send stubs to auditor with trip report. Mileage books are not limited, and are good for any person, and coupons may be detached for more than one fare from the same book. You will detach one coupon for each mile traveled, according to mileage schedule, but in no event shall less than four coupons be detached for each fare, and mileage is not good for local fares in Rochester, Canandaigua and Geneva. On the back of coupons detached you will write the numbers of stations from and to which passengers travel, thus $\frac{7}{21}$—2, entering the number of the leaving station above the line, and the number of the arriving station below the line, and at the right-hand side the number of persons transported, if more than one. Cash fares shall be charged as shown on cash fares schedule. A duplex ticket shall be issued for each cash fare, except $.05 and $.10 cash fares, which shall be rung on fare register, if same is in car. If there is no fare register in car issue duplex. The auditor's half of the ticket must be turned in with trip report."

In considering the possibility of building up a large patronage for this road attention must be given the material inducements offered by the new company. In addition to frequent service in comfortable cars and other conveniences, such as stopping on signal, a considerable difference in fare is offered. For instance, a single fare between Rochester and Canandaigua, the present terminal points, is 58 cents on the steam road, and 45 cents on the electric, while round-trip tickets are sold for 75 cents on the electric and $1.10 on the New York Central. Corresponding reductions are made for other points by the electric company, and, consequently, the new road is attracting a considerable portion of the patronage formerly enjoyed by the steam road; moreover, it is encouraging people to travel, building up a new clientele of its own, and developing a large business between neighboring stations.

FREIGHT AND EXPRESS

In addition to the passenger business the company expects eventually to engage in the handling of freight and express, but this service has not yet been put on. It is expected that the express service will be started early in the year, and when the line is opened to Geneva considerable business of this kind is looked for.

ORGANIZATION AND MANAGEMENT

The Rochester & Eastern, from Canandaigua to Rochester, has been taken over by the railroad company from the contractors, the Comstock-Haigh-Walker Company, and has been in operation between those points since Oct. 15, 1903. The line from Canandaigua to Geneva is in the final stage of construction, and it is anticipated that it will be in operation, even with most unfavorable weather conditions, by April 1. The traffic from Rochester to Canandaigua has been more than satisfactory to the builders and owners.

The officers of the Rochester & Eastern Rapid Railway Company are: President, W. B. Comstock, Alpena, Mich.; vice-president, A. L. Parker, Detroit; secretary, W. A. Comstock, Canandaigua; treasurer, Henry A. Haigh, Detroit; engineer, F. W. Walker, Canandaigua; general manager, J. H. Pardee, Canandaigua; superintendent, W. R. W. Griffin, Canandaigua; chief despatcher, W. G. Park, Canandaigua; auditor, E. E. Lentz, Canandaigua.

THE NEAR CORNER ORDINANCE IN NEW YORK

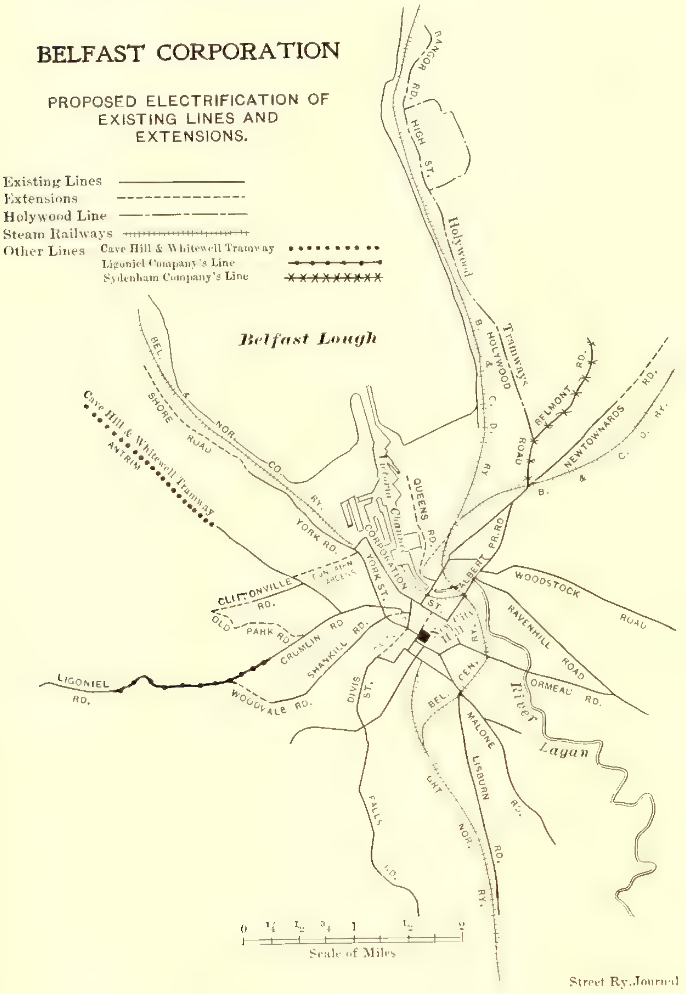
The ordinance recently passed in New York City requiring all surface cars to stop on the near side of the street does not go into effect in Manhattan and The Bronx until Jan. 17. In Brooklyn, however, the cars commenced to stop on the near corner on Jan. 1, and during the last two weeks there have been a great many complaints in the public press from those who do not like the new plan.

Unfortunately for the success of the innovation the city streets since the first of the year have been in an exceptionally bad condition from mud and slush, alternated with large banks of snow from the recent storms, which have not yet been carted away. It is doubtful whether a worse period of the year could have been chosen for the trial. Those passengers who have left the car by the rear platform have often encountered considerable difficulty in reaching the sidewalk dry-shod. On the other hand, it has been a frequent cause of complaint that those who choose the front platform for making their exit, would open the door some time before the car stopped, letting a cold draught blow upon the seated passengers, and would neglect to close the door after leaving the car.

It remains to be seen how the new plan will fit the habits of the patrons of the Interurban Street Railway Company. If the streets are in good condition, a not very likely event in midwinter, the trial may be successful. If not, there will probably be a repetition of the complaints which are now being heard on the Brooklyn side of the East River. In view of the frequent proposals of this plan, it is sincerely to be hoped that a fair trial, at least, will be given it by the public.

IMPROVEMENTS TO THE BELFAST CORPORATION TRAMWAYS

The tramways in the city of Belfast date from 1872, when a system of horse roads was built by a London company. This system has been constantly extended, until at the present time it consists of some 45 track miles owned by the company, and 7 miles operated by the company, and leased from the city. In the days when most of the tramways were worked by horse traction, Belfast was in many ways considered the pioneer system, being as up-to-date as any other in the Kingdom. Up to quite



MAP OF BELFAST LINES AND EXTENSIONS

recently the service compared favorably with that of the horse systems in London, but during the past few years the approaching termination of the company's concession has naturally had its effect upon the management.

To explain why such a large system still remains unelectrified involves more space than can here be given. It is sufficient to say that negotiations have been in hand between the city corporation and the company for many years, but hitherto without result. Under the terms of the original act the former could buy the company out in 1893, but this right was not exercised, and the franchise was extended for a period of fourteen years. This period terminates in 1907, but the city has suffered so much from the want of electric traction that it is applying to Parliament for a bill to exercise the powers of purchase without further delay.

In addition to operating its own system, the company, as stated above, operates certain lines built by and belonging to the city under Parliamentary powers granted in 1898, and has also purchased two small lines to Legoniel and Strantown respectively.

In addition to the powers for purchasing and electrifying the above lines, the bill includes the right to build a number of extensions which are indicated by broken lines on the map accompanying this article. None of the extensions, and only a small portion of the present system go beyond the city limits.

The extension scheme, which has been designed by the firm of Charles H. Merz, which is acting as consulting engineers to the corporation in connection with all of the work, involves some £200,000, and includes, not only the doubling of many existing lines, but a number of new lines as well. Certain of these are in the center of the city and are proposed with the object of reducing the congestion which would otherwise result from the concentration of all the cars at one point. Others are in the nature of loop lines, or are extensions on the ends of the present spurs, reaching, in most of cases, to the city boundary.

The entire system, when completed, will comprise some 76 track miles in a city with a population of 370,000, as against Dublin's 92 miles with a population of 350,000. While the city is fortunate in having recently extended its boundaries so that it has a considerable area for its scene of operations, it is nevertheless somewhat restricted as regards reaching country districts. There are numerous directions in which it would be desirable to make extensions, and a line is being promoted this session between Belfast and Holywood, a seaside resort some 3 miles away.

The policy of the city has been that, while it would oppose any company seeking compulsory running powers over its system, it is willing to favor the promotion of any lines on the outskirts of the city, realizing that they will be useful feeders to its own system, as well as giving greatly improved facilities to the citizens for holiday traffic. Such a course is undoubtedly the only reasonable one for local authorities to take, inasmuch as these country lines supply a need which they cannot themselves supply, and the only result of opposing them hitherto has been that the company has succeeded in getting compulsory running powers in spite of the corporation.

The Holywood line, which is also shown on the map, will be seen to be parallel with the line of the County Down Railway Company, which, on pressure, is likely to oppose it. It is, however, being strongly supported by all the local authorities, and in view of the complete failure of the railway companies during the past few sessions to get Parliament to pay any attention to the plea of competition, there can be little doubt that it will be successful.

The electrical energy for operating the line will probably be obtained from the existing lighting station.

RECORD CARDS USED IN ROCHESTER REPAIR SHOPS

The Rochester Railway Company has adopted a form of card record for the mechanical departments which has many points

No. IN DATE

THIS CARD MUST BE SENT TO MASTER MECHANIC WHEN CAR IS IN GOOD ORDER.

	OUT OF ORDER	WORK DONE	REP. BY
BRAKES			
MOTORS			
CONTROL'RS			
WIRES			
BODY			
HEATERS			
TRUCKS			

This Car Put in Order M. 190

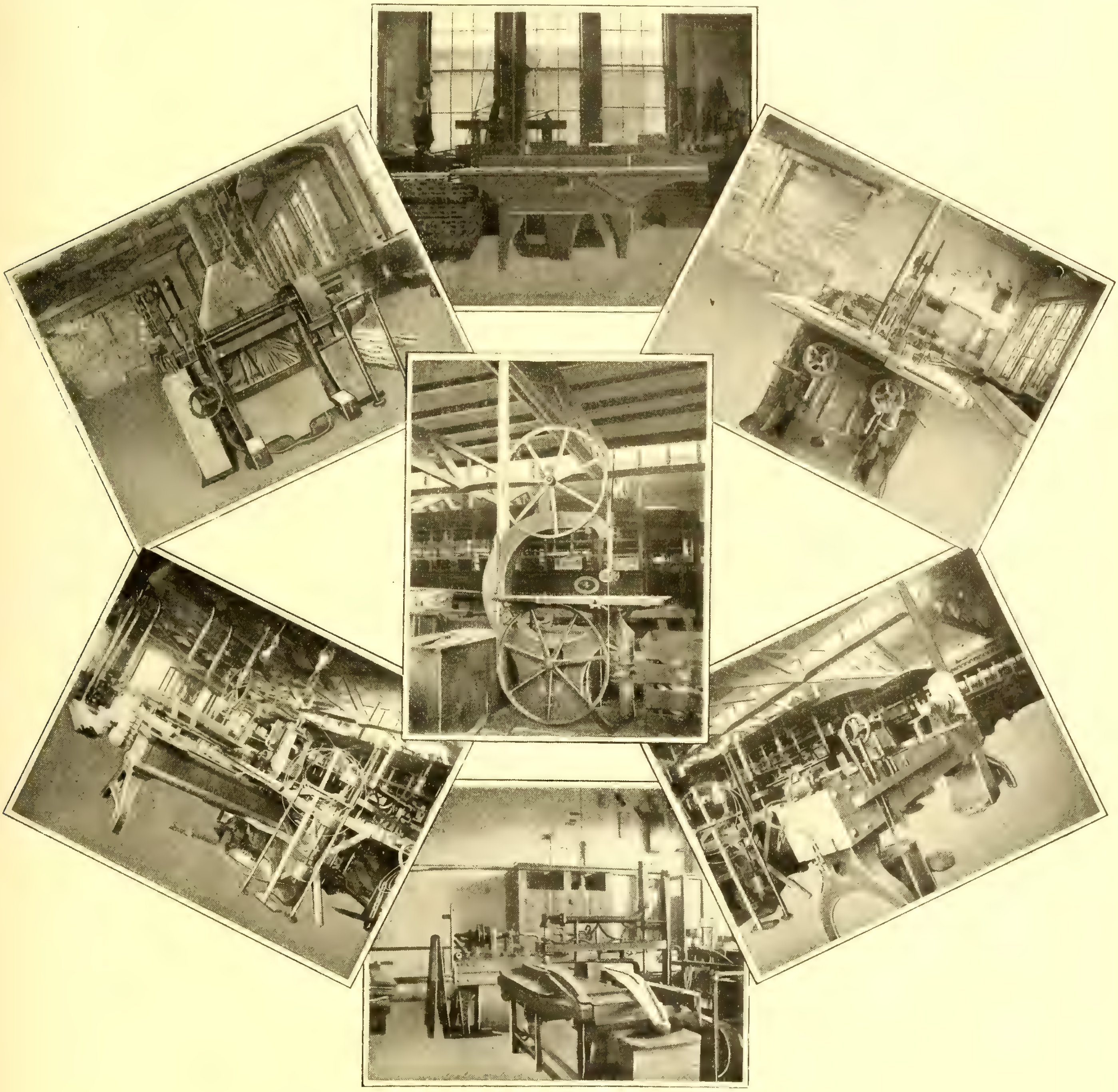
Station Foreman.

CARD RECORD FOR REPAIR SHOPS

of merit. The card itself is 6 ins. wide and 4 ins. high, and may be printed on white or colored paper, so as to make a distinction between different classes of cars or branches. In

Rochester three colors are used, one for cars employed in city service and the other two for suburbans and interurbans controlled by the city company. By examining the cut presented herewith it will be noticed that there is a blank space left for the car number, the color of the ticket indicating the service in which it is engaged. These tickets must be filled out and signed by the foreman of the shop in which the repairs are made, and sent to the master mechanic every night at the close of working hours. The ticket itself needs no explanation, as it presents at a glance the information required about the car.

These cards are all filed in a box, which may be made any convenient length, depending entirely on the number of cars employed in the system and the amount of repair work done in the shops. In filing, each card is placed in its regular order, both in color and numerically, and in case there have been several cards turned in for one car within a short time, the master mechanic's attention will be attracted to the fact, and an investigation instituted at once, if necessary, to learn why that particular car has been in the shop so often, or, if it appears that the same trouble has happened more than once, the question of responsibility may be determined. One of the chief advantages of the system, therefore, is that it serves as a reminder and record at the same time, whereas, if shop reports were merely entered in a book they could not be consulted as frequently and conveniently by the master mechanic, as the book would be in the hands of a clerk most of the time with the other records. Now the significant facts are brought to the attention of the master mechanic every night when the foremen file their cards.



VIEWS OF WOOD-WORKING DEPARTMENT IN ROCHESTER CAR SHOPS

NEW SHOP EQUIPMENT

The necessity for a system of this kind has been felt by the company for a long time, as the amount of work done in the shops is constantly increasing. This is partly due to the fact that the company has taken over additional properties and that the city equipment is growing all the time. In addition to the repair work now on hand the company is at present putting six new cars of its standard type through the shops. These will be ready for service very shortly.

Several views of the shop and the mechanical equipment are presented herewith. The company has added to its original

equipment, which has been thoroughly described, together with the shops in these columns. Conspicuous among the machines shown in the cut are the following: A 20-in. jointer and a 24-in. planer, a two-spindle shaper and a 34-in. band-saw of the Clements pattern. A 7-in. tenoner is also shown. Among the most interesting machines, however, is the 20-in. swing turning lathe, on which is a band-saw brazer with a Bunsen burner. A router, made in the shops from a Sanderson sand-papering machine, is also illustrated, and, as will be seen, it is used for working out car posts.

In addition to the machines shown is a large cut-off saw, of the Woods pattern, used for cutting heavy timber, the diameter of the saw being 36 ins., and a double saw-table, the size of the saw used being 14 ins. A mortising machine is also in use, but as it is an upright No. 2½ it is rather light for the work now done. The company also uses a 7-in. four-sided sticker.

Other departments of the shop are equally well equipped, and, altogether, it will be seen that for its size the Rochester Railway Company is prepared to do considerable work in the way of building new equipment as well as making repairs. Alfred Green, the master mechanic and chief electrician of the company, is in charge of this department.

SOME POSSIBILITIES OF THE ALTERNATING-CURRENT SINGLE-PHASE RAILWAY MOTOR*

BY. A. H. ARMSTRONG

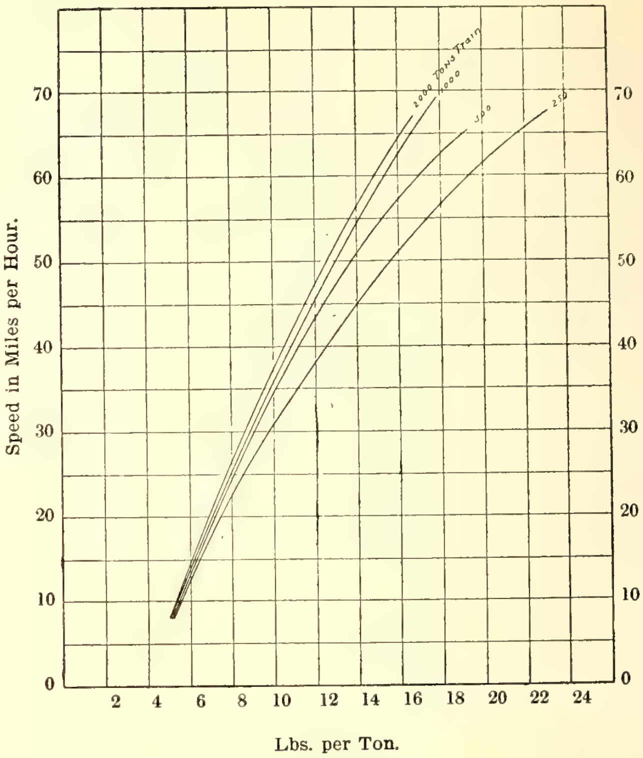
The electric railway motor has replaced the horse and cable on our city streets, the steam locomotive on overhead and underground rapid transit lines, and has conclusively proved its exclusive right to operate suburban cars over distances reaching more than 50 miles from the outskirts of larger cities. All this has been accomplished with the direct-current series motor operating at a potential approximating 600 volts and with alternating-current distribution to suitably located rotary converter sub-stations. There are isolated cases where the electric motor has replaced the steam locomotive on steam lines, and where this has been done the increase in the dividend earning power of the road has been sufficiently great to warrant the extension of the electric service and the changing over of more steam-operated lines. With the commercial development of the alternating-current railway motor, new possibilities are introduced in electric railroading, owing to the much higher voltages for which the motor itself can be wound, and due also to the fact that alternating current is used directly as motive power without the expensive transforming apparatus required for the direct-current series motor.

The alternating three-phase induction motor has been applied to traction work with doubtful success, owing to its practically synchronous characteristic, its limited output making it sensitive to the heavy voltage drops liable to occur in railway work, and due, furthermore, to the complication of double overhead trolley required for this type of motor.

During the past few years there have been developed several types of single-phase alternating-current motors having speed-torque characteristics even better adapted for railway work than that of the direct-current series motor, and, furthermore, providing ample starting torque with any voltage variation liable to occur in practical electric railway operation. As these motors can be operated with a single trolley and ground return, and can, furthermore, be operated satisfactorily on either direct or alternating current, it makes their field of usefulness much greater than their direct-current series competitor.

Having such a motor with practically no restriction as to voltage, it is possible to break away from the exclusive field of electric traction with frequent service and small units and consider the operation of freight and passenger trains over our regular steam lines. In order to arrive at some general conclusions not limited by the local considerations of a specific case, this paper is devoted to a somewhat brief and general discussion of the operation of our steam lines by the alternating-current railway motor.

To make the conclusions general, trains of different weight have been taken, operating at different speeds and varying



CURVE SHEET NO. 1, TRAIN FRICTION CURVES

headway over a level track. As being typical, train weights of 2000, 1000, 500 and 250 tons of 2000 lbs. have been selected. As the investigation of the operation of these trains will be carried to maximum speeds of 60 m. p. h. to 70 m. p. h., the total friction of the train expressed in pounds per ton is given in curve sheet 1. This friction is not that of the trailing load, but includes the running and wind friction of the locomotive itself.

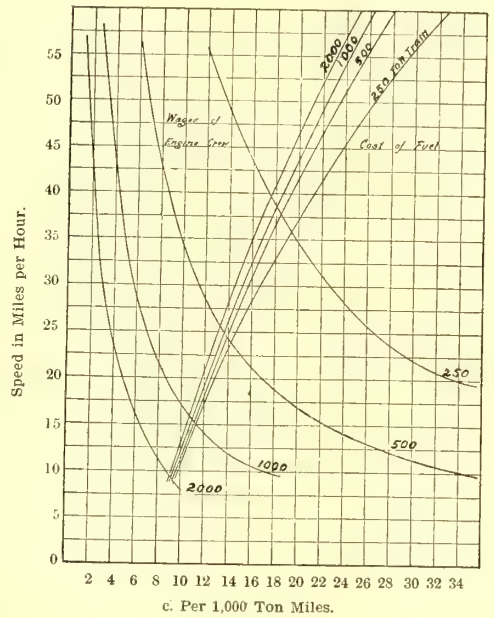
From a number of tests a steam consumption of approximately 30 lbs. per indicated horse-power-hour is taken as the basis of all locomotive work. It is assumed that locomotives are compound, as this steam consumption could hardly be expected with simple engines under average conditions. To make all results comparable further assumptions are made of an evaporation of 7 lbs. of water per pound of coal, an engine efficiency of 85 per cent, and cost of coal at $2 per ton of 2240 lbs. The price of fuel will vary, and this is considered later. As we are figuring upon actual performance of the locomotive, that is, work done in overcoming train friction, it will be necessary to introduce a factor allowing for coal wasted in making up and damping fires, and general waste incident to locomotive practice when standing idle for a large part of the 24 hours. Furthermore, a steam locomotive is called upon to operate throughout the year at varying temperatures of the surrounding air, and coal consumption during the winter months is in excess of that during the summer. This excess may reach 20 per cent as an average during the cold weather, and hence 10 per cent additional fuel is charged to the locomotive for the work assumed, to take care of the different conditions of operation which the electric locomotive does not have to contend with.

*Paper read before the Electrical Section of the Canadian Society of Civil Engineers, Nov. 19, 1903.

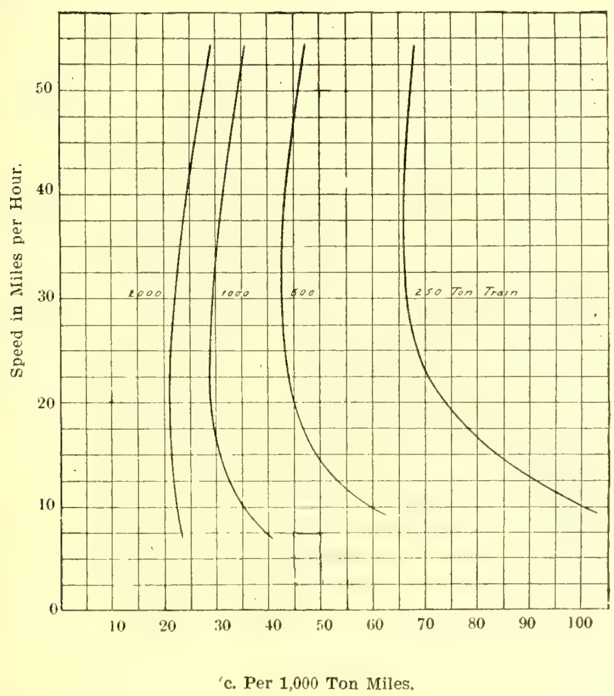
On the basis of the above assumptions, all of which are the result of practical tests, curve sheet 2 is obtained.

These figures check up reasonably close with the locomotive performance sheets for steam roads after superfluous mileage has been deducted from the total mileage given. As an example, the shifting locomotives and pushers are charged with so many miles per hour, and often do not make one-third the mileage charged to them, so that locomotive performance sheets, as published, sometimes indicate too low a coal consumption per 1000-ton mile of actual work done.

The next item of considerable expense in steam operation is the labor account. As it is immaterial to the train crew whether steam or electric locomotives are supplied, this item will not be entered into. The engineer and fireman, however, are greatly influenced by the character of the motive power. In steam operation a crew working 10 hours a day average for the railroad company will not be in actual service on the road more than 40 per cent or 50 per cent of the time, the remainder of the time being taken up in caring for the locomotive. In electrical operation the full time of the crew can be utilized for active duty, and hence a considerable saving effected in this item. In steam operation a crew costing $8.50 for 10 hours labor has been assumed to be in



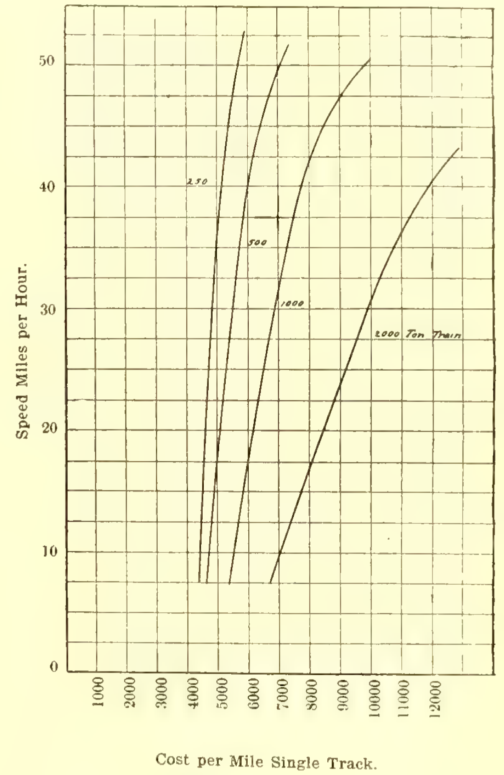
CURVE SHEET NO. 2, COST OF STEAM OPERATION—COAL $2.00 PER 2240 LBS



CURVE SHEET NO. 3, COST OF STEAM OPERATION—COAL $2.00 PER 2240 LBS

active commission for 5 hours per day, while in electric service the crew is assumed to be in commission 8.3 hours per day out of the ten. For shorter hours of labor the same proportion would hold true, and the crew for the electric locomotive will cost but 60 per cent of that for the steam locomotive. The cost of wages per 1000-ton mile is given in curve sheet 2.

In order to approximate the repairs on steam locomotives of different capacities, it is assumed that the locomotive will have



CURVE SHEET NO. 4, COST OF ELECTRICAL INSTALLATION, TEN TRAINS EACH WAY PER DAY

its weight proportioned to the trains which it is to handle, and as a basis of the repair item the following values are assumed, agreeing closely with the results of compound locomotives in actual service:

STEAM OPERATION—REPAIRS, CENTS PER 1000-TON MILE

	Cents
250 tons	25.
500 tons	13.6
1,000 tons	7.7
2,000 tons	3.3

The items of oil, waste and water are not determined here at length, but are introduced in the final values obtained for operating expense. Combining the figures obtained above for steam operation, including fuel at $2 per 2,240 lbs., engine crew at $8.50 per 10 hours (five of which are in actual service), repairs, oil, waste, water, etc., the results in curve sheet 3 are obtained.

It is evident from the curves that each weight train can be run at a certain speed with a minimum expense for operation, this speed varying with the weight of the train. This economical speed will, of course, vary with any variation of the constants assumed above, such as the price of coal, labor, etc., but the values obtained are instructive and are given below:

SPEEDS OF ECONOMICAL OPERATION

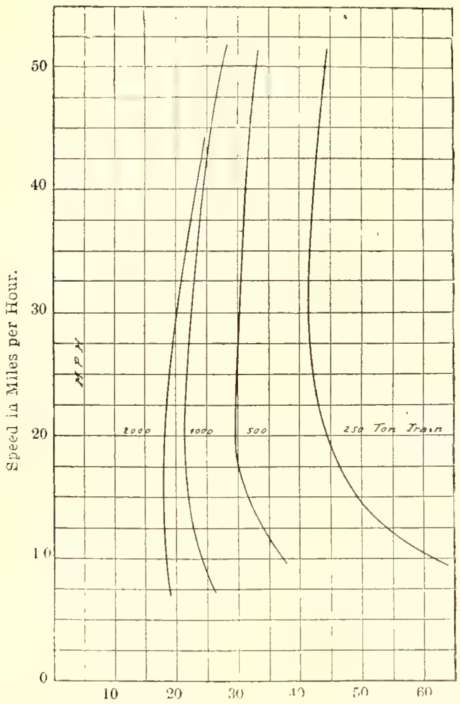
	M. P. H.
250 tons	38
500 tons	28
1,000 tons	23
2,000 tons	19

Considerable latitude is given above and below these speeds without greatly increasing expense per 1000-ton mile for operation.

Coming now to the determination of the cost of operating an electrically-propelled train under the same conditions, we arrive at some very interesting results due to the low first cost of electrically equipping the proposed steam line afforded by the alternating-current single-phase motor.

The same friction values are used as given in curve sheet 1

for steam operation. From these values the kilowatt capacity of each train is determined for the different speeds and varying weights of trains. From these values the cost of trolley copper, step-down line transformers and generating station are determined. The electrical system consists, in brief, of a generating station controlling 100 miles of track, that is, feeding 50 miles in either direction. At intervals of approximately 12 miles are installed step-down transformers reducing the transmission potential to 3000 volts or more for the trolley potential. This trolley potential is assumed at 3000 volts for a good majority of the results, but for heavy work, that is, 1000-ton and 2000-ton miles, the voltage is somewhat increased, but nowhere exceeds a safe operating value. The transmission potentials also are kept entirely within practical limits. The generating station does not get excessively large, and the electrical system throughout presents no features of unusual interest, but rather duplicates work that is being done throughout the country. By keeping all values within conservative limits, the results obtained become of practical application and not of theoretical interest.



CURVE SHEET NO. 5, COST OF ELECTRIC OPERATION—COAL $2.00 PER 2240 LBS

The cost of installing the electric system complete, including generating station, transformer sub-stations, transmission line, pole, bonding of track, etc., is given in the following table:

COST OF ELECTRICAL INSTALLATION—COST PER MILE SINGLE TRACK

M. P. H.	Five trains each way	Ten trains each way	Twenty trains each way
	2,000-ton Train		
10	5,600	7,020	9,860
20	6,520	8,490	12,430
30	8,510	9,840	14,580
40	11,690	11,910	16,770
	1,000-ton Train		
10	4,800	5,500	6,920
20	5,200	6,200	8,100
30	6,250	6,900	9,400
40	7,600	7,700	10,600
50	9,820	9,820	12,700
	500-ton Train		
10	4,400	4,700	5,400
20	4,500	5,100	6,000
30	5,100	5,500	6,800
40	5,900	6,000	7,500
50	7,100	7,100	8,600
	250-ton Train		
10	4,200	4,400	4,800
20	4,300	4,600	5,000
30	4,600	4,800	5,400
40	5,100	5,200	6,000
50	5,700	5,700	6,600

The above tables are given at length, as they form very interesting reading, showing how the cost increases with the size of the unit rather than by the frequency of the trains. Also it is very necessary to arrive at an initial cost of electrical installation somewhat accurately, as this constitutes a funded debt upon which the saving, if any, between electrical and steam operation must pay dividends.

In determining the cost of electrical operation it has been necessary to consider the cost of producing power, and a sliding scale has been taken for the different kilowatt outputs, ranging from 4 mills per kilowatt-hour to nine or more, with coal at $2 per ton, depending upon the kilowatt capacity of the generating station. It is assumed that steam turbines and modern methods of generating station construction are used, looking to the greatest economy of operation. Wages of engine crew, as stated, are taken at 60 per cent of those for steam operation. Repairs for electrical locomotives are given in the following table:

ELECTRICAL LOCOMOTIVE REPAIRS

250 tons	8.	cents per 1,000-ton mile
500 tons	4.8	" " "
1,000 tons	2.3	" " "
2,000 tons	1.	" " "

These repairs, in common with that given for steam operation, include all running repairs, overhauling and renewals. The cost of electrical operation is given complete in curve sheet 5, which is directly comparable to the cost of operation for steam previously given. It is obvious that as there is a fixed charge of 5 per cent depreciation and repair account on the entire electrical installation, it is necessary to consider the frequency of travel over our proposed route. In order to make it as general as possible, it has been assumed that there will be five, ten and twenty trains per day each way. The cost of operation, expressed in cents per 1000-ton mile, does not vary greatly with the different frequency of trains, but the dividend account must be based upon a selected train frequency. For convenience, a train frequency of ten per day each way is taken, and the cost of electrical operation given. For other frequency of trains, the cost of operation per 1000-ton mile will not vary more than 1 cent or 2 cents either way from the results given in the curves, and they are, therefore, of fairly general application.

By comparing this curve with that given for steam operation, a considerable saving is shown, giving varying dividends depending upon the frequency of travel, weight of train, maximum speed, etc. In fact, frequency of travel and weight of train are the determining features in considering the adoption of electric transportation. In order to show the dividend-earning power, that is, the saving in electric operation over steam as the percentage of the cost for electrical installation, the three following tables have been prepared for a frequency of train service of five, ten and twenty trains each way per day:

INTEREST ON ELECTRICAL INVESTMENT

Five Trains Per Day Each Way

M. P. H.	2000 Tons	1000 Tons	500 Tons	250 Tons
10	5.75%	8.17%	9.25%	9.22%
20	3.88	4.92	5.73	6.02
30	1.81	3.82	4.1	4.85
40	....	3.47	3.68	4.07
50	....	....	3.36	3.74

Ten Trains Per Day Each Way

M. P. H.	2000 Tons	1000 Tons	500 Tons	250 Tons
10	8.48%	14.8 %	17.5 %	18.3 %
20	4.68	8.87	11.05	11.9
30	1.31	7.2	8.1	9.65
40	....	6.8	7.62	8.14
50	....	....	6.72	7.48

Twenty Trains Per Day Each Way

M. P. H.	2000 Tons	1000 Tons	500 Tons	250 Tons
10	8.92%	23.1 %	31.4 %	34.5 %
20	2.6	12.9	19.1	22.1
30	....	9.8	13.65	17.8
40	....	9.73	12.8	15.[illegible]
50	....	....	11.25	13.7

As shown by the above tables, electric locomotives cannot compete with steam for trains of 2000 tons at higher speeds, owing to the enormous cost of equipping the road electrically with the constants chosen. Should such heavy railroading be contemplated electrically, it would be necessary to adopt longer transmissions than the 50 miles either way from the power house assumed, and which is very conservative, also the use of higher voltages on the trolley than the 5000 volts or 6000 volts maximum assumed in arriving at the tables. The scope of the paper has been limited, however, to the use of standard apparatus and the voltages met with in every-day practice. The results given thus represent the practice of to-day and not what electrical engineers may be able to do sometime in the future. The consideration of the operation of 2000-ton trains at speeds of 50 m. p. h. or 60 m. p. h. is hypothetical, as no steam locomotive could be constructed that would furnish sufficient power to haul a train of this weight at the speeds considered. The problem is feasible from an electrical standpoint, as the weight of the locomotive could be distributed among a number of units distributed throughout the train to lessen the draw-bar pull without exceeding a permissible weight per axle.

The discussion of the paper has been limited thus far to the use of coal costing $2 per ton for both steam and electric locomotive work. It is a well-known fact that generating stations can use cheaper coal than it is economical to use on steam locomotives, and hence it is interesting to follow through the results with varying prices of coal. In figuring the cost of coal, it is assumed that coal will be charged to operation at the price for which it could be sold in the wholesale market at the locality used. Coal at $2 per ton is somewhat cheap, especially for some of the Western roads, and the same method of figuring has been used in determining the earning capacity of the electrical installation for $3 and $4 coal as well. As the saving in electrical operation and its percentage of the cost of installing the electrical system are of fundamental importance, the tables for interest-earning capacity, expressed as percentage of the electrical installation, is given in the following tables, both for $3 and $4 coal:

COAL AT $3.00 PER 2240 LBS.—INTEREST ON ELECTRICAL INVESTMENT

Five Trains Per Day Each Way

M. P. H.	2000 Tons	1000 Tons	500 Tons	250 Tons
10	8.35%	10.6 %	10.8 %	9.6 %
20	6.77	6.8	6.9	6.4
30	4.35	5.8	4.85	5.02
40	8.12	5.5	4.94	5.0
50	....	....	4.7	4.67

Ten Trains Per Day Each Way

M. P. H.	2000 Tons	1000 Tons	500 Tons	250 Tons
10	12.8 %	17.7 %	19.5 %	19.4 %
20	8.77	12.1	13.2	13.
30	7.3	10.7	10.	11.1
40	6.	10.75	10.47	10.3
50	....	....	9.4	9.34

Twenty Trains Per Day Each Way

M. P. H.	2000 Tons	1000 Tons	500 Tons	250 Tons
10	14.9 %	27.8 %	38.4 %	36.3 %
20	8.2	17.7	22.6	23.8
30	7.9	15.	17.	20.1
40	6.25	15.2	17.3	18.1
50	....	....	20.4	16.9

COAL AT $4.00 PER 2240 LBS.—INTEREST ON ELECTRICAL INVESTMENT

Five Trains Per Day Each Way

M. P. H.	2000 Tons	1000 Tons	500 Tons	250 Tons
10	11.0 %	11.65%	11.6 %	10.2 %
20	9.65	8.65	8.15	7.19
30	7.04	7.74	6.35	5.72
40	5.64	7.54	6.2	5.75
50	....	....	6.13	5.6

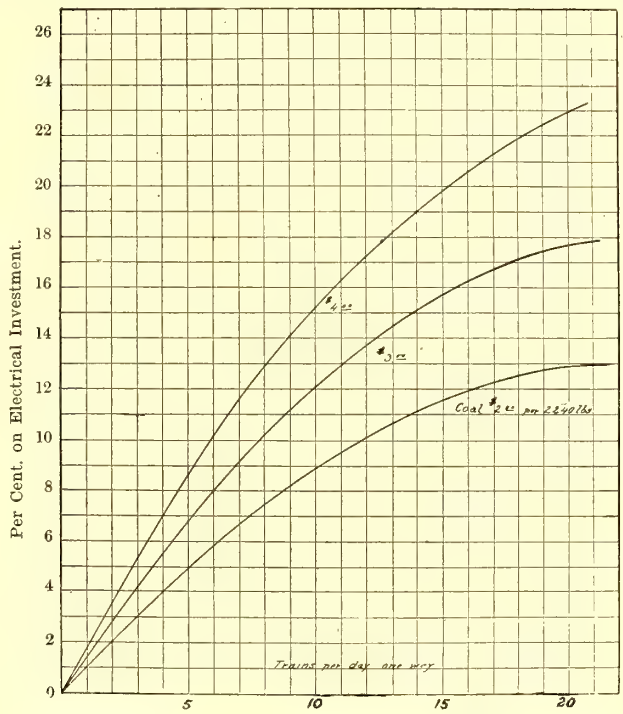
Ten Trains Per Day Each Way

M. P. H.	2000 Tons	1000 Tons	500 Tons	250 Tons
10	16.8 %	20.8 %	21.4 %	20.4 %
20	13.4	15.2	15.8	14.7
30	12.0	14.3	12.2	12.7
40	10.72	15.	12.8	11.8
50	....	....	12.2	11.2

Twenty Trains Per Day Each Way

M. P. H.	2000 Tons	1000 Tons	500 Tons	250 Tons
10	21.1 %	33.2 %	38.4 %	38.0 %
20	14.8	22.9	27.4	25.6
30	16.8	20.3	20.3	22.6
40	12.4	20.9	21.1	20.7
50	....	....	20.4	20.1

A study of the above tables brings out the fact that for very infrequent service, that is, five trains per day each way or less, it would hardly pay to equip the road electrically, there being a dividend of from 4 per cent to 7 per cent on the capital invested.

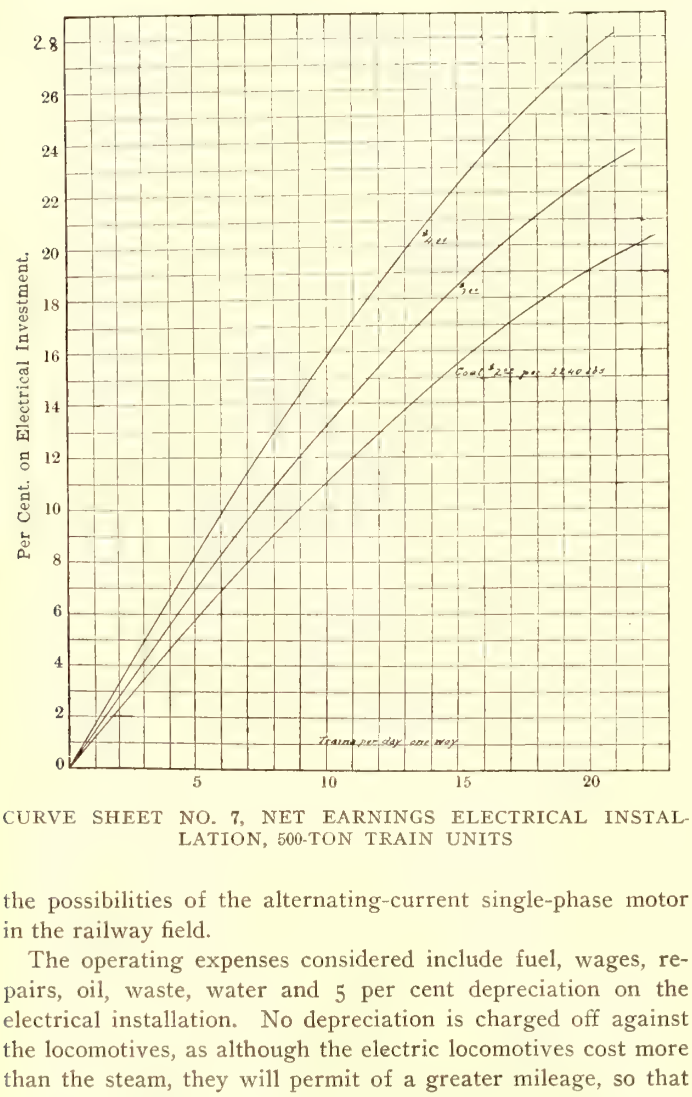


CURVE SHEET NO. 6, NET EARNINGS ELECTRICAL INSTALLATION, 1000-TON TRAIN UNITS

With more frequent service, however, the saving in electrical operation becomes more marked until at from fifteen to twenty trains per day each way, the interest-earning power of the electrical investment is worthy of very careful consideration. It should be borne in mind that all these figures do not contemplate increase in the present traffic of the road, and, therefore, do not take into consideration one of the chief characteristics of electric traction, that is, developing short-haul local traffic, and thus increasing the dividends by increasing the receipts rather than by cutting down operating expenses. The well-known ability of electric roads to greatly increase previous steam traffic has lead them to be installed, in many cases, without too close an investigation into their economical installation. We must also take into account that the electrically-equipped road, while caring for the heavy through freight traffic with an earning capacity of from 4 per cent to 7 per cent on the investment, can also build up a local traffic, both freight and passenger, with practically no additional cost and showing very large returns.

Taking up the possibilities of the alternating motor in general haul work the problem had to be treated in a general way, in order not to lose sight of the scope of the problem in considering local details. The average specific problem has its local conditions, which must be carefully considered in detail, and, in many cases, would show a greater return for the money

invested than indicated in this paper. For instance, all power is supposed to be generated from coal from power house devoted to the interests of railroading alone. Along many of our roads exist water-power facilities which could be advantageously developed and furnish power much cheaper than the figures assumed from coal generation. Furthermore, the cost of power in the smaller generating station capacity has been assumed as high as 1 cent per kilowatt-hour or more, and should a generating station supply other industries, such as mining, lighting, general power distribution, etc., the cost of purchasing power would be considerably decreased with a consequent reduction in cost of operating electrically. The results given in the table, therefore, are of general application only, and may be considerably modified when considering the local aspect of a given proposition. It is believed, however, that the results as obtained are based upon conservative assumptions, in fact, most of these assumptions were obtained from operating conditions, and, with the figures given, outline somewhat briefly



CURVE SHEET NO. 7, NET EARNINGS ELECTRICAL INSTALLATION, 500-TON TRAIN UNITS

the possibilities of the alternating-current single-phase motor in the railway field.

The operating expenses considered include fuel, wages, repairs, oil, waste, water and 5 per cent depreciation on the electrical installation. No depreciation is charged off against the locomotives, as although the electric locomotives cost more than the steam, they will permit of a greater mileage, so that the total capital invested in locomotives should be practically the same in either case. There are a number of expenses incidental to steam operation other than those considered, which must be done away with with the adoption of the electric locomotive. While each of these expenses is small they may amount to considerable in the aggregate. For example, the electric locomotive is double ended and requires no turn-table. Two electric locomotives can be coupled together and operated by one engineer in the cab of the leading locomotive, each locomotive doing an equal share in hauling the train. In fact, it is not strictly necessary to consider the use of a fireman in electric propulsion, as his duties will be largely confined to ringing the bell and waiting for the engineer to die of heart disease. His services can be dispensed with entirely if we consider that the electric locomotive cab can be made the caboose for the train, and the train crew serve as a reserve for the engineer in case of trouble. The cost of fuel has been assumed equal in both cases, but there is an added expense in handling the fuel for steam operation as the source of supply of the locomotives is distributed in small pockets over considerable track, each pocket requiring more or less outlay for its establishment and maintenance, all of which can be saved by electric locomotive fed from a central generating station. The increasing tendency toward the adoption of very heavy trains calls for heavier locomotives with consequent increase in weight of rail, cost of bridges, ballasting track, and general maintenance of the right of way. Indeed, the wear upon a light rail with a heavy reciprocating engine must be considerably more than that given to the rail by an electric locomotive of half the weight, and having a perfectly uniform rotary impulse imparted to the drivers. Just how much money may be saved by the lessened maintenance of the track is conjectural, and hence has not been entered into here, but the figure must reach a considerable size for heavy locomotive work. As the maintenance of electric locomotives is considerably less than its steam competitor it will reduce the size of the repair shops required, the difference in the interest on which should appear as a fixed charge against steam operation. Furthermore, a steam locomotive, including a tender, has not more than 50 per cent of its weight upon the drivers, which will constitute from 7 per cent to 10 per cent of the average train weight. As this is a dead weight, producing no revenue, it would be fair to compare the two systems by estimating upon a train for steam operation from 7 per cent to 10 per cent heavier than for electric operation. The comparative figures given in the table, based upon 1000-ton miles, are not, therefore, entirely fair toward electric operation, but should be somewhat increased for haulage involving the use of the steam locomotive.

The earning capacity of the money invested in electric equipment can be looked upon, therefore, as exceeding the values given in the tables, but as stated above, local conditions will largely affect the application of the general figures to any given example. Should all the factors entering into the engineering expense of operating roads by steam and by electric locomotives be carefully considered, the possibilities opened up by the use of the alternating motor are sufficiently great to warrant its replacing the steam locomotive in many of our railway systems, either in part or for the complete system.

POWER REQUIRED FOR OPERATING CARS

During the investigation of transportation problems in New York the State Railroad Commission secured some interesting data regarding the amount of power required for operating cars on surface and elevated lines, and also made inquiries of the several companies with reference to the supply of power. The Brooklyn Heights Company took an average day's record on which 224 elevated electric cars and 1247 surface cars were operated. The average station load while these cars were in service was 51,171 amps., which was divided approximately as follows:

	Amps
224 elevated cars, at 67 amps..........	15,008
1247 surface cars, at 29 amps...........	36,163
Total	51,171

As these figures were procured on the evening of June 10, at 5:30 o'clock, no provision was made for heating and lighting, but the records show that taking into account these factors the average amount of power required for the operation of one surface car and one elevated car at station bus-bar is as follows:

SURFACE CAR

	Amps	Kilowatts Per Car
Operation	29 or	15.95
Heating	6 "	3.63
Lighting	2 "	1.1
ELEVATED CAR		
Operation	67 "	36.85
Heating	15 "	8.25
Lighting	2 "	1.1

In Manhattan, on the elevated system, the current consumed in the operation of an average loaded car is 35 amps. at 600 volts, or 21 kw. For lighting, 1.5 kw is allowed, while 4.8 kw must be provided for heating and 6 kw for operating air pumps. This amounts to 27.9 kw at the car, and, assuming that the car kilowatts represent 78 per cent of the station kilowatts, it will be seen that provision must be made for 35.6-kw output at the station for each car in operation.

The Interurban Street Railway Company's figures for the surface lines in Manhattan show that the "power required for each car is about 16 kw in summer and 25 kw in winter. This includes current for both light and heat." Touching upon the available supply of power the Interurban's report is interesting:

"We have never, since we began the electrification of the street car lines in New York City, been short of power, having at various dates installed three temporary power stations with an aggregate capacity of 7000 kw, to furnish power for our lines in process of conversion, while our large Ninety-Sixth Street power station was building. These temporary power stations were continued in operation until the Ninety-Sixth Street power station was finished and able to furnish all power required. They were then dismantled.

"On Jan. 1, 1902, we had the following power available, but not all required or used:

"Ninety-Sixth Street power station, nine generators, of 3500 kw each; total, 31,500 kw.

"Twenty-Fifth Street power station, four generators, of 900 kw each; total, 3600 kw.

"One Hundred and Forty-Sixth Street power station, three generators, of 900 kw each; total, 2700 kw.

"One Hundred and Forty-Sixth Street power station, two generators, of 500 kw each; total, 1000—3700 kw; grand total, 38,800 kw.

"In addition we had storage batteries for use on the peak of the load aggregating 10,000 kw for 2 hours, or 15,000 kw for 1 hour, or a total power available at time of heaviest load of 53,800 kw.

"On June 8, 1903, we had power available as follows:

"Ninety-Sixth Street power station, eleven generators, of 3500 kw each; total, 38,000 kw May 1.

"Kingsbridge power station, four generators, of 3500 kw each; total, 14,000 kw.

"Storage batteries, 15,000 kw. Grand total, 67,000 kw.

"This power is distributed through the city by means of nine sub-stations with transforming machinery aggregating 42,000 kw at normal load, or 63,000 kw at 50 per cent overload."

NEW CAR SHOPS IN THE SOUTH

The Southern Car Company, of High Point, N. C., successor to the Briggs Car Company, of Amesbury, Mass., has located its new electric car-building plant at High Point, N. C. The place chosen possesses many advantages, as the town is in the heart of a district abounding in timber suitable for car building. The officers of the company have, in combination with others, purchased a tract of 50,000 acres of this timber land, and will cut 100,000 ft. per acre. High Point is also the center of numerous furniture factories, and the company is, therefore, in position to draw upon a large local body of skilled mechanics and woodworkers. The new works are on the main line of the Southern Railway, and thus enjoy excellent shipping facilities.

The plant is equipped with the most up-to-date apparatus for turning out all styles of electric cars, and this, combined with the natural advantages of the site, will, no doubt, enable the company to turn out an excellent product at low cost.

The machine and erecting building measures 230 ft. x 160 ft., with a setting-up capacity of sixty to eighty cars. This building is constructed of brick, with trussed monitor roof, having 100-ft. spans, with large wings, allowing all of the machine, cabinet work and finishing to be completed under one roof.

Two spacious offices open into a large, well-lighted drafting room, located at the entrance to this building. Between the drafting room and stock room there is a long passage to the erecting room. The time registers and paymaster's desk are located in this hall, and all workmen going to and from work register as they pass through.

A part of the large stock room is utilized as a sewing room for making covers, curtains and seat linings. From this stock room doors lead to the erecting and machine rooms. The machine room, 160 ft. x 40 ft., has a well-equipped woodworking department. All the machinery, including iron-working machinery, is motor driven. The power house, dry kiln and blacksmith shop are about 50 ft. from the main building, to which they are connected by tracks.

The company has a novel arrangement for transferring its kiln-dried lumber from kiln to machine room by means of three tracks and roller-bearing trucks, which permits drying and transferring three carloads of lumber with but one handling. The blacksmith shop is well equipped with blast forges, trip hammers, lathes, punches and shears for the handling of that part of the company's work.

A fine lavatory for the workmen has been set apart between the machine and cabinet room. The cabinet room is well lighted and conveniently arranged with benches and gluing facilities. From this room two large doors open into the erecting room, and from the cabinet room all work goes into a large painting room, which has tracks and other facilities for painting and finishing a number of cars at once. This paint room opens into the erecting room by folding doors. The erecting room has a clear space without posts of 100 ft. x 200 ft., with twelve tracks for transferring, has a fine cemented floor level with the rails and a large car pit. At the rear of this room are two large balconies for the finishing and handling of sash, doors and headlinings. The first balcony is suspended at the same height as the staging of roofing, allowing workmen to go and come from this balcony carrying their roofing stock along the staging.

The front of this erecting room has twelve double doors, and running the whole front of this building is a 40-ft. transfer table. The grade of the land here is such that the flat cars on their side tracks for shipping are flush with this transfer table, thus permitting cars to be run out of the finishing room onto flat cars for shipment without raising or lowering, and making a great saving in time and handling. In addition to large lights in monitor roof the partitions which separate the wings from the main erecting room are also well filled with sash for lighting the lower part of this room.

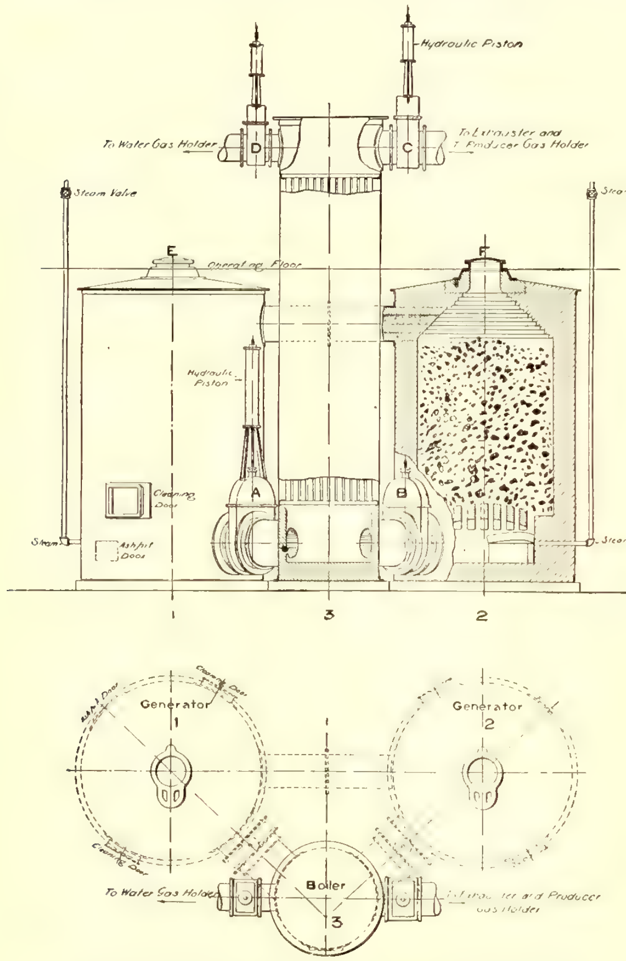
The officials of the Southern Car Company are men who have had much experience in car building. The principal officers are: President, J. Elwood Cox; vice-president, E. A. Snow; secretary and treasurer, E. R. Briggs.

The Indianapolis, Franklin & Columbus Railway, in Indiana, has placed along its route thirty-five new and comfortable waiting stations.

THE PRODUCTION OF GAS FOR GAS ENGINES

The constantly increasing use of gas engines for power and lighting work has brought with it a strong demand for apparatus that will produce a working gas of constant calorific value. The dissatisfaction with the earlier types of gas engines was principally due to their poor regulation and to the rapid deterioration caused by high-working temperatures and impure gases. Improved methods of construction have in a large measure reduced their mechanical defects, but even the best gas engines will fail unless supplied with proper fuel.

The Power & Mining Machinery Company (formerly Loomis-Pettibone Gas Machinery Company), of New York, has for many years made a specialty of erecting plants for the production of fuel gas, having long recognized the necessity of providing the means for producing gas for power at the lowest possible cost, utilizing in the highest degree the heat value of



PLAN AND ELEVATION OF GAS PRODUCER

the fuel gasified and adapting its apparatus to the use of all kinds of fuel. Loomis generators are being used for power purposes on a large scale, and are adapted to use all grades of bituminous and anthracite coal, also wood and coke. The gas yield in heat units varies, of course, with the quality of fuel used, but it is claimed that the average thermal efficiency is about 80 per cent.

The accompanying illustrations show, in plan and elevation, the Loomis gas apparatus for making water and producer gas. The unit consists of two generators, 1 and 2; vertical boiler, 3; water-cooled valves, A and B; producer-gas valve, C; water-gas valve, D. The generator is cylindrical, constructed of iron and steel, from 5 ft. to 11 ft. in diameter, and from 12 ft. to 18 ft. in height. The lining is of fire-brick with fire-brick arched grates, ash pit and flue to boiler in the bottom. It is provided with a door on top for firing and admission of air, two cleansing doors above the grate and one below the grate, opening into the ash pit. The vertical boiler is of the multitubular type, and is connected at its base with the generators. A positive exhauster is connected with the top of the boiler beyond the producer-gas valve, C. The four valves, A, B, C and D, are operated by hydraulic pistons.

In starting fires in the generators a layer of coke or coal, about 5 ft. in depth, is put in and ignited at the top, the exhauster creating a downward draft. When this fuel is ignited coal is frequently charged, raising the fuel bed to about 8 ft. above the grates, and there maintained. Bituminous coal is generally used, and is charged at intervals, as needed, through the feed door in the top of the generator.

Air is also admitted through the same doors, and by the exhauster is drawn down through the fresh charge of coal, and then through the hot fuel bed beneath. The resultant producer or generator gas is drawn down through the grates and ash pits of generators 1 and 2, valves A and B, up through the vertical boiler 3, valve C to scrubber and exhauster, valve D being closed, and is delivered into a gas holder. When the exhauster has brought the fuel up to incandescence the charging doors, E and F, are closed, valve B lowered, valve C closed, and valve D, leading to the water-gas holder, is opened. Steam is then turned on into the ash pit of generator 2, and, in passing through the incandescent coal, is decomposed, forming water gas. From generator 2 the gas passes through the connecting pipe, shown near the top of the generators, and down through machine No. 1. The gas passes through valve A into and up through the boiler, 3, and thence, after being washed in a scrubber, is conducted into a holder. Water gas is made for 5 minutes, when, the temperature of the fuel beds having been considerably reduced, the steam is shut off, valve D closed, valves C and B opened, and the charging doors, E and F, opened. This process of making water gas and producer gas is alternated at intervals of five minutes or more, according to the quality of gas desired.

In making the next run of water gas the course of steam is reversed, i. e., valve A is closed and the steam is turned into the ash pit of generator No. 1. Valve B is left open, but the other valves, C and D, and the charging doors, E and F, are operated the same as in the first case.

While the fires are being blasted and during the making of a run of water gas, the hot gases in passing through the boiler give up a large proportion of their sensible heat, which is converted into steam. This, in turn, is directed under the fires in the generators for decomposition. Another advantage of the double generator apparatus is that, as all gas is made to pass through the fire the tarry matter from the coal is converted into fixed gases that can be conducted any distance through ordinary pipes and at any temperature or pressure. Again, as the steam is forced through two fires the percentage of condensable water vapor is exceedingly small.

Instead of making water gas in every alternate stage for the same length of time as producer gas, the generator may be worked on producer gas alone, steam being then admitted at various points while the exhauster is running and the operation of making producer gas is going on.

From the generating plant the producer gas is delivered to one holder and the water gas to another holder. From these holders the two gases pass to an especially designed proportional mixing valve, by which they are uniformly mixed in any proportion desired. From this mixing valve the mixed or power gas passes to the engines wherever located.

The operation of a pair of generators of the type described is exceedingly simple, and it is stated that a man with ordinary intelligence, even if he has had no previous experience in the manufacture of gas, would be competent, with a week's practice, to take charge and run the apparatus. As the valves are provided with hydraulic pistons the labor is reduced to a minimum, and only a few seconds are required to change from making one kind of gas to another.

Among the plants in which the Power & Mining Machinery Company has recently installed its gas producers are the following: Velardeña Mining & Smelting Company, Valardeña, Durango, Mexico, for 2300 hp, consisting of four Crossley double-cylinder gas engines. The engines are to be belted to 25-cycle alternators, the current to be used for lighting and power. Rockland Electric Company, Hillburn, N. Y., for 1000 hp, consisting of three 300-hp Westinghouse gas engines and one 100-hp unit, all connected to Westinghouse 60-cycle alternators. The Velardeña and Rockland plants are nearing completion. Winchester Repeating Arms Company, New Haven, Conn., for seven three-cylinder vertical type Westinghouse gas engines, consisting of one 80-hp, one 90-hp and five 160-hp engines, connected to Westinghouse direct-current generators. Potosiña Electric Company, San Luis Potosi, Mexico, for three Westinghouse double-acting gas engines, total capacity 750-hp, connected to Westinghouse 60-cycle alternators.

CONVERTIBLE CARS FOR AUSTIN, TEXAS

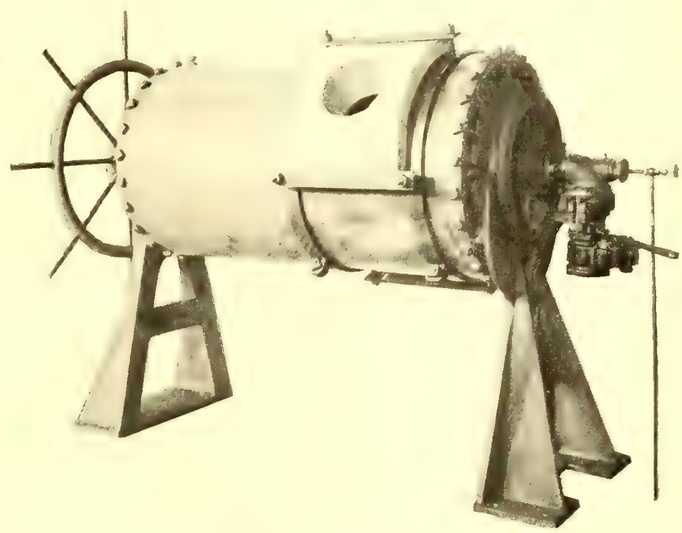
The Austin Electric Company, of Austin, Tex., has received, lately, two convertible cars from the J. G. Brill Company which are especially interesting from the fact that they are provided with portable vestibules, including double folding doors. The substantial character and handsome appearance of these vestibules is plainly to be seen in the accompanying illustration. When the vestibules are removed, folding gates, which close the entrances when desired, are attached to the car bodies. Another unusual feature in these cars is the solid paneling of the entire space between the double corner posts. Usually that part which comes above the belt rail is occupied by a sash, but in this case oak panels were substituted. The cars are for use on the city lines of Austin and also for the lines which run a short distance into the suburbs to the park and fair grounds controlled by the company. Besides being the capital of the State, Austin is one of the largest commercial centers in Texas, and affords an excellent field for electrical operation on a large scale. About a year ago the American Car Company, of St. Louis, built eight cars of this type, which are reported to be giving excellent satisfaction.

CONVERTIBLE CAR USED IN AUSTIN, TEXAS

The new cars are 20 ft. 7 ins. long over end panels, and 30 ft. 7 ins. over crown pieces; from panels over crown pieces, 5 ft.; width over sills and sill plates, 6 ft. 10¼ ins., and over posts at belt, 7 ft. 9 ins.; sweep of posts, 5 ins.; from center to center of posts, 2 ft. 7 ins. The side sills are 5¼ ins. x 6 ins., plated on the outside with 6-in. x ⅝-in. steel. The end sills are 4¼ ins. x 6 ins.; thickness of corner posts, 3¾ ins. Guard rails are provided on either side, and when not in use are held under the water boards by special gravity catches. The interiors are finished in ash with ceilings of birch. The seats are 33 ins. long, and are of the reversible-back type. The seating capacity of a car is thirty passengers. The cars are mounted on Brill 21-E trucks, having 7-ft. 6-in. wheel base, 33-in. wheels and 4-in. axles, and are equipped with two 25-hp motors.

A NEW METAL-MELTING FURNACE

The accompanying cut illustrates a new metal-melting furnace which has been evolved by the Lunkenheimer Company, of Cincinnati, Ohio, after considerable experimenting with nearly every type of furnace on the market. The company is using ten of these furnaces in its own foundry, and states that it has found this type to afford a very efficient and economical method of melting metals, particularly brasses and bronzes. The furnace consists of a cylindrical sheet-steel drum having cast-iron heads. The interior of this drum is lined with fire-proof tile, with two openings on opposite sides of the drum.



METAL MELTING FURNACE

Only one of these openings is in use at one time, the other being closed by a fire-clay filling. The object of having two openings is to increase the life of the furnace linings. It has been found that the furnace wears out quicker around the filling hole (which also serves as outlet for the flame) than elsewhere. The advantage that this furnace has over others is that when one filling hole is worn out it can be closed by a fire-clay filling and plate, the furnace reversed, and the other opening used.

The oil burner is of a special type, designed to give the greatest amount of heat with a minimum oil consumption. In the Lunkenheimer foundry from six to seven heats per working day of 10 hours have been secured from each furnace. The weight of each heat averages about 550 lbs., and the oil consumption varies from 2 gals. to 2½ gals. of crude oil per 100 lbs. of metal melted. The life of the linings is from 300 to 400 heats, varying with the kind of metal melted. The whole furnace is of heavy and substantial construction. On account of the simple form of the tile it is very easy to reline.

This furnace is made in two sizes, the No. 1 size having a capacity of 550 lbs. of metal per heat, and the No. 2 size having a capacity of 1200 lbs. of metal per heat.

The Maumee Valley Railway & Light Company, of Toledo, Ohio, has abandoned the practice of handling freight, and will confine itself exclusively to passenger business in the future. It was found that the handling of freight at existing freight rates and in competition with the steam roads was not profitable. Some of the other Toledo roads, however, claim that their freight business is increasing and proving popular, and some of them are increasing their facilities looking to enlarging the scope of this branch of the business.

AN EIGHT-CAR EXPRESS TRAIN FOR THE NEW YORK SUBWAY

EIGHT-CAR EXPRESS TRAIN FOR THE SUBWAY

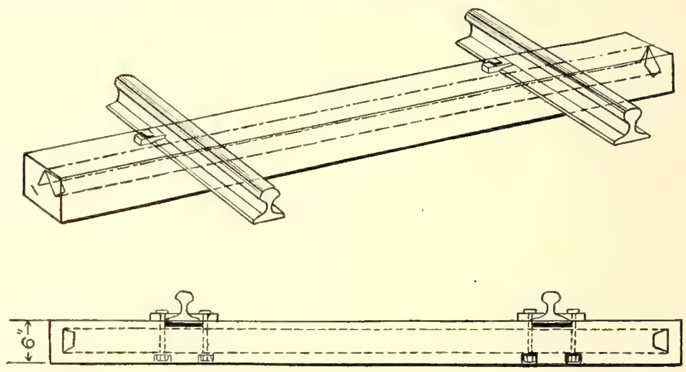
The accompanying cut illustrates an eight-car train for service in the New York Subway, comprising one of the latest shipments made by the John Stephenson Company on its order of 100 cars for the Interborough Rapid Transit Company, of New York. These cars are each 50 ft. 1 in. long, and the total length of the train of eight cars will, therefore, exceed 400 ft. This is the largest number of cars that will be operated in a single train, and these, of course, will not be run excepting in rush hours. Each express train will be made up of four motor cars, the estimated weight of which will be 86,000 lbs. each, and four "trailers" of 50,000 lbs. each, and will weigh, therefore, with equipment and passengers, according to the engineers' estimates, 272 tons.

A train of this size will have a seating capacity of 416 passengers, and, judging from the space in the aisles, as many more can be accommodated when necessary without discomfort. These are probably the longest trains in service of this character, and they are equal in carrying capacity to most trains operated on steam lines. The Manhattan Elevated, when operated as a steam railroad, was limited to five-car trains, and since electricity has been introduced six-car trains have been adopted. This is the nearest approach to the subway plans that has been made in this class of service, but the Manhattan cars cannot accommodate as many passengers as the subway coaches, and, consequently, they fall far short of the latter in their capacity per train.

The Interborough Rapid Transit Company will operate two classes of train service in the subway, the same as in the elevated branch, one being for local and the other for express. The first will consist of five-car trains, composed of three motor cars and two trailers, making an average speed of approximately 16 m. p. h. The second will be the eight-car express trains, one of which is shown in the accompanying cut, made up of four motor cars and four trailers. The requirements of the subway franchise include a provision for the maintenance of an average speed of 30 m. p. h. on the express trains. Each motor car will carry two 200-hp motors, and the necessary controlling and braking apparatus. All of these features, as well as the construction details of the car bodies, have already been described in these columns.

THE AFFLECK CEMENT RAILWAY TIE

Various forms of steel and cement railway ties have been proposed. One of the simplest is the invention of David S. Affleck, of Chesterton, Ind., who has had some under test on a sand-pit siding of the Lake Shore & Michigan Southern Railroad at that place for about six months. It is stated that an average of twenty locomotives per day with trains of sand cars have passed over this track, and the ties have not shown the



CEMENT RAILWAY TIE

slightest defect, either before or since the winter set in. As can be seen from the accompanying drawing this tie consists of steel angle-bars imbedded in Portland cement. The ends of these angle-bars are slightly bent, to anchor them more securely in place. The rails are held by clips and bolts. The bolts pass clear through the ties, with nuts in recesses in the bottom of the tie. A thin wooden shim is placed between the rail base and tie.

RECENT IMPROVEMENTS IN BROOKLYN

The traffic of the Brooklyn elevated lines has shown such a continuous increase that up to this week the company has found it impossible to abandon steam power entirely, even during the non-rush hours. The recent arrivals of new rolling stock and other equipment, however, has finally permitted the company to put these lines on an exclusively electrical basis during all except the rush hours.

Among the recent orders placed by the company is one for 100 new elevated cars. This order was divided as follows: Twenty-five to the J. G. Brill Company, forty to the Laconia Car Company, and thirty-five to the Bradley Car Works, of Worcester, Mass. The Brooklyn Heights Railroad Company has also ordered thirty steel ash cars from the South Baltimore Car Works, and during the last few months has placed with the Westinghouse Electric & Manufacturing Company orders for 200 elevated railway motors and 500 surface railway motors.

The Corporation of Liverpool, England, has decided to hand over to the poor of the city the discarded uniforms of tramway employees. Some one has expressed the hope that proper care will be taken to cancel or obliterate the badges of office, in the shape of buttons, etc., in order to forestall cases of bogus conductors collecting fares, and bogus inspectors catching them at it and reporting them at imaginary headquarters.

FINANCIAL INTELLIGENCE

WALL STREET, Jan. 13, 1904.

The Money Market

As had been expected, from the analysis of conditions a week ago, a further lowering of money rates has occurred during the past week. Call money from an average of 4 per cent dropped to an average of 2½. On sixty and ninety-day loans, the rate fell from 5 to 4¼ per cent, while 4½ per cent is now freely quoted for the distant options. All this has been accompanied by a decided change in the relations between lenders and borrowers. Funds are now being pressed by the lending institutions for the first time in a very long while. The same phenomenon is noticeable in the market for commercial paper, where the demand for prime material has suddenly grown much more active. The explanation for this change in the money situation simply lies in the fact that the crop-moving money which went out to the West and South during the autumn, is flowing back to this city in very large volume. Chiefly as a result of this movement, and in smaller part owing to receipts of gold from Europe, excess disbursements by the Treasury and the redeposit of cash drawn out for local circulation during the holiday period, the banks reported on Saturday the unusual increase of $10,000,000 in their cash holdings. Since that time another $1,000,000 gold has arrived from London, and the Sub-Treasury has paid out a further large sum on routine government expenditures. Everything suggests, therefore, another good-sized cash increase at the end of the present week, and indeed a continued balance in favor of the banks for another month at least.

Surplus reserve, raised $5,145,000 by last week's operations, stands now at $14,687,000, which is almost exactly the same as a year ago, and a trifle ahead of 1902. Only two contingencies can be foreseen to interfere with this satisfactory state of affairs. One is the possibility of a foreign war, in which case the United States would undoubtedly be appealed to to extend its credit freely to the European markets. The other is the danger that the prevailing low rates of interest may lead to heavy borrowing by our own railway and industrial corporations, many of which have long stood in need of money for improvements, and to reimburse them for extraordinary expenditures advanced out of current earnings. With the precedents of 1902 and 1901 in mind—when the same sort of borrowing tied up, to the market's great detriment, a mass of previously active capital—the heavy loan expansion the last three weeks is a decidedly unwelcome symptom. The loan item of the Clearing-House banks stands now close to $916,000,000, which is the highest reached since last September, and only $34,000,000 below the record total of February, 1903.

The Stock Market

A generally strong stock market, with activity entering in specialties and light trading in most of the usually active stocks, comprises the record of the week. Outwardly, the crisis in the Far East has been the principal influence. It has notably depressed the European markets, British consuls touching, last Wednesday, the lowest price in thirty-eight years. Foreign dealings on our own Exchange have accordingly curtailed, and, on the whole, Europe has sold more of our stocks than it has bought. It was hard to say, however, just how far the fear of an outbreak of war is responsible for the restricted business in the local market. In the opinion of many careful observers the numerous causes of uncertainty in the domestic financial situation sufficed to explain why our market should move with extreme caution. There are at least four definite restraints upon any considerable advance in prices at the present time: First, the doubt which the unfavorable Steel report has raised, fresh in everybody's mind, whether the reaction in general trade which began last summer has not further to run; second, the increasing tendency toward expansion, and the already high level of bank loans; third, the approaching presidential election; and fourth, the decision which is expected within the next month or two in the Northern Securities case. Probably the last of these four drawbacks on the market is just now the most cogent. That anything but a flatly hostile opinion will be handed down by the Supreme Court, very few people dare to expect. The question as to what will be done in case the Northern merger is dissolved, and what will happen to the other combinations which, on a similar interpretation of the statute, must be considered illegal, is something that can only be vaguely discussed. What the market fears chiefly is the first violent sentimental shock that would almost inevitably follow. Accordingly, cautious persons are now found taking the ground that with this dreaded blow overhanging, much of an advance from the present level of prices is not to be expected. It looks as if we shall have a rather narrow traders' market for the time being, with more or less rapid fluctuations in either direction.

The local traction stocks have rather taken a back seat in the week's speculation. Interest has shifted into other quarters, where the rise in prices hitherto has been less pronounced. Most of the gossip in the traction group concerns the speculative position of the stocks, and nothing more is heard of the silly rumors of combinations and alliances, leases and so forth, which were in circulation a fortnight ago. The pool in Brooklyn Rapid Transit still appears to retain its hold, but observers of the trading claim that there is quiet realizing from the inside whenever conditions permit. The earnings of the company having been published, the "good news" is regarded as out. Manhattan and Metropolitan are well bought on the recessions, but there have been no further attempts to advance the prices.

Philadelphia

Dealings among the Philadelphia street railway specialties have been light, with no important variation on the week. The principal activity has centered in the common shares of the Philadelphia Company, which have sold as high as 40⅞, as low as 39¾, and ended yesterday at 40. Philadelphia Company preferred lost a point, from 46 to 45. Rapid Transit, after dropping to 8 early in the week, rallied later to 8¾, receiving better support than has appeared for some time. Philadelphia Electric has fluctuated between 5⅞ and 6⅜. Philadelphia Traction sold at 97½ and 97⅝, Union Traction from 45⅞ to 46⅛, Railways General at 1¼ and 2, United Traction of Indiana at 35, Consolidated of New Jersey at 65½ and 65⅜, and American Railways at 44. One hundred shares of Fairmount Park Transportation sold at 18½, another hundred at 18¾, and several odd lots at 19.

Chicago

The season of annual reports and dividend action is at hand in the Chicago market. City Railway shares have advanced from 162 to 165, on the expectation that the year's traffic statement, due middle of next month, will show about the same total gross earnings as a year ago. On the other hand, North Chicago stock broke to a new low record—80—on the reduction of the quarterly dividend from 2 to 1¼ per cent. West Chicago rose 2 points, from 45 to 47, on the report that the dividend on the stock would not be altered. The Union Traction stocks, which are, of course, intimately concerned in these matters, have held rather steady, the common selling between 6½ and 6⅞, and the preferred between 30½ and 31. The annual report of the Northwestern Elevated is expected to reveal about 4 per cent earned on the preferred stock, but there is little idea of the beginning of dividends in the near future. One sale of the preferred shares has been reported this week at 50, and 100 of the common sold at 16¾. Scattering transactions are recorded in South Side at 93, Lake Street receipts at 2⅛, and Metropolitan common at 17½. The last-named has been helped by the knowledge that the voting trust will soon be dissolved, after which the common shareholders will have the same voting privileges as the holders of the preferred.

Other Traction Securities

On considerably increased trading Massachusetts Electric common rose from 19 to 21½ in the Boston market. The preferred fell as low as 75, but later recovered to 76. West End common advanced from 89½ to 90, and the preferred sold at 108 and 109. Elevated shares were unchanged, fluctuating in small lots between 140 and 140½. On the Baltimore Exchange, weakness reappeared in the United Railways Company. The common stock at 8⅛ and the income bonds at 55¾, represented the lowest prices of the season. Later there was some recovery, the stock returning to 8⅜, and the incomes to 56¼. Meanwhile the general mortgage 4s declined from 91⅜ to 91. Other sales for the week in Baltimore comprise Atlanta Street Railway 5s at 103, City & Suburban (Washington) 5s at 91½ and 93. Charleston Consolidated Electric 5s at 102, City & Suburban (Baltimore) 5s at 112, Anacostia & Potomac 5s at 90, and Baltimore City Passenger 4½s at 101½. On the New York curb, Interborough Rapid

Transit declined another half-point to 92, then rallied to 93⅞. Brooklyn City Railroad sold at 234 and 233½ for 100 shares. Eight hundred Washington Traction preferred changed hands, between 47 and 47½. An odd lot of New Orleans preferred sold at 31. Washington Electric common changed hands between 12⅞ and 13⅛, and Brooklyn Rapid Transit 4s sold at 77½.

Tractions were stronger at Cincinnati. Cincinnati, Newport & Covington issues were leaders in the activity. The 5 per cent first mortgage bonds were in strong demand, and dozen sales, aggregating $64,000 worth, were made, the range being from 108 to 109, the former the close. The preferred stock showed a slight decline on sales of about 200 shares. Several sales were made in the common at 29½ and 30. Cincinnati Street Railway touched 134, and then dropped back a point on sales of 200 shares. Detroit United sold at 65, and then advanced to 67 for a small lot. Cincinnati, Dayton & Toledo sold at 26½. The 5s of this company sold at 81½. Northern Ohio Traction consolidated 5s are in demand, at around 99. Rather a quiet week at Columbus. Columbus Railway & Light sold at from 33 to 34, the old common at 85 and the preferred at 104.

In Cleveland the Northern Ohio Traction & Light was practically the only active issue. Two hundred shares sold at 14, and a 100-share lot at 14¼, the highest mark in several months. Northern Texas Traction sold at 32, the previous mark. A small lot of Cleveland Electric sold at 68½, but holders are asking 75 for more.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Cosing Bid Jan. 5	Jan. 12
American Railways	43½	a44
Aurora, Elgin & Chicago (preferred)	a55	a55
Boston Elevated	140	140
Brooklyn Rapid Transit	49⅛	49⅛
Chicago City	160	160
Chicago Union Traction (common)	6½	6
Chicago Union Traction (preferred)	28	30⅝
Cleveland Electric	65	66½
Consolidated Traction of New Jersey	—	a65¼
Consolidated Traction of New Jersey 5s	105½	105½
Detroit United	66½	65½
Elgin, Aurora & Southern	a32	—
Lake Shore Electric (preferred)	—	a42
Lake Street Elevated	1¾	2⅛
Manhattan Railway	142½	142
Massachusetts Electric Cos. (common)	19½	21¼
Massachusetts Electric Cos. (preferred)	75¼	76
Metropolitan Elevated, Chicago (common)	17	17
Metropolitan Elevated, Chicago (preferred)	51	51
Metropolitan Street	122¼	120½
Metropolitan Securities	88	87
New Orleans Railways (common)	10	9⅝
New Orleans Railways (preferred)	30½	29
New Orleans Railways 4½s	80	79
North American	83½	85
Northern Ohio Traction & Light	13¼	13¼
Philadelphia Company (common)	40¾	40
Philadelphia Rapid Transit	8¼	8½
Philadelphia Traction	97	97½
St. Louis Transit (common)	13	a13⅝
South Side Elevated (Chicago)	92¼	91
Third Avenue	119	122
Twin City, Minneapolis (common)	91	89
Union Traction (Philadelphia)	45	46
United Railways, St. Louis (preferred)	55	55
West End (common)	89½	89½
West End (preferred)	109½	108½

a Asked.

Iron and Steel

The announcement of an advance in prices on the principal products of the American Steel & Wire Company is the most gratifying news that the steel trade has had in some time. It may not show conclusively that a turn for the better has come, but it does show that some good judges believe that it has. In the greater part of the trade conditions remain substantially what they have been for the last six weeks. Consumers are waiting for lower prices, and meanwhile living from hand to mouth; producers are refusing to make any further commissions. In pig-iron the Northern furnaces have cut quotations, influenced to this action by the lower cost of fuel; they are, accordingly, getting the business away from the Southern makers. Quotations are as follows: Bessemer iron $13.75 and $14, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 12⅞ and 13⅛ cents, tin 29¼ cents, lead 4⅛ cents, and spelter 4⅞ cents.

CHICAGO ELEVATED RAILWAY TRAFFIC IN 1903

Daily average traffic figures for the Chicago elevated roads for the year 1903 were as follows:

SOUTH SIDE

	1903	1902	Inc.
January	86,637	79,154	7,483
February	88,516	79,386	9,130
March	87,989	80,313	7,676
April	87,553	81,000	6,544
May	82,884	76,063	6,821
June	85,262	76,449	8,813
July	76,236	70,067	5,460
August	72,646	68,334	4,312
September	81,887	76,572	5,315
October	85,788	83,112	2,670
November	143,398	83,299	60,099
December	93,937	88,513	5,424
Daily average for year	89,280	78,566	10,714

Gain for year, 13.65 per cent.

NORTHWESTERN

January	68,266	62,010	6,256
February	69,885	64,760	5,125
March	70.070	65,362	4,708
April	71,340	65,430	5,910
May	66,990	63,199	3,791
June	66,571	60,813	5,758
July	59,393	56,110	3,283
August	60,093	57,911	2,182
September	68,107	63,950	4,157
October	71,617	69,362	2,055
November	71,422	67,236	4,186
December	76,259	71,607	4,652
Daily average for year	68,315	63,986	4,329

Gain for year, 6.77 per cent.

METROPOLITAN

January	112,171	98,029	13,712
February	116,690	100,466	15,624
March	116,716	105,512	11,204
April	117,597	109,246	8,351
May	109,330	105,799	3,531
June	111,613	101,743	9,870
July	102,057	97,920	4,128
August	102,971	100,099	2,872
September	112,993	109,751	3,242
October	117,387	115,980	1,407
November	114,148	110,289	3,859
December	120,694	115,682	5,012

Gain for December, 4.33 per cent.

The gains on the South Side Elevated Railroad were helped by the excessive traffic during the Chicago City Railway strike. The increase on the Metropolitan West Side Elevated Railway is believed to have been caused by the introduction of universal transfers on the Chicago Union Traction lines.

ANNUAL REPORT OF THE BOSTON ELEVATED RAILWAY COMPANY

The annual meeting of the stockholders of the Boston Elevated Railway was held Jan. 4, and the old board of directors was re-elected, as follows: Frederick Ayer, William A. Bancroft, John J. Bright, Samuel Carr, T. Jefferson Coolidge, Jr., Francis H. Peabody, James Phillips, Jr., William S. Spaulding, Walter S. Swan and Robert Winsor.

President Bancroft presented the report for the year ending Sept. 30, 1903, which in part was as follows:

The total number of stockholders is 2554, holding 133,000 shares of stock. Of these 2172, holding 106,550 shares, are in Massachusetts.

In the management of the property for the fiscal year ending

Sept. 30, 1903, the directors were obliged to contend with the high price and uncertain supply of coal brought about by the strike in the coal fields. It was necessary to buy coal wherever it could be bought, and at prices which the stringency of the situation had fixed. The increase in the cost of coal over the previous year was $398,289.46, to which should be added an increase in the cost of labor in handling the same over the previous year of $10,727.65, making a total of $409,017.11. Deducting the natural increase, it leaves $400,248.16 as the extra expense on the coal account over the previous year, or an increase of about 71.08 per cent.

During the year a revision of wages has been made. In order to make it easier for young men who desire to enter the car service of the company to spend the time, which sometimes takes several weeks, to learn enough of the business to perform their appropriate duties, provision was made to pay such learners at the rate of a dollar a day while so learning. That the compensation of new or "extra" men after they were accepted in the surface car service should be certain, a minimum wage of one dollar and one-half a day was established for all those who report for duty at the car-houses and remain there during the prescribed hours, even if not actually employed in the operation of cars. To more suitably recompense those who by the experience of long and faithful service become more efficient, an increased compensation of 5 cents a day was established for every five years of continuous service up to fifteen years of such service. The daily wage for the surface car men, when hired, is $2.25 per day for the first five years, then $2.30 for the second five years, and $2.35 for the third period of five years, and thereafter $2.40 per day, until such time as incapacity to operate a car shows itself. Then, that men may be still further encouraged to render long and faithful service, such employment as a man is fit to perform is given to him; but in case a man is, in the judgment of the management, unfit to perform any duty in the service of the company, and has been continuously employed by the company for a period of twenty-five years, or has reached the age of sixty years, and has been continuously employed by the company for a period of fifteen years, it was determined to contribute to the support of such employee a sum not exceeding $25 per month during the rest of his lifetime. These, or corresponding provisions, apply also to elevated car men, and to certain others connected with the operation of cars. Further, as an inducement for meritorious service, it was determined to pay the sum of $15 at the end of the calendar year to each car service man (and to certain others connected with the operation of cars) who has rendered continuous and satisfactory service throughout the year. This revision of wages is estimated to increase the pay-roll during the first year, beginning Jan. 24, 1903, by about $200,000. The company has also provided free legal advice for all its employees, and last winter supplied coal at less than cost to all its employees who desired it. About 7250 tons of coal was so supplied at an estimated saving to the employees of $40,000.

The increase in the total number of revenue passengers for the entire system was 5 per cent as against an increase of 4.1 per cent for the previous year. The increase in the number of persons entering the subway was 9.75 per cent. as against 14.97 per cent increase of the previous year. The number of free transfer passengers still continues to increase. It is estimated that the total for the year was not far from 130,000,000. This is more than 55 per cent of the revenue passengers, which numbered 233,563,578. This is an increase of 13 per cent for free transfer passengers as against 5 per cent for revenue passengers.

The operation of the elevated lines has continued with good success. As against a 5 per cent increase in total revenue passengers, the receipts at main line elevated stations, exclusive of subway, increased 15.9 per cent, and at Atlantic Avenue elevated stations 59.3 per cent. The receipts at subway stations for elevated service alone increased 8.3 per cent. The surface car mileage increased but 0.8 per cent, while the elevated car mileage increased 23.8 per cent.

The extension of the surface tracks amounted to 5.16 miles. The total length of surface tracks controlled by the company, including that leased from the Old Colony Street Railway Company, is now 421.48 miles. The elevated mileage is over 16 miles, making a total mileage of 437,499. Sixty-one surface cars have been ordered. These are somewhat larger and heavier than the standard car, and are to be used on certain lines only, because it is not feasible to use them on most of our lines. They will be equipped with air-brakes, because of their size and weight. Twenty-four elevated cars have also been ordered, and are to be equipped with an improved type of multiple unit control, to be supplied by the General Electric Company. Motors for these cars and motors and controllers for the new surface cars have also been purchased from the General Electric Company.

A summary of the business for the year is as follows:

Gross earnings from operation		$11,959,514.54
Operating expenses		8,259,860.49
Net earnings from operation of owned and leased lines		$3,699,654.05
Subway rental	$217,932.03	
Less amount collected from the Boston & Northern Railway Company	20,039.79	
	$197,892.24	
Interest on funded debt of West End Street Railway Company	644,615.76	
Dividend on preferred stock of West End Street Railway Company, 8 per cent	512,000.00	
Dividend on common stock of West End Street Railway Company, 7 per cent	651,848.75	
Dividend on stock of Somerville Horse Railway Company, 6 per cent	9,180.00	
Taxes on West End Street Railway Company	501,761.96	
Total payments under lease of West End Street Railway Company		2,517,298.71
		$1,182,355.34
Miscellaneous interest		59,856.72
		$1,242,212.06
Taxes, Boston Elevated Railway Company	$312,043.05	
Compensation tax under Act of 1897	103,214.43	
		415,257.48
Balance		$826,954.58
Dividend No. 6, paid Feb. 15, 1903, to stockholders, 3 per cent	$399,000.00	
Dividend No. 7, paid Aug. 15, 1903, to stockholders, 3 per cent	399,000.00	798,000.00
Surplus for the year		$28,954.58

VOLUME OF BUSINESS FOR THE YEAR

Total revenue passengers carried	233,563,578
Increase over business of previous year	11,078,767
Or an increase of about	5%

SUBWAY TRAFFIC

Total number of subway passengers, Oct. 1, 1902, to Sept. 30, 1903, was 32,018,986; and they were carried from the various subway stations as follows:

Boylston Street	1,514,823
Mason Street	3,548,277
Park Street	11,401,624
Scollay Square	9,337,791
Adams Square	2,847,064
Haymarket Square	3,369,407
Total number carried from these stations in previous year was	29,172,150
Gain over previous year	2,846,836
Or about	9.75%
Average number of subway passengers per day	87,723
Average number of subway passengers per day previous year	79,923
Gain	7,800
Or about	9.75%

GENERAL BALANCE SHEET, SEPT. 30, 1903

ASSETS

Construction	$5,133,359.35
Equipment	1,614,332.90
Real estate	5,104,898.52
Subway construction and equipment	160,343.38
Cash on hand and in bank	4,019,431.64
Bills and accounts receivable	855,963.31
Stocks and bonds	208,010.72
Bonds deposited with Commonwealth of Massachusetts	500,000.00
Materials and supplies	1,045,011.22
Somerville Horse Railroad Company	102,851.11
West End Street Railway Company (open account)	753,429.72
West End Street Railway Company (property account)	860,427.07
Total assets	$20,358,058.94

LIABILITIES

Capital stock	$13,300,000.00
Audited vouchers and accounts	293,784.86
Salaries and wages	124,051.35
Dividends not called for	7,697.50
Matured interest coupons unpaid	31,337.50
Rentals unpaid	333,873.75
Outstanding tickets and checks	24,407.79
Interest accrued and not yet due	113,651.66
Taxes accrued and not yet due	904,351.88
Rentals accrued and not yet due	131,825.00
West End Street Railway Company (lease account)	1,207,201.98
West End Street Railway Company (bond account)	171.80
Damage fund	598,015.93
Insurance fund	360,000.00
Depreciation fund	600,000.00
Surplus	2,327,687.94
Total liabilities	$20,358,058.94

INCOME ACCOUNT FOR THE YEAR ENDING SEPT. 30, 1903

DEBIT

Operating expenses		$8,259,860.49
For general expenses	$730,058.20	
" maintenance of roadway and buildings	791,189.93	
" maintenance of equipment	822,190.25	
" transortation expenses	5,916,422.11	
Taxes		917,019.44
West End Street Railway Company's tax on capital stock and property	501,761.96	
Boston Elevated Railway Company's tax on stock and property	312,043.05	
Boston Elevated Railway Company's compensation tax on income	103,214.43	
Coupon interest on West End Street Railway Company's bonds		644,615.76
Rentals of leased railways		1,173,028.75
Rental of subway	217,932.03	
Less amount collected of Boston & Northern Railway Company	20,039.79	197,892.24
Dividends paid on capital stock		798,000.00
Balance carried to surplus account		28,954.58
Total		$12,019,371.26

CREDIT

Earnings from operation		$11,959,514.54
From passengers carried	$11,666,906.60	
" carriage of mails	26,362.83	
" tolls for use of tracks by other companies	47,765.62	
" rentals of real estate	100,191.64	
" advertising in cars	77,039.11	
" interests on deposits, etc	34,440.43	
" miscellaneous income	6,808.31	
Interest from special deposits		59,856.72
Total		$12,019,371.26

MILEAGE OF ELECTRIC EQUIPMENT

Miles of elevated track completely equipped with electric third-rail system	16.015
Miles of surface track completely equipped with electric overhead system	413.461
Miles of surface track partially equipped	1.970
Miles of overhead electric feeder lines	549.973
Miles of underground conduit	26.528
Miles of underground conduit duct	239.446
Miles of underground electric feeder lines	141.016
Miles of underground electric return lines	113.466
Miles of submarine cables	4.587

EQUIPMENT

Box elevated railway cars	150
Box cars, horse	20
Open cars, horse	5
Box cars, electric, 16-ft. bodies	51
Box cars, electric, 20-ft. bodies	330
Box cars, electric, 25-ft. bodies	1,182
Open cars, electric, 7 or 8 benches	568
Open cars, electric, 9 benches	747
Open cars, electric, 10 benches	46
Open cars, electric, 12 benches	181
Mail cars, electric	12
Service cars	22
Horses	279
Electric car motors (320 elevated, 4,276 surface)	4,596
Snow plows, horse	75
Snow plows, electric	215
Snow sleds	551
Miscellaneous vehicles	538

PROGRESS OF CHICAGO PUBLIC HEARINGS

The Chicago City Railway franchise ordinance which is being considered in a series of public hearings in Chicago has been severely attacked by various radical believers in municipal ownership. Municipal ownership advocates having expressed their views, the views of those favoring the ordinance are now being heard. Clarence S. Darrow, the attorney prominent in representing union labor interests, made the most severe attack on the ordinance, and claims that the figures given in the ordinance as to the amounts to be expended on improvements are entirely too high, and that no such expenditures are necessary. Mr. Darrow, however, gave nothing to substantiate the sweeping general statements in which he condemned the ordinance. The hearing will soon be closed and the matter taken up by the Council.

CHICAGO CITY COMPANY OFFERS COMPENSATION

On Tuesday, Jan. 12, the Chicago City Railway Company made its first definite proposition to the local transportation committee on the question of compensation. The company agrees to pay 5 per cent of the gross receipts for the next twenty years, and 20 per cent of the gross receipts above $197,000,000. The city estimates that the income for the term of the franchise will be between $227,000,000 and $240,000,000. The company figures on gross receipts of $7,000,000 for the first year of the franchise, and an average annual increase of $300,000. The compensation offered by the company is in lieu of all other public charges against the corporation, excepting taxes on tangible property. The company, of course, expects to pay taxes upon its real estate and personal property as heretofore, but it asks that the taxes on capital stock be deducted from the compensation paid to the city, and also the car license charges and bridge taxes, which have heretofore been borne by the company.

The question of what compensation should be paid to the city by the Chicago City Railway had been argued for the corporation on Jan. 8, by F. H. Parke, of Haskins & Sells. He told the committee on local transportation of the probable earnings and expenses of the company during the twenty years the franchise under discussion has to run, premising his argument with the statement that the further earnings of the company depend entirely on the growth of the city. What the population of Chicago would be twenty years from now, Mr. Parke said, could not be foretold with certainty Assuming that the growth of Chicago for the last twenty years will continue for the next twenty, Mr. Parke said that in 1924 the city ought to have a population of 3,400,000.

Taking this and other considerations into account Mr. Parke figured that the increase in the earnings of the railway company would average $300,000 a year, with expenses also increasing, but not in proportion. The present plant would give a salvage of $10,000,000, and it would cost $15,000,000 more to improve it, making a total value of $25,000,000, of which $15,000,000 would be bonds. For seven years, estimating operating expenses at 6 per cent of gross receipts, and allowing for interest and sinking fund for the bonds, and 6 per cent on $18,000,000 of stock, there would be a deficit, but, after that, a continually increasing surplus. At the end there would only be left $5,863,850 to go to the city. This would equal 2½ per cent of average gross earnings.

In these estimates Mr. Parke puts the total earnings for the twenty years at $197,000,000, and, in addition to $118,000,000 for operating expenses, estimates it will cost $7,030,000 for taxes, $1,000,000 to pay personal injury debts; to provide new equipment during the twenty years, $3,000,000; to fight or prevent strikes, $2,000,000; to pay interest on bonds, $9,097,150; to pay off the bonds, $12,092,000; to pay dividends, $21,600,000, and for the maintenance, $17,088,000.

CHICAGO UNION TRACTION DEVELOPMENTS

Charles H. Aldrich, former Solicitor-General of the United States, has been added to the legal force of the Chicago Union Traction Company under the receivership, as that company now has enough important legal business on its hands to employ a number of eminent attorneys.

Judge Grosscup suggested that the hearing on the famous 99-year-act case be held at Washington in February or April, so that Justice Day, of the United States Supreme Court, could sit with him in hearing the case. If Justice Day were to sit with him in Chicago it would be necessary to wait until June. Attorneys for the city of Chicago, however, objected, as they wish the case tried in Chicago. Judge Grosscup will probably hear the case alone. In any event, it will be October before the case can be appealed and heard in the United States Supreme Court,

so that at best 1904 will be nearly gone before there can be any settlement of franchise matters, as far as the Chicago Union Traction Company is concerned.

An appeal has been introduced in Congress declaring the tunnels under the Chicago River an obstruction to navigation, and ordering them removed. The Chicago Union Traction Company has addressed a letter to Colonel Hepburn, chairman of committee on Interstate and Foreign Commerce, asking that no hasty action be taken on this bill in view of the fact that the Chicago Union Traction Company is now endeavoring to arrive at a settlement of franchises and future routes of the Chicago Union Traction Company in the streets of Chicago. It asks that a thorough investigation be made by the committee before taking action looking to the passing of the bill.

UNION TRACTION TO ASK FRANCHISES

After strengthening its legal grip upon the bridges leading into the heart of Chicago from the North and West sides by filing two auxiliary bills before Judge Grosscup, the Union Traction Company receivers have decided to make a direct appeal to the Common Council for a renewal of expiring franchises on Washington, Adams and Harrison Streets. These grants, together with others on the West Side, were given the Chicago Passenger Railway, and are not affected by the ninety-nine year act dispute.

The filing of the bills has caused Corporation Counsel Tolman to ask for and obtain a postponement of ten days for the hearing set for Jan. 16. He also protests against having the case heard in Washington, and suggests that Chief Justice Melville W. Fuller be asked to come West and sit with Judge Grosscup, if Justice Day is unable to do so.

An important session of the receivers was held Jan. 9, at which the financing of the proposed improvements was earnestly discussed. Harry B. Hollins, of New York, took the place of Receiver R. R. Govin, who is detained in Cuba by the illness of his mother.

THE THREE-CENT FARE SITUATION IN CLEVELAND

As outlined in the last issue of STREET RAILWAY JOURNAL, the Johnson contingent in the City Council of Cleveland decided to push through all pending three-cent fare measures before the State Legislature could pass the proposed law placing the granting of all street and electric railway franchises in the hands of a State railway commission. At the Council meeting held Monday evening, Jan. 11, this programme was carried out in a manner which astonished even Mayor Johnson himself. Not only did the Johnson Democrats support the measures, but the nine Republican members of the City Council were solid in favor of the ordinances. It developed at a caucus before the meeting that the three-cent fare measures would pass, and it is thought that rather than to give Johnson the opportunity of making political capital of what was to come to pass, the Republican members decided tentatively to support the measures.

All three ordinances outlined last week are now the law in Cleveland. Under the first grant the Forest City Railway Company has the right to construct and operate a line over the following route: Public Square to Ontario Street, to Broadway, to Woodland Avenue, to Southern Avenue, to South Woodland Avenue, to Corwin Street; also from the corner of Woodland and Wilson and Kinsman Streets, on Kinsman Street to the city limits. These routes are now occupied by the Woodland and Kinsman Street lines of the Cleveland Electric Railway Company, which grants, the ordinance states, expire by limitation on Sept. 20, 1904.

The second ordinance gives the Forest City Company the right to build and operate over the following route: Commencing at the corner of Prospect and Erie Streets, on Erie Street, to Central, to Lincoln Avenue; also commencing at the corner of Quincy Street and Wilson Avenue, on Quincy Street, to Woodland Hills Avenue. These routes are occupied by the Central Avenue, and a portion of the Scoville Avenue lines of the Cleveland Electric Railway, and the ordinance states that the franchises expire by limitation on March 22, 1905.

The ordinances provide, among other things, that the lines shall be completed and in operation the day after the ordinance goes into effect, unless prevented from doing so by legal complications; that the valuation of the property agreed upon by the two parties, plus 20 per cent, shall be paid, in the first case by June 20, 1904, and in the second case by Dec. 22, 1904; that in event of failure to agree upon a valuation for the properties the matter shall be adjudicated by a court of competent jurisdiction, the payment in either case to be made by the guarantee in cash; that all new construction shall be of the latest type; that the rate of fare shall be 3 cents for each passenger, said fare to entitle the passenger to one continuous ride in the same general direction and one transfer on any other line operated by the company if said transfer shall be necessary to enable said passenger to reach his destination, the city reserving the right to regulate the issuance and use of transfers to carry out this provision, and also the right to establish other transfer points, and require the exchange of free transfers with other street railroad companies; that the city shall have the right at any time to purchase the lines at a price to be agreed upon by the two parties interested, or by a committee of arbitration, composed of three persons, one selected by each interested party, and the third to be chosen by these two; and that the city reserves the right to grant any other parties the joint use of not to exceed 10 per cent of the length of any route mentioned.

As already outlined in these columns, the Cleveland Electric Railway Company maintains that the grants here mentioned do not expire for several years later than stated in the ordinances, the claim being made that in every case the time of limitation was extended at the time the old companies received the right to change their power to electricity. This Mayor Johnson denies.

The third ordinance may or may not be of vast importance in the future of all electric railways in Cleveland. The ordinance provides that in all cases in which the city, by virtue of ordinances previously passed, has not divested itself of the power to regulate the rates of fare by a stipulated rate in the ordinance, the same are hereby required to make a rate of 3 cents. This ordinance takes effect within ten days from date of publications, so that unless injunctions are put in force, the citizens of Cleveland within the district bounded by Wade Park Avenue, Harvard Street, Dennison Avenue and Edgewater Park, embracing more than three-fourths of the territory within the limits of Cleveland, will have the advantage of 3-cent fares. As the ordinance says nothing about transfers, this small satisfaction is left to the old company. It is understood that only three grants, the Euclid Avenue, Payne Avenue and Scoville Avenue, stipulate that the rate of fare shall be 5 cents, and in consequence are immune from the sweeping attack. It is unofficially announced that the Cleveland Electric Railroad has decided to accept the reduction, and thus dispose of the matter, and that the effect of this action will be that 85 per cent of the residents of Cleveland will pay 3 cents, and 12 per cent will pay the present rate of 5 cents, while the remaining 3 per cent will have to pay 7 cents, but may transfer for twenty-one miles.

FOREIGN INVITATIONS TO THE INTERNATIONAL ELECTRICAL CONGRESS OF ST. LOUIS

In response to the request of the Director of Congresses at St. Louis, the president of the American Institute of Electrical Engineers, and the committee of organization of the congresses, the State Department at Washington has issued instructions to the American diplomatic officers abroad that they shall invite the various foreign Governments to appoint official delegates to the International Electrical Congress at St. Louis in September, 1904. The number of delegates requested to be appointed by each country is in conformity with the precedents established at the Chicago Congress of 1903, and at the Paris Congress of 1900.

IMPORTANT NEW PROJECTS IN MICHIGAN

The Ionia & Owosso Railway Company and Jackson & Lansing Railway Company have been incorporated, the former with a capital stock of $1,500,000, and the latter with a capital stock of $1,200,000, for the purpose of building electric railway lines from Ionia to Jackson via Owosso and Lansing. These two lines, together with the recently organized Grand Rapids & Ionia Railway Company, controlled by the same persons, contemplate the construction this year of a line that will run through the principal part of central Michigan, and, in connection with the lines owned by the Hawks-Angus syndicate, form a complete trunk line clear across the State, from Muskegon on the west to Detroit on the east. E. M. Hopkins, of Detroit and New York, president of all the companies, is authority for the statement that the survey is practically completed from Grand Rapids to Ionia, and that the entire line will be completed during 1904. The plan of the projectors is to begin work as soon as the weather conditions will permit. The entire line will be constructed upon private right of way, except through the cities and villages. Franchises have been secured in nearly all of the latter, and the private right of way is rapidly being procured. The officers of the companies are E. M. Hopkins, of Detroit and New York, president; Ex-Governor John T. Rich, of Detroit, vice-president; C. H. Pomeroy, of Saginaw, treasurer; Frank Westcott, of Vernon, secretary; Govrenor A. T. Bliss, of Saginaw; J. L. Hudson, of Detroit; W. E. Harris, of DeGraff, Ohio; Judge F. S. Porter, of Lansing, and W. W. Steele, of Detroit, directors.

THE TROLLEY IN DELAWARE

Before many months lower Delaware will probably be connected by trolley with the city of Wilmington, Delaware's metropolis, and unless the plan now under consideration miscarries, there will be an electric railway all the way from Wilmington to Smyrna, a distance of 38 miles. In addition, it is likely that the line will be extended to the extreme end of the State, reaching Lewes and Rehoboth, the terminus of the Delaware line. To substantiate the talk of the trolley, representatives of the Middletown & Odessa Company and Wilmington & New Castle Trolley Company have held several conferences lately about the proposed extension down the State, and all that is lacking is the signing of a written agreement on the part of the companies in question. An official of the Middletown & Odessa line is authority for the statement that an agreement imposing the conditions mentioned has been drawn up and is now being considered by officials of the Wilmington & Delaware City line. It is expected that Harry A. Richardson, of Dover, president of the Wilmington & Delaware City line, will soon append his signature to this agreement. If this is done, construction of the Smyrna extension will begin in a few months.

According to the plan under consideration, the Wilmington & Delaware City Railway is to be extended to Odessa, provided the Middletown & Odessa line is extended to Smyrna, in Kent County. Officials of the Middletown road desire to build down the State, but first wish to be assured that their passengers can be carried into Wilmington without inconvenience. The extension of the Wilmington & Delaware City line to Odessa would solve the problem, and it is understood that officials of that company have assured the Middletown officials that they will build from Delaware City to Odessa provided the extension from Middletown is laid down. If the line is built to Smyrna, as contemplated, the State Capital will undoubtedly be reached, as part of the road has already been graded and leveled by a company incorporated here several years ago.

WORK OF THE Y. M. C. A. STREET RAILWAY BRANCHES

Y. M. C. A. officials report that during the year just closed the association has made greater strides than ever before in the new department for street railway employees. Well equipped and thoroughly organized branches have been established in Rochester, Brooklyn and Richmond, Va., with experienced railroad secretaries in charge.

The association at Rochester has quarters in the State Street car house, and the board of directors of the company has just made an appropriation of $3,000 to provide needed improvements and enlargement. In the city of Brooklyn a new building costing over $30,000 has been turned over to the association by the Brooklyn Rapid Transit Company, yet there are times when the facilities are taxed to the utmost by the men who are anxious to take advantage of the many opportunities for physical and intellectual development. At Richmond, Va., the Passenger and Power Company recently made an appropriation for fitting up rooms in the car houses for the use of employees. Over 300 men have expressed a desire to join the new association. A library valued at $1,000 will be installed, and a music box and talking machine provided.

In a number of other cities, at the request of street railway officials, investigations have been made by representatives of the association, and reports made in each case outlining the work to be done. While it is true that this work is comparatively new, the interest manifested by the men and the companies seems to warrant the confidence shown by representatives of the association, that during 1904 a number of additional branches will be organized in metropolitan centers for the use of men in the employ of street railway companies.

THE INTERURBANS OF OHIO IN THE RECENT STORM

The interurban roads of Ohio made a very fine showing during the severe snow storms last week. With the exception of one or two new lines that had not yet secured snow plows, all of the companies were prepared for the storm, and kept their lines open and operated cars almost on schedule time. The Cincinnati Traction Company operated twenty-two sweepers on its city and suburban lines, and kept cars running at regular intervals on every line but one, on which wires were down. Cars on the system of the Interurban Railway & Terminal Company were troubled by sleet, but the lines were kept open. The Cincinnati, Dayton & Toledo cars were delayed, but none of them were thrown out of service. All of the Columbus interurbans were kept open, with the exception of the Urbana, Mechanicsburg & Columbus, which had not yet secured its snow plows. Owing to the unfinished condition of this line, the company has obtained a court order permitting it to suspend operations for sixty days, if desirable. Some of the Cleveland roads operated under reduced headway, but traffic was not suspended by any of them. The Lake Shore Electric Railway made a particularly creditable record, as its entire line from Cleveland to Toledo was kept open, and all cars ran through without an accident. Not one of the cars on the Lake Shore was more than an hour late, whereas all of the trains on the Lake Shore & Michigan Southern (steam), which parallels the electric line, were delayed from one to six hours. President Bicknell, of the Lake Shore, is greatly elated over the showing made by his road, particularly because of the fact that a Lake Shore & Michigan Southern flyer was tied up near Norwalk by deep snow, and the passengers took the electric line into the city. Many of these passengers abandoned the steam line entirely and came through to Cleveland in the electric cars.

THE STRIKE AT BLOOMINGTON, ILL.

The extreme violence of the striking employees of the Bloomington & Normal Railway, Electric & Heating Company seems to have finally awakened the law-abiding citizens of the city to the appreciation of their duty, and the measures adopted for protection give hope that the lawless element will soon be effectually put down. The Mayor has recently issued a proclamation on the strike announcing that all who interfere with the operation of cars in any way will be prosecuted vigorously, and the Citizens' Alliance of the city, composed of business men and citizens, has tendered the sum of $10,000 to aid the company in its contest with the strikers. So determined now are the authorities that all lawlessness shall cease that even the Aldermen patrol the streets twirling rosewood police clubs, and wearing huge tin stars pinned to their civilian overcoats.

The State Board of Arbitration convened at Bloomington, but adjourned on Jan. 7, announcing its inability to make any settlement. On that very date regular service was resumed by the company with local non-union men, and on Saturday, Jan. 9, the last of the imported men were deported for Chicago. The strike was declared Jan. 1, the issue being the refusal of the company to grant the men an increase in wages from 17 to 18 cents an hour.

CHANGE IN CAR HOUSE CONSTRUCTION AT CLEVELAND

In addition to the adoption of the plan of storing many of its cars in the open, as outlined in a recent issue of the STREET RAILWAY JOURNAL, the Cleveland Electric Railway has decided to make a number of changes in the construction of some of its car houses which will be used for storing cars that are out of season. At the Windermere car house, which is one of the largest in the city, it is the intention to erect a solid brick cross-wall, thus dividing the house into four sections, each division being sufficiently large to hold twenty cars. There will be entrances and curves from both ends, and the tracks will be elevated at the center, giving them about a 1½ per cent grade, which it is thought will be sufficient to allow cars to run out when the brakes are released. Similar arrangements will be made at other car houses. At the Lake View house the wooden walls will be replaced with brick. The company is using every precaution to avoid a repetition of the Holmden Avenue car house fire.

CHANGE IN THE MANAGEMENT AND SALES OFFICES OF THE NATIONAL ELECTRIC COMPANY

At a meeting of the board of directors of the National Electric Company, successor to the Christensen Engineering Company, F. C. Randall was elected vice-president and general manager to succeed R. P. Tell, resigned. R. P. Tell was elected secretary and treasurer of the company, and B. T. Becker was appointed assistant general manager.

The general sales office of the Christensen air brake department of the National Electric Company has been transferred from 135 Broadway, New York, to the Milwaukee works, and will be under the direct charge of F. C. Randall, vice-president and general manager of the company. The company will still retain a sales office at 135 Broadway, New York, which will take care of New York City and all of New England and Canada. This office will be in charge of J. T. Cunningham, who has been the New England representative of the company for the last two years. J. D. Maguire has been appointed special sales representative of the airbrake department of the National Electric Company, and will make his headquarters at the New York office. J. H. Denton, who formerly made his headquarters at the general sales office at New York, has been appointed chief of the inspection department at the Milwaukee works in addition to his position as chief engineer of sales department for Christensen air brakes. Mr. Denton in future will be located in the Milwaukee office.

COMING BANQUET OF THE NEW ENGLAND STREET RAILWAY CLUB

The annual banquet of the New England Street Railway Club, which is always held in mid-winter in Boston, is scheduled this year for Thursday evening, Jan. 28. It will be held at the Hotel Brunswick, on Boylston Street, and a large attendance is expected.

As the demand for tickets will undoubtedly be greater than the capacity of the hotel, no tickets unpaid for by Jan. 21 will be reserved. Members will be permitted to purchase tickets for guests, until the committee considers that it is being done to such an extent as to exclude members. The price of tickets is $2.50 each, and they can be secured at any time now by application to J. H. Neal, secretary-treasurer, 101 Milk Street, Boston. The banquet will begin at 7 p. m., and will be preceded by a reception to commence at 6 p. m.

NEW BOSTON ENGINEERING FIRM

George W. Swazey and Herbert W. Smith, both of Boston, have joined their interests, and will give their attention to the building of street railways, the installation of lighting and power plants, and the handling of supplies, representing some of the leading houses in that line. They are now negotiating to act as purchasing agents for several foreign syndicates.

Mr. Swazey is well known to the street railway profession, having completed and placed in operation several lines, the last being the Claremont Railway & Lighting Company, Claremont, N. H., whose power plant is a combination of water and steam.

Mr. Smith has been for several years connected with the supply business, being for the last four years assistant manager of the railway department of the Stuart-Howland Company.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED JAN. 5, 1904

748,591. Third-Rail Cover; Henry F. Duffy, Seattle, Wash. App. filed June 20, 1903. A third-rail protector consisting of a sectional cover whose sections are successively raised and lowered by the car to permit the contact-shoe to make uninterrupted contact with the rail.

748,592. Third-Rail Protector; Henry F. Duffy, Seattle, Wash. App. filed June 20, 1903. A modification of the preceding patent.

748,619. Electric Railway; Charles J. Kintner, New York, N. Y. App. filed Sept. 22, 1899. The sections of the working conductor are held in a strained and bowed condition by springs acting on rock-shafts connected with their terminals. The contact shoe presses the section downward to connect it with the feeder.

748,620. Electric Railway; Charles J. Kintner, New York, N. Y. App. filed March 10, 1902. A feature of this invention is the provision of circuit closers which automatically connect and disconnect turn-out third rails when the track switch is thrown.

748,621. Safety System of Electric Railways; Charles J. Kintner, New York, N. Y. App. filed Nov. 15, 1902. Circuits and circuit connections whereby the current potential is always maintained substantially constant to the motor on the car and each sectional conductor is automatically disconnected from the current feeder only after electrical connection has been severed between it and the current collecting means carried by the car.

748,628. Automatic Guard or Life Saver for Tram Cars or the Like; David Maxwell, Dundee, Scotland. App. filed Aug. 15, 1902. Details.

748,688. Street Railway Switch; Walter J. Bell, Los Angeles, Cal. App. filed May 7, 1903. Details of construction of a switch-throwing apparatus operated by hydraulic cylinders controlled by electric valves.

748,810. Electric Car Plow; William F. Taylor, Jr., Providence, R. I. App. filed March 30, 1903. In connection with the main contact for the propelling current, subsidiary contacts are provided for engagement with extra rails in signaling or switch-throwing circuits.

748,811. Switch; William F. Taylor, Jr., Providence, R. I. App. filed March 30, 1903. Contact plates in the roadbed are engaged by hinged arms on the car to deliver current from the trolley to motors in the roadbed which move the switch.

748,812. Switch-Throwing Mechanism; William F. Taylor, Jr., Providence, R. I. App. filed March 30, 1903. A special arrangement of gearing actuated by an electric motor to throw the switch tongue.

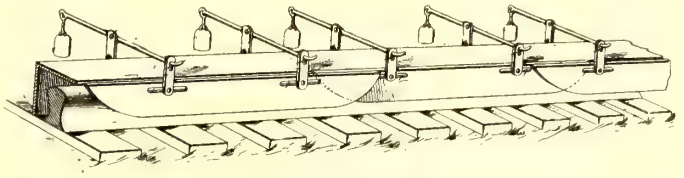
748,813. Contact-Shoe; William F. Taylor, Jr., Providence, R. I. App. filed March 30, 1903. Details of construction of a shoe suspended from overhead supports to be engaged by a trolley.

748,815. Railway Block Signal and Switch; William F. Taylor, Jr., Providence, R. I. App. filed March 30, 1903. A controller on the car platform adapted to operate both signals and rail switch.

748,872. Electric Railway System; William G. Lowrie, New York, N. Y. App. filed June 21, 1901. The invention relates particularly to the construction of a trolley which moves through a closed conduit in contact with conductors therein, the motion being obtained by the attraction of a magnet carried by the car.

748,903. Car Seat; Hubert Witte, St. Louis, Mo. App. filed Sept. 14, 1903. Details of construction of a "walk-over" seat.

748,987. Trolley Harp; Edward D. Rockwell, Bristol, Conn. App. filed Nov. 7, 1903. The trolley wheel is mounted in bearing blocks adapted to slide into ways in the harp, the wheel being free to rock to follow curvatures in the wire.



PATENT NO. 748,591

749,009. Device for Operating Street Railway Switches; Harry T. Young, Homestead, Pa. App. filed April 18, 1903. A rotary disc with projections thereon connected with the switch tongue by link and lever connections is adapted to be engaged by a spring-pressed rack bar carried by the car, to thereby rotate the disc and actuate the switch.

749,042. Electric Railway System; William M. Eader, Middletown, Md. App. filed July 27, 1903. A third-rail collecting device, consisting of spring-mounted rollers spaced apart and arranged to readily engage a second section of the rail when passing from one section to another.

PERSONAL MENTION

MR. EZRA D. WHITAKER has resigned as treasurer of the Hoosac Valley Street Railway Company, of North Adams, Mass., a position he has filled for two years. He resigned because of the pressure of other business.

MR. IRVING H. REYNOLDS, formerly with the Allis-Chalmers Company, and for many years identified with the design and construction of that company's engines, has accepted a position with the William Tod Company, of Youngstown, as consulting engineer.

MR. A. B. SANDERS, who has for a number of years been connected with the engineers' department of the American Telephone & Telegraph Company, of New York City, and later with the Electric Storage Battery Company, of Philadelphia, has taken charge of the electrical department for John B. Watson, Drexel Building, Philadelphia.

MR. SAMUEL C. GRIER, president of the Youngstown, Park & Falls Street Railway Company, of Youngstown, Ohio, died at Pittsburg a few days ago. Mr. Grier was born in Allegheny, Pa., in 1851. He was at the head of several manufacturing establishments in Pittsburg and Allegheny, and was a director of two leading banks at Allegheny.

MR. T. J. RODERICK, superintendent of the Indianapolis, Shelbyville & Southeastern Traction Company, of Shelbyville, Ind., for the past year, has resigned and will be succeeded by Mr. Arthur A. Anderson, who will also be superintendent of the Indianapolis & Cincinnati line when completed. Mr. Anderson formerly was superintendent of the Indianapolis city lines.

MR. J. B. McCLARY, who, on Jan. 1, retired as general manager of the railway department of the Birmingham Railway & Light Company, of Birmingham, Ala., after having served with the company for more than sixteen years, was presented with a handsome gold watch Dec. 31 by the employees of the company as a token of esteem. Mr. McClary's successor, as previously announced in the Street Railway Journal, is Mr. George Harris, who has been connected with the company since 1890.

MR. N. S. BRADEN, formerly manager of the Westinghouse Electric & Manufacturing Company's district office at Cleveland, Ohio, has been appointed sales manager of the new Canadian Westinghouse Company, Ltd., and assumed the duties of that office Jan. 1, 1904. Mr. Braden succeeds the late Mr. Thomas C. Frenyear, who died on Dec. 10, 1903. Mr. Frenyear's office was at Toronto, but Mr. Braden will make his headquarters at Hamilton, Ont. Mr. Braden was born at Indianapolis thirty-four years ago. He went to the Jenny Electric Motor Company, in his native city, in 1892, and remained with that company until 1899, when he joined the Cleveland district sales office of the Westinghouse Electric & Manufacturing Company as a salesman, where he later became manager.

MR. GEORGE W. PARSONS, who for a long term of years has ably managed the business of the frog, switch and signal department of the Pennsylvania Steel Company, has resigned from the active management of the department, but will remain connected with it in an advisory capacity. Mr. C. W. Reinoehl, who has also been for a long time with the Pennsylvania Steel Company, succeeds Mr. Parsons as superintendent of the frog, switch and signal department, and Mr. W. C. Cuntz succeeds Mr. Reinoehl as sales agent, in charge of the Steelton (Pa.) sales office. These different appointments became effective Jan. 1, 1904.

MR. F. L. WANKLYN, who recently retired as general manager of the Montreal Street Railway Company, of Montreal, Quebec, was waited on a few days ago by the leading officials of the company and presented with a gold mounted mantel clock. Mr. W. G. Ross, the new managing director, in a few remarks, referred to the progress the company had made under Mr. Wanklyn's management, and the regret felt by all that his other business arrangements had necessitated his withdrawal from the company. The clock, which bears a neat inscription, was handed to Mr. Wanklyn by Mr. P. Dube, the new secretary. Mr. Wanklyn, in expressing his gratitude, hoped the friendships he had formed would endure long after he had severed his connection with the company. Mr. Wanklyn's retirement from the office of general manager and vice-president of the Montreal Street Railway Company will affect both that company and the Light, Heat & Power Company. In the Montreal Street Railway Company Mr. Duncan McDonald will become general manager, while Mr. W. D. Ross will occupy the new position of managing director, and in order to do so retires from the board of the Light, Heat & Power Company.

MR. FRANK C. RANDALL, who has just been elected vice-president and general manager of the National Electric Company, of Milwaukee, has for a long time been prominently identified with the street railway trade. He obtained his early education at the English High School of Boston, and in 1875 entered the office of his father, who was an importer of special grades of English iron and steel in Boston. After two years in this office he entered the employ of the New York & New England Railroad Company as "Performance of Engine" clerk in the Norwood central shops, and later was appointed chief clerk of the motive department of the same road, at Hartford, for all divisions west of Willimantic. He later left his position to accept that of chief clerk of the motive power department of the Boston & Lowell Railroad and its leased lines. Upon the consolidation of the latter road with the Boston & Maine Railroad Company he severed his connection with the steam railroad business, and decided to enter the manufacturing field. He obtained a position in the shops of the Tripp Manufacturing Company, and after several years of practical work, during which he acquired a knowledge of the manufacture of electric railway car trucks, he was promoted to the position of foreman and later superintendent of the plant of the company. He resigned this position to accept a position as Eastern sales agent of the J. G. Brill Company, and later was made Western sales agent of this company, with headquarters at Chicago. After being in the employ of the J. G. Brill Company about six years he was offered the position of Eastern sales agent of the Christensen Engineering Company, which he accepted, and later was appointed general sales agent of this company and its successor, the National Electric Company.

F. C. RANDALL

During Mr. Randall's connection with the sales department of the company the sales of Christensen air brakes increased from less than 200 equipments to the enormous total of over 11,000, which are in use at present time. During his steam railroad experience he gained a valuable knowledge of organization, which, added to his acquaintance of electric railway affairs gained by personal contact with the leading electric traction operating men, enabled him to form a corps of salesmen and engineers, covering the railway field of the entire country, and in the success of this organization he takes great pride. In his new position as vice-president and general manager of the National Electric Company, Mr. Randall will still attend to the duties of general sales agent not only of the air brake, but also of the electrical machinery department of the company.

EARNINGS OF NEW YORK STREET RAILWAYS

The reports of the street railway companies of New York State for the year ending June 30, 1903, have been filed with the State Railroad Commission, as required by law. Through the courtesy of the commission the STREET RAILWAY JOURNAL has been permitted to make transcriptions of the several reports, and the main figures are given in the table on the opposite page. The total gross earnings from operation were \$48,974,748.77, an increase of \$2,069,560.90 over 1902. Operating expenses were \$28,259,721.28, an increase of \$629,856.31 over 1902. The percentage of dividends declared to capital stock is 3.66 per cent, a decrease of .25 per cent. The total number of passengers carried (including transfers) was 1,267,563,057; the total number carried in 1902 was 1,209,510,539, 58,052,518 more being carried in 1903 than in 1902. The mileage of road increased 128.481 miles. The percentage of operating expenses to gross earnings was 57.70 in 1903, against 58.91 in 1902.

Thirty-nine passengers, twenty-two employees and 111 others (total 172) were killed, and 432 passengers, forty-two employees and 332 others (total 805) injured on the street surface railroads during the year.

The total mileage of the State is 1858 miles. The greatest increase during the year was on the Hudson Valley (17.6 miles), and the Schenectady (21.315 miles). The average number of persons, including officials, employed during the year ended June 30, 1903, on all the street surface railroads of the State (including horse railroads), was 30,028; in 1902, 30,529. The aggregate amount of salaries and wages paid them during the year was \$17,841,895.49; in 1902, \$17,857,825.83. The number of tons of freight carried in 1902 was 394,641, and in 1903, 516,460.

The board's electrical expert devotes considerable space to high-voltage transmission and block signals. In regard to the former he says:

"The question of high-voltage transmission lines has assumed serious proportions. It seems evident that this method of transmitting power will be universally adopted by electric railroads, where there is reliable water-power available within reasonable distance. The higher the voltage used the less cost for construction; for this reason the tendency will be to increase, rather than to reduce, the voltage. The question of the location of these lines on highways or private right of ways; the danger to be caused the public by their use; the means of relieving such danger and other questions in reference to their operation are now being considered by special committees of the American Institute of Electrical Engineers, the National Board of Fire Underwriters, and the New York Street Railway Association."

In speaking of train despatching he says:

"Defects in methods in train despatching in use on electric railroads have resulted in more serious accidents during the past year than from any other cause. Head-on collisions have occurred on two of the roads operating under the most approved system of train despatching employed on any of the roads in this State. These collisions were the result of defects in the methods of running cars by train orders.

"A more perfect method of operating cars by train orders should be adopted by the different high-speed roads to prevent collisions, or some other means, such as block signals, should be used for that purpose."

The report adds:

"The most serious complaints which we have considered during the year were those against the street surface and elevated railroads of New York and Brooklyn. We believe that unbiased consideration of these statements will lead to the conclusion that much has been accomplished by the board toward the alleviation of the conditions of passenger transportation in New York City. When the tunnel railroad in Manhattan and the Bronx is in operation conditions will be much improved. When cars may cross the newly opened bridge to Brooklyn, and when the tunnel to Brooklyn is completed, conditions in Brooklyn will also be much improved."

Financial Reports of the Operating Street Railways of New York State for the Year Ending June 30, 1903.

Name	On June 30, 1903		Year Ending June 30, 1903					
	Capital Stock	Funded Debt	Total Receipts All Sources	Operating Expenses	Charges on Earnings	Dividends Paid		Surplus For Year
						Amount	Per Cent	
	$	$	$	$	$	$		$
Interurban St. Ry. Co.	52,000,000	37,030,000	15,273,363	7,068,428	8,453,645	......	..	df. 248,709
Brooklyn Rapid Transit Co.	45,000,000	12,000,000	13,557,814	7,931,079	4,829,952	......	..	796,783
Manhattan Railway Co.	55,197,922	39,558,000	12,555,197	5,460,794	3,648,859	2,718,000	2½ & 2¾	727,544
International Ry Co.*	16,320,500	10,928,000	3,225,662	1,738,449	765,564	652,820	4	68,829
The Third Avenue R. R. Co.	15,995,800	40,000,000	2,961,659	1,170,594	1,746,538	......	..	44,526
United Traction Co. (Albany)	4,999,950	4,241,300	1,624,305	1,076,847	299,138	249,997	5	def. 1,677
Coney Island & Brooklyn R. R. Co.	2,000,000	2,000,000	1,605,30[illegible]	1,009,040	270,288	320,000	16	5,973
Rochester Ry. Co.	5,000,000	4,557,000	1,324,353	692,931	392,882	156,250	6¼	82,289
Union Ry. Co. (New York)	2,000,000	2,000,000	1,139,582	820,226	294,949	......	..	24,308
Brooklyn, Queens County & Suburban R. R. Co.	2,000,000	6,624,000	867,371	434,192	384,757	......	..	48,421
Forty second St., Manh'nville & St. Nich. Ave. Ry. Co.	2,500,000	2,800,000	833,523	475,733	422,146	......	..	def. 64,357
Syracuse Rapid Transit Ry. Co.	4,000,000	3,839,000	753,277	421,961	230,901	......	..	100,415
Schenectady Ry. Co.	600,000	2,000,000	648,763	356,751	119,767	......	..	172,246
Utica & Mohawk Valley Ry. Co.	2,500,000	2,700,000	621,976	368,382	147,680	......	..	105,915
New York & Queens County Ry. Co.	3,235,000	3,000,000	619,434	363,994	191,200	......	..	64,239
Dry Dock, East Broadway & Battery R. R. Co.	1,200,000	2,050,000	566,992	435,599	138,515	......	..	def. 7,122
Thirty-fourth Street Crosstown Ry. Co.	1,000,000	1,000,000	495,100	297,808	69,821	......	..	127,471
Central Crosstown R. R. Co.	600,000	250,000	490,331	309,061	107,844	60,000	10	7,426
Fonda, Johnstown & Gloversville R. R. Co.	2,500,000	5,600,000	b 485,343	271,567	169,379	24,000	4	20,399
Hudson Valley Ry. Co.	3,000,000	3,750,000	349,218	338,337	184,708	......	..	df. 173,827
Richmond Light & R. R. Co.	2,871,750	2,200,000	291,219	163,740	123,597	......	..	3,882
The Yonkers R. R. Co.	1,000,000	1,000,000	260,723	243,643	64,052	......	..	46,972
Westchester Electric R. R. Co.	500,000	500,000	238,413	281,514	37,216	......	.	def. 80,324
Binghamton Ry. Co	792,360	1,420,000	226,702	126,600	68,100	15,846	2	16,156
Albany & Hudson R. R. Co.	1,750,000	1,500,000	213,551	111,286	123,193	......	..	def. 20,927
Twenty-eighth & Twenty-ninth St. Crosstown R. R. Co.	1,500,000	1,500,000	186,655	100,702	87,650	......	..	1,697
Elmira Water, Light & R. R. Co.	† 429,818	......	184,815	135,751	48,403	......	..	661
Staten Island Midland R. R. Co.	1,000,000	1,000,000	153,457	94,162	59,189	......	..	106
The Jamestown Street Ry. Co.	100,000	300,000	139,519	91,831	33,540	......	..	14,148
Auburn & Syracuse	1,300,000	714,000	121,470	73,794	38,926	......	..	8,749
New York & Stamford Ry. Co.	500,000	396,000	116,309	75,855	22,056	......	..	18,938
Long Island Electric Ry. Co.	600,000	600,000	112,901	80,023	35,965	......	..	def. 3,086
Kingston Consolidated R. R. Co.	400,000	700,000	112,164	64,553	38,725	......	..	8,886
Ithaca Street Ry. Co.	325,000	325,000	109,090	60,996	22,907	......	..	25,185
Orange County Traction Co.	325,000	425,000	103,827	67,479	28,201	......	..	8,147
Poughkeepsie City & Wappinger's Falls El. Ry. Co.	750,000	404,000	98,010	79,187	20,957	......	..	def. 2,134
Syracuse, Lakeside & Baldwinsville Ry.	500,000	500,000	87,976	53,520	31,542	......	..	2,915
Niagara Gorge R. R. Co.	1,000,000	1,000,000	82,711	36,642	52,096	......	..	6,028
Peekskill Lighting & R. R. Co.	350,000	500,000	76,052	30,612	29,125	......	..	16,315
Hamburg Ry. Co.	200,000	300,000	75,090	60,085	15,679	.....	..	674
Syracuse & Suburban R. R. Co.	400,000	500,000	75,032	44,136	26,436	......	..	4,460
Olean Street Ry. Co.	300,000	433,500	74,866	38,715	21,228	......	..	14,923
Geneva, Waterloo, Seneca Falls & Cayuga Lake Tr. Co.	450,000	436,500	73,017	40,682	20,652	......	..	11,682
Tarrytown, White Plains & Mamaroneck Ry. Co.	300,000	300,000	72,933	76,343	17,349	......	..	20,760
Black River Traction Co.	105,000	55,000	66,156	68,479	4,845	......	..	def. 7,168
Oneonta, Cooperstown & Richfield Springs Ry. Co.	1,464,000	1,364,000	64,188	85,123	2,228	......	..	23,163
Waverly, Sayre & Athens Traction Co.	200,000	150,000	56,821	38,210	11,0[illegible]8	......	..	7,603
Southern Boulevard R. R. Co.	250,000	250,000	56,718	44,581	18,382	......	..	def. 6,245
Rochester & Suburban Ry. Co.	420,000	......	56,316	34,494	27,419	......	..	def. 5,597
Dunkirk & Fredonia R. R. Co.	150,000	100,000	55,801	31,684	6,941	27,141	a 19	def. 9,964
Van Brunt Street & Erie Basin R. R. Co.	200,000	65,000	53,609	29,898	6,011	10,000	5	7,700
Citizens' Railroad Light & Power Co.	175,000	175,000	51,444	26,877	14,396	.....	..	10,171
Kingsbridge Ry. Co.	8,600	......	51,441	34,459	1,721	......	..	15,261
Middletown-Goshen El. Ry. Co.	100,000	275,000	47,093	43,986	2,112	.....	..	994
Cortland County Traction Co.	320,000	180,000	42,551	32,387	8,832	.....	..	1,332
Bennington & Hoosic Valley Ry. Co	200,000	182,000	39,610	28,314	9,700	......	..	1,596
Oswego Traction Co.	300,000	288,000	38,373	31,383	13,774	......	..	6,785
Fulton Street R. R. Co.	500,000	500,000	38,289	30,319	21,668	......	..	def. 13,697
Corning & Painted Post St. Ry. Co.	100,000	100,000	38,156	22,926	6,999	......	..	8,231
Elmira & Seneca Lake Ry. Co.	300,000	300,000	36,968	33,941	18,475	......	..	15,448
Coney Island & Gravesend Ry. Co.	35,400	......	36,312	32,377	379	......	..	3,550
The New York & Long Island Traction Co.	1,000,000	......	34,677	35,256	334	......	..	def. 914
The Ballston Terminal R. R. Co.	300,000	385,000	30,305	20,909	13,764	......	..	def. 4,368
Ogdensburg St. Ry. Co.	150,000	150,000	29,200	26,550	9,906	......	..	def. 7,256
Troy & New England R. R. Co.	180,000	183,725	27,385	18,853	10,210	......	..	def. 1,678
Port Jervis Electric Light, Power & Gas R. R. Co.	450,000	275,000	27,176	10,187	4,059	......	..	12,930
Rochester, Charlotte & Manitou R. R. Co.	97,500	81,250	20,011	16,196	4,880	......	..	1,065
Hornellsville & Canisteo Ry. Co.	50,000	80,000	18,837	11,349	3,867	......	..	3,621
Penn Yan, Keuka Park & Branchport Ry.	94,000	100,000	18,795	15,391	6,885	......	..	def. 3,481
Plattsburgh Traction Co.	100,000	80,000	18,740	16,289	7,174	......	..	def. 4,733

* Not including Crosstown Railroad. † Net investment. a 10 per cent. was paid in stock. b Not including the Amsterdam Division

Financial Reports of the Operating Street Railways of New York State for the Year Ending June 30, 1903.—*Continued.*

Name	On June 30, 1903		Year Ending June 30, 1903					
	Capital Stock	Funded Debt	Total Receipts All Sources	Operating Expenses.	Charges on Earnings	Dividends Paid Amount	Dividends Paid PerCent	Surplus For Year
	$	$	$	$	$	$		$
New Paltz & Poughkeepsie Traction Co.	100,000	100,000	18,328	12,187	6,314	......	..	174
Westchester Traction Co.	300,000	206,000	18,359	19,592	9,348	......	..	10,582
Buffalo & Williamsville Electric Ry. Co.	75,000	......	17,868	10,032	625	......	..	7,210
The Hornellsville Electric Ry. Co.	50,000	70,000	16,035	14,422	3,541	......	..	def. 1,928
Buffalo, Gardenville & Ebenezer Ry. Co.	39,300	22,000	14,103	11,791	1,803	......	..	508
Huntington R. R. Co.	30,000	26,000	13,712	13,390	1,825	......	..	def. 1,503
Lewiston & Youngstown Frontier Ry. Co.	134,000	134,000	12,285	12,767	9,979	......	..	def. 10,460
Buffalo & Depew Ry. Co.	305,000	350,000	9,938	22,428	19,700	......	..	def. 32,190
Pelham Park R. R. Co.	50,000	27,750	8,899	7,148	2,0 6	......	.	def. 315
Catskill Electric Ry. Co.	60,000	54,000	8,117	7,841	3,040	......	..	def. 2,764
The Nassau County Ry. Co.	35,000	......	7,541	6,187	......	......	..	1,354
Ontario Light & Traction Co.	30,000	39,952	7,184	5,118	281	......	..	1,785
City Island R. R.	50,000	27,873	6,346	5,865	1,817	......	..	def. 1,336
Oneida Ry. Co.	15,000	10,000	6,244	7,110	749	......	..	def. 1,615
Northport Traction Co.	45,000	......	6,037	8,000	111	......	..	def. 2,075
Ocean Electric Ry. Co.	35,000	20,000	3,896	2,516	1,301	......	..	79
Southfield Beach R. R. Co	250,000	21,000	3,747	3,114	1,732	......	..	def. 1,099
Fulton & Oswego Falls St. Ry. Co.	15,000	15,000	2,216	2,592	1,266	......	..	def 1,642
Rome City Ry. Co.	150,000	123,500	2,102	3,637	6,780	......	..	def. 8,315

NEW WORK IN 1904

For several years past it has been the practice of the Street Railway Journal to obtain at the beginning of the new year an outline of the work planned by the various street railway companies throughout the country. This practice has again been followed this year, and the Journal thus is able to present to its readers the following outline of some of the new work:

PUBLIC WORKS COMPANY, of Bangor, Maine, will build a car house.

ERIE ELECTRIC MOTOR COMPANY, of Erie, Pa., plans to build 4 miles of track.

BENTON POWER & TRACTION COMPANY, of St. Cloud, Minn., is to build a new car house and repair shop.

SOUTH CHICAGO CITY RAILWAY COMPANY, of Chicago, Ill., is in the market for about 60 tons of copper wire.

PASCAGOULA STREET RAILWAY & POWER COMPANY, of Scranton, Miss., will buy a 100-kw alternator, belted.

UNITED ELECTRIC COMPANY, of Dennison, Ohio, within a few months, will contract for 1000 ft. of new track.

SYRACUSE RAPID TRANSIT RAILWAY COMPANY, of Syracuse, N. Y., expects to put up a car house next year.

QUINCY HORSE RAILWAY & CARRYING COMPANY, of Quincy, Ill., will rebuild 2 miles of track with 60-lb. T-rail.

LATROBE STREET RAILWAY COMPANY, Latrobe, Pa., during the next three months will contract for a 5-mile extension.

EL PASO ELECTRIC RAILWAY COMPANY, of El Paso, Tex., will build 1¼ miles of track, and possibly purchase four cars.

GEORGETOWN & LEXINGTON TRACTION COMPANY, of Lexington, Ky., expects to purchase storage battery equipment.

COLUMBUS, BUCKEYE LAKE & NEWARK TRACTION COMPANY, of Newark, Ohio, may possibly build from Etna to Pataskala.

SPRINGFIELD & XENIA TRACTION COMPANY, of Springfield, Ohio, will buy five or six passenger cars and one express car.

INDIAN TERRITORY TRACTION COMPANY, of South McAlester, Ind. Ter., intends to construct about 15 miles of road shortly.

HORNELLSVILLE & CANISTEO RAILWAY COMPANY, of Hornellsville, N. Y., will probably purchase some car equipments soon.

CUMBERLAND ELECTRIC RAILWAY COMPANY, of Cumberland, Md., expects to purchase two cars during the next two months.

THE LORAIN STREET RAILWAY COMPANY, of Lorain, Ohio, may purchase four new cars and some shaker grates during the year.

TORRINGTON & WINCHESTER STREET RAILWAY COMPANY, of Burrville, Conn., will purchase a boiler. Capacity not stated.

LEHIGH TRACTION COMPANY, of Hazleton, Pa., will purchase ten new cars, equipped. Orders are to be placed within four months.

RADFORD WATER POWER COMPANY, of Radford, Va., will purchase one lathe for repair shop and one two-motor car equipment.

SIOUX CITY TRACTION COMPANY, of Sioux City, Ia., will build six new cars and six trailers and rebuild about 3 miles of old track.

HORNELLSVILLE ELECTRIC RAILWAY COMPANY, of Hornellsville, N. Y., contemplates purchasing some equipment for its power station.

SYRACUSE & ONEIDA LAKE ELECTRIC RAILWAY COMPANY, of Syracuse, N. Y., will contract for the following within the next six months: Eleven miles of new track and overhead line, six complete motor car equipments, six trail car equiments, and one snow-plow.

DENISON & SHERMAN RAILWAY COMPANY, of Denison, Tex., expects to do something in the line of amusement attractions for park.

ALTON LIGHT & TRACTION COMPANY, of Alton, Ill., will within the next two months place contracts for two steel bridges, 124 ft. x 117 ft.

BEAUMONT, SOUR LAKE & PORT ARTHUR TRACTION COMPANY, of Beaumont, Tex., will build 10½ miles of track and terminals.

PROVIDENCE & DANIELSON RAILWAY COMPANY, of Providence, R. I., will purchase six passenger cars, with motors and full equipments.

MACON RAILWAY & LIGHT COMPANY, of Macon, Ga., has purchased some new machinery, and is installing same. The old material is for sale.

TEXARKANA LIGHT & TRACTION COMPANY, of Texarkana, Ark., expects to purchase equipment for 150-acre park, with lake and race track.

THE WEST CHESTER STREET RAILWAY COMPANY, of West Chester, Pa., plans to contract for a car house within the next six months.

CHARLOTTESVILLE & ALBEMARLE RAILWAY COMPANY, of Charlottesville, Va., is to purchase a 72-in. x 18-ft. boiler within six months.

THE DURANGO RAILWAY & REALTY COMPANY, of Durango, Col., will buy one or two closed double-truck cars, and possibly a street sprinkler.

JACKSON & SUBURBAN STREET RAILROAD, of Jackson, Tenn., writes that stage settings and scenery will be bought for park opera house.

NORTHAMPTON TRACTION COMPANY, of Easton, Pa., expects to build 3 miles of track and purchase five twelve-bench double-truck open cars.

GRAND RAPIDS, HOLLAND & LAKE MICHIGAN RAILWAY, of Holland, Mich., expects to enlarge its amusement park, adding new attractions.

WASHINGTON, ARLINGTON & FALLS CHURCH RAILWAY COMPANY, of Washington, D. C., is building a 2½-mile extension and a new car house.

SAN JOSE RAILROAD, of San Jose, Cal., within six months will place contracts for 4 miles of new road. Trucks, sand-boxes, etc., are to be purchased.

INTERSTATE TRACTION COMPANY, of Duluth, Minn., will purchase two cars; 3000 ft. of track will be built. Contracts are to be placed within six months.

MADISON TRACTION COMPANY, of Madison, Wis., expects to build a fireproof car house 200 ft. x 200 ft., contract for which will be placed in two months.

CONSOLIDATED RAILWAYS, LIGHT & POWER COMPANY, of Wilmington, N. C., is to erect a large pavilion for excursions, vaudeville shows, etc.

TAZEWELL STREET RAILWAY COMPANY, of Tazewell, Va., has an idea of changing its horse car line to an electric line, but the plans are not yet matured.

INDIANAPOLIS, COLUMBUS & SOUTHERN TRACTION COMPANY, of Columbus, Ind., expects to purchase engine, generator and boilers. Report not definite.

OLYMPIA LIGHT & POWER COMPANY, of Olympia, Wash., will build about 1200 ft. of track. The company may also build new car house and purchase one or two cars.

BINGHAMTON RAILWAY COMPANY, of Binghamton, N. Y., expects to build an extension to Owego, about 12 miles, and complete car house and repair

shop. Foundations for the latter are erected and material bought. The company is considering the addition of a miniature railway to its park; also a "circle swing."

BERLIN & WATERLOO STREET RAILWAY COMPANY, LTD., of Berlin, Ont., may build new power house, 200-kw capacity.

CARLISLE & MT. HOLLY RAILWAY, of Carlisle, Pa., will purchase a couple of naphtha launches. Nothing definite decided in regard to extension to Gettysburg Battlefield.

PORTLAND RAILWAY COMPANY, Portland, Ore., will build about 16 miles of track during 1904. The company will also build and equip about twenty double-truck cars.

NORTH ALABAMA TRACTION COMPANY, of New Decatur, Ala., during the next ten months, will build 2½ miles of line, and purchase six 9 or 10 bench summer cars, complete.

EAST ST. LOUIS & SUBURBAN RAILWAY COMPANY, of East St. Louis, Ill., is planning to build some short extensions in East St. Louis, and to purchase some open cars.

CHICAGO & SOUTH SHORE RAILWAY COMPANY, of Laporte, Ind., within the next ten months will award contracts for the building of 30 miles of electric railway to South Bend.

FERRO CARRIL URBANO DE COLIMA, Colima a Villa de Alvarez, State of Colima, Mex., will purchase brake shoes, registers or punches, and a merry-go-round, steam or horse.

CORSICANA TRANSIT COMPANY, of Corsicana, Tex., will build 2 miles of new track and purchase two cars.

OSWEGO TRACTION COMPANY, of Oswego, N. Y., will build ¼ mile track in pavement, and rewire 3 miles overhead with 00 wire. Contracts are to be awarded during the next six months.

CHAUTAUQUA TRACTION COMPANY, of Jamestown, N. Y., will purchase 60 miles of transmission wire for a potential of 16,000 volts, 18 miles of trolley lines, and 18 miles 500,000-cm feeder.

INDIANAPOLIS & MARTINSVILLE RAPID TRANSIT COMPANY, of Indianapolis, Ind., will contract within the next four months for an extension of 24 miles of road into Bloomington.

PAN-HANDLE TRACTION COMPANY, of Wheeling, W. Va., reports that an extension will be built in the spring, of about 1¼ miles. All supplies are purchased with the exception of the trolley wire.

BALLSTON TERMINAL RAILROAD COMPANY, of Ballston Spa, N. Y., will build from Wayville, N. Y., connecting with Boston & Maine Railroad to Johnstown and Gloversville, N. Y. Power is to be rented.

VICKSBURG RAILWAY & LIGHT COMPANY, of Vicksburg, Miss., expects materially to increase the capacity of its present plant, or perhaps build an entirely new one. The question has not been definitely decided.

GUELPH RADIAL RAILWAY COMPANY, of Guelph, Ont., anticipates building during 1904 about 10 miles of track and purchasing power house apparatus (just what is not stated), and snow-plows, motors, sand-baxes, etc.

SHAMOKIN EXTENSION ELECTRIC RAILWAY COMPANY, of Shamokin, Pa., will place contracts within the next six months for building and equipping 24 miles of road; a car house and a power house will also be built.

SHEBOYGAN LIGHT, POWER & RAILWAY COMPANY, of Sheboygan, Wis., has in contemplation an extension of 26 miles. A power plant is under construction. The company expects to build theater, hotel, race track, etc.

PITTSBURG RAILROAD COMPANY, of Pittsburg, Kan., during 1904 may, conditions being favorable, purchase a new 300-kw generator and engine to suit, and possibly new boilers and heaters. Also make some extensions to track.

WESTERNPORT & LONACONING RAILWAY COMPANY, of Cumberland, Md., expects to build a large pavilion for dancing, also to lay out a park and baseball grounds at Reynolds, Aleghany, Md., same to be ready by spring.

FRESNO CITY RAILWAY COMPANY, of Fresno, Cal., expects to build 4½ miles of standard gage line and enlarge car house to accommodate eight more cars. A 250 to 300 kw motor generator set and four to six new cars will be purchased.

BUFFALO CONSTRUCTION COMPANY, of Buffalo, N. Y., will award contracts during 1904 as follows: For the building of 50 miles of track and one bridge 540 ft. long (viaduct), ten cars, 60 ft., equipped with heaters, registers, etc.

GALVESTON CITY RAILWAY COMPANY, of Galveston, Tex., expects to spend about $30,000 in street paving that has been outlined by municipal government. The company will also build a paint shop, 30 ft. x 120 ft., one story, during 1904.

WICHITA RAILROAD & LIGHT COMPANY, of Wichita, Kan., during next year will build 1 mile of new road and a new car house 50 ft. x 135 ft. Four new open trail cars will be purchased, and a new boiler may be installed in the power station.

GRAND RAPIDS RAILWAY COMPANY, of Grand Rapids, Mich., will build about 2 miles of extensions. Material and equipment will be purchased for six single-truck passenger cars, which are to be assembled in the company's own shops.

PAWCATUCK VALLEY STREET RAILWAY COMPANY, and the WESTERLY & HOPKINTON RAILWAY COMPANY, of Westerly, R. I., report that they will place contracts during the next few months for the building of 6 miles of new road; Westerly & Hopkinton Railway, a new power house and an addition to car house, and will purchase generators, engines and boilers; also five new cars.

GETTYSBURG TRANSIT COMPANY, Gettysburg, Pa., between March 1 and May 1, expects to rebuild entire overhead construction for 10 miles of single track. Will purchase arc headlights, sand boxes, air brakes, registers, trucks, motors, etc.

MICHIGAN TRACTION COMPANY, of Kalamazoo, Mich., reports that it will make extensions in Battle Creek and Kalamazoo, and build a new car house and a new bridge. Six new single-truck semi-convertible cars, complete, are to be purchased.

BERKSHIRE STREET RAILWAY COMPANY, of Pittsfield, Mass., is building an addition to main car house, of brick, 62 ft. x 85 ft.; also a stock room 49 ft. x 22 ft., a blacksmith shop 20 ft. x 22 ft., and a machine shop 52 ft. x 22 ft., all of brick.

PEOPLE'S RAPID TRANSIT COMPANY, of Toledo, Ohio, during 1904 will build 50 miles of new track, a power station, repair shop and several small bridges, and will purchase the necessary power station apparatus and repair-shop machinery for same.

KANAWHA VALLEY TRACTION COMPANY, of Charleston, W. Va., will build about 6 miles of interurban road and a girder bridge. Two interurban cars and some park attractions will be purchased. Orders will be placed during the next four months.

DANBURY & BETHEL STREET RAILWAY COMPANY, of Danbury, Conn., may build some 2 miles of extension during the coming season, but this has not been definitely decided as yet. Some supplies and rolling stock and equipment are also to be bought.

INDIANAPOLIS COAL TRACTION COMPANY, of Indianapolis, Ind., will build about 100 miles of track, car houses, power stations and sundry buildings, and purchase engines, boilers, etc.; also rolling stock and equipments. All this is to be done in 1904.

BRISTOL & PLAINVILLE TRAMWAY COMPANY, of Bristol, Conn., contemplates extension of 1¼ miles in spring. The company is constructing car house, 92 ft. x 140 ft., and will erect repair shop, office building, etc., in spring. Six open cars are to be purchased.

JOHNSTOWN PASSENGER RAILWAY COMPANY, of Johnstown Pa., expects to relay 1000 tons of 95-lb. girder rail next summer. An extension is being built to the power house. A generator and an engine have been purchased for installation in the extended plant.

LOWELL, ACTON & MAYNARD STREET RAILWAY COMPANY, of Maynard, Mass., will build 14 miles of track during 1904. Six open and six closed cars will be purchased, to be equipped complete with motors, brakes, sand-boxes, headlights, registers, fenders, etc.

CEDAR RAPIDS & IOWA CITY RAILWAY & LIGHT COMPANY, of Cedar Rapids, Ia., during January or February will build sub-station buildings, car house and repair shops, and purchase engine and generator, 600 kw to 800 kw, fare registers and park attractions.

THE SPRINGFIELD, TROY & PIQUA RAILWAY COMPANY, of Springfield, Ohio, will build a car house and repair shop, a freight house and a two-span steel bridge. About five or six passenger cars will be purchased. Contracts to be placed during next six months.

BATON ROUGE ELECTRIC & GAS COMPANY, of Baton Rouge, La., during the next three months will place contracts for a 150-kw 550-660-volt generator, and a 400-hp steam or gas engine; if the latter, a producer plant also. Expects to sign summer theater company.

LIBERTY & JEFFERSON ELECTRIC RAILROAD COMPANY, of Liberty, N. Y., will build 16 miles of road; transmission line of 12 miles, and purchase the required amount of rolling stock and equipment for 16 miles of road. Contracts to be awarded within six months.

RUTLAND STREET RAILWAY COMPANY, of Rutland, Vt., during 1904, will build 8 miles of road, from Fair Haven, Vt., to Whitehall, N. Y., and purchase a stock of amusement attractions for a small park. The company may also buy some rolling stock and equipments.

LEWISTOWN & REEDSVILLE ELECTRIC RAILWAY COMPANY, of Lewistown, Pa., will place contracts during the next six months for half a mile of single track, 60-lb. T-rail, and for one new car house. Two new double-truck cars, equipped complete, will be purchased.

ADRIAN STREET RAILWAY COMPANY, of Adrian, Mich., will relay one-half mile of track, with 60-lb. T rail and build a new freight and passenger station. The company will buy a second-hand 6 or 8-bench open car complete. Contracts are to be placed within six months.

UNION ELECTRIC COMPANY, of Dubuque, Ia., anticipates rebuilding 20 miles, 70-ft. T-rail; ties 6 ins. x 8 ins. x 8 ft.; one brick and steel central station, and one brick and steel car house. The company has not determined whether it will purchase any additional rolling stock.

BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY, of Birmingham, Ala., will build a few miles of track and some viaducts, also an addition to its power station. Material for the latter and for the additional equipment has been ordered. Twenty closed cars will be bought.

WILKESBARRE & HAZLETON RAILWAY COMPANY, of Hazleton, Pa., will contract for a 3½-mile extension, two sub-stations, repair shop, car house, office building, etc., within the next four months, and purchase equipment for the sub-stations, and increase present power-station equipment.

CONSOLIDATED TRACTION COMPANY, of Indianapolis, Ind., is building from Indianapolis to Crawfordsville, parallel to the Big Four road. The company expects to build from Crawfordsville to Danville, Ill., within six months, and from Crawfordsville to Lafayette, Ind. Estimates should be submitted without delay, as the company will place contracts immediately for all the equipment necessary for these lines.

SANTA CRUZ, CAPITOLA & WATSONVILLE RAILWAY COMPANY, of Santa Cruz, Cal., within three months will place contracts for 3 miles of extensions, three new bridges, new car house and power house. The company will buy double trucks, arc headlights, fenders, three new cars and motors.

CONCORD, MAYNARD & HUDSON STREET RAILWAY COMPANY, of Maynard, Mass., is as yet undecided as to what it will buy in the way of extra power-house equipment; probably about 1000-hp engine and generator to match. Six to nine miles of road will be built and three or four cars purchased.

TOLEDO, BOWLING GREEN & SOUTHERN TRACTION COMPANY, of Findlay, Ohio, during 1904 will build a new power house complete and purchase the necessary dynamos, boilers, engines, etc., for same. The company will also buy six interurban cars and six small car-bodies for city service.

WARREN & JAMESTOWN STREET RAILWAY COMPANY, of Warren, Pa., will build 21 miles of single track line; also car house and a power station. Several bridges and sub-stations will be constructed, and six complete car equipments will be purchased. Contracts will be awarded during the next two months.

WINNIPEG ELECTRIC STREET RAILWAY, of Winnipeg, Man., during 1904, will build a new car house, addition to boiler room and some double track in city. Will purchase railway generator, alternating-current generator, new boilers, coal conveyors and twelve new cars complete with motors and trucks.

THE WABASH & ROCHESTER RAILWAY COMPANY, of which T. W. Tuttle, of Geneva, Ohio, is manager, reports that it will build from Wabash to Rochester during the coming season, and erect some more new buildings. Will also purchase some new machinery and rolling-stock equipment. Details are not given.

NEWPORT & PROVIDENCE RAILWAY COMPANY, of Newport, R. I., has placed the contract for building 12 miles of new track, car house and repair shop. Power will probably be rented. Eight open cars and six closed cars are to be purchased. George E. Macomber, of Augusta, Maine, is treasurer of the company.

MONTEREY & PACIFIC GROVE RAILWAY COMPANY, of Monterey, Cal., reports that it will place contracts during the next six months for building 11 miles of single track, and that it will purchase a steam turbine outfit, 400-kw alternating current, five sets double trucks, two motor, and five No. 49 Westinghouse equipments.

BOSTON & WORCESTER STREET RAILWAY COMPANY, of Boston, Mass., expects to place contracts within the next six months for 10 miles of track, 75-lb. T rail with joints, and broken stone ballast. Will change a power station at Marlboro, Mass., to a sub-station, and purchase a G. E. 2000-kw turbine, 1000-hp boilers and five semi-convertible cars.

MICHIGAN & INDIANA TRACTION COMPANY, of Battle Creek, Mich., will award contracts within six months for the building of road from Battle Creek to Lansing and Grand Ledge, and for the necessary power station, car houses and other buildings. Everything needed in the way of power station apparatus and rolling stock equipment will be purchased.

THE CHELAN TRANSPORTATION & SMELTING COMPANY, of Chelan, Wash., during the next three months will place contracts for the building of 14 miles of new track and all necessary buildings for a line of this size. Complete rolling stock will be purchased for same as a mining road for hauling ore, supplies and passengers. The roadbed is finished.

AKRON, CANTON & MASSILLON RAILWAY, of Akron, Ohio, will place contracts within the next four months for the building of 31 miles of road to connect the three cities named. The road will be first class in every way, with a view of making fast time between points. All material and equipment will have to be purchased. Address communications to Thomas L. Childs.

JOLIET, PLAINFIELD & AURORA RAILROAD COMPANY, of Joliet, Ill., will build 10 miles of track. The company has contracted for rails, ties and poles. A brick car house and repair shop will be built at Painfield, and tools for repair shop will be purchased. The company also expects to buy something in the line of park attractions, but no decision has been reached on this question.

KANSAS & OKLAHOMA INTERURBAN RAILWAY, of Arkansas City, Kan., is to award contracts for 33 miles of track, the necessary buildings, twelve cars, from 100 to 200 freight cars, 40,000 lbs. capacity, and the necessary machinery for power house, etc., etc. Expect to start construction work about April or May. Communications should be addressed to L. H. P. Northrup, general manager.

HUMBOLDT TRANSIT COMPANY, of Eureka, Cal., expects to build within city of Eureka about four miles of new track, and extend the line 32 miles more for freight and passenger service. Will also build a new car house, power station and repair shops in Eureka, and purchase 1000-hp steam auxiliary plant, about fifteen passenger cars and twenty freight cars. Orders to be placed within six months.

SANDUSKY SOUTHWESTERN RAILWAY COMPANY, of Wapakoneta, Ohio, will build 70 miles of road, connecting the cities of Wapakoneta, Kenton, Lima and Belfontaine and the county seats of Auglaize, Hardin Allen and Logan counties. One power house of 1500-kw output, and four sub-stations will be built in the vicinity of Lake View, Ohio. Will purchase two alternating units of 750-kw capacity each; two cross compound Corliss condensing engines or two steam turbines. Also twenty four-motor cars, 75 hp, of the double-end vesibule type.

GRAYS HARBOR ELECTRIC COMPANY, of Aberdeen, Wash., will soon build a small car house and repair shop. The company would like to duplicate as nearly as possible its 24 x 48 Allis-Corliss double-eccentric engine, with 18-ft. x 36-in. wheel. The company wants second-hand engine as above, and would also like to hear of good second-hand interurban cars of standard make, with up-to-date equipments, including 38-B Westinghouse motors.

HARRISBURG & MECHANICSBURG ELECTRIC RAILWAY COMPANY, of Harrisburg, Pa., will award contracts within the next six months for the following: For building 16 miles of single track; a new power house, and an extension of present car house 100 ft., with new offices, large repair shops, etc. The company will also improve its rolling stock, and make additions to the power station and repair shops. Just what the latter will consist of is not stated.

URBANA, MECHANICSBURG & COLUMBUS ELECTRIC RAILWAY COMPANY, of Columbus, Ohio, expects to build an extension of 9 miles, which will necessitate the building of several bridges of spans varying from 10 ft. to 500 ft., and several small trestles of from 50 ft. to 200 ft. in length. Several cars, motor equipments, electric locomotive, dump cars and equipment, and electric launches will be purchased. Contracts are to be awarded during the next four months.

THE EASTERN CONSTRUCTION COMPANY, of Cleveland, Ohio, during 1904 will complete the building of the Cleveland & Sharon Traction Company, from Middlefield, Ohio, to Kinsman, Ohio, thence to Sharon, Pa.; also from Kenilworth, Ohio, to Warren, Ohio. The necessary car houses, power stations, repair shops, buildings, bridges, etc., will be built, and complete apparatus for power station and repair shops, rolling stock and equipments will be purchased. Some park attractions are to be bought, but these probably not until 1905.

BUFFALO & DEPEW RAILWAY COMPANY, of Depew, N. Y., will contract for the following during the next six months: Building 60 miles of road, T, tram-headed, girder and grooved girder rail; one main power house and three sub-stations. The company will purchase the necessary rails, ties, poles, brackets, trolley and feed-wire, etc., and complete power-station equipment, including alternating-current dynamos, direct connected; steam turbines or engines, and boilers. Also twenty of the latest type interurban cars, rotary snow-plows, freight cars, etc.

CINCINNATI, GEORGETOWN & PORTSMOUTH RAILROAD, Cincinnati, Ohio, expects to build from Georgetown to West Union, Ohio, the latter place being the county seat of Adama County, and the only county seat in Ohio without railroad connections. Two new sub-stations are to be built, and one 1000-hp engine, with boilers to correspond, will be added to power house; also such electric machinery as may be necessary. Twenty-five thousand ties, five passenger cars, ten box cars and ten center dump ballast cars, will be purchased. Orders to be placed within three months.

BRITISH COLUMBIA ELECTRIC RAILWAY COMPANY, of Vancouver, B. C., during 1904 will build 1 mile of single track in Vancouver and relay 1 mile with 80-lb. T-rail. The company will complete new car houses and repair shops and equip same with labor-saving machinery. Intends to build 1000 ft. of bridge over an arm of the sea. Among equipment to be purchased will be a 1000-kw 700-volt 60-cycle generator for direct connection to water-wheel, and step-up and step-down transformers; also air brakes for the company's interurban cars, acetylene or arc headlights, and two motor equipments for 22-ft. car bodies.

W. B. UPTON COMPANY, INC., Washington, D. C.—Mr. Upton has been appointed chief engineer in charge of the construction of the Great Falls & Old Dominion Railroad Company, which proposes to build 14 miles of double track electric railway from Georgetown, D. C., crossing the Potomac River over the Aqueduct Bridge, and thence to the Great Falls on the Virginia side of the river. The company also expects to construct a crosstown line in Washington, D. C., using the underground electric system from Georgetown, D. C., to the new Union Station, and beyond to the northeast portion of the city, besides another crosstown line to the Navy Yard. A large power house will be constructed to provide the power, and probably a number of sub-stations.

THE INDIANAPOLIS & CINCINNATI TRACTION COMPANY, of Indianapolis, Ind., during the season just closed has completed about three-fourths the grading from Indianapolis to Rushville, and will be able to complete the entire work rapidly next spring and lay the track, and have that section of the road in operation some time during the month of June. The roadbed and bridge abutments are being constructed for a double track. It has been definitely decided to use the third-rail system. During next season the company expects to press the work forward and have the line in operation as far as Connersville by the close of the year. The power house at Rushville is well under way. To the equipment of this plant will be added either a 1500-kw or 2000-kw unit, with the necessary boilers, etc. The repair shops and car houses necessary will also be built during the year.

KANSAS CITY RAILWAY & LIGHT COMPANY, at a meeting of the directors on Dec. 18, voted $1,000,000, to be applied upon improvements now under way by the Metropolitan Street Railway Company. It is stated that very much better service will be had very soon. The new power-house is sufficiently large to accommodate machinery to operate a street car line and light a city of one and one-quarter million people. It is expected that operations will begin somewhere between Jan. 15 and Feb. 1. The ultimate capacity of the power plant will be some 40,000 kws. The directors also authorized the purchase of about forty new cars for summer use. The following directors attended the meeting: P. A. Valentine, Chicago, Ill.; Louis C. Krauthoff, C. L. Blair and John B. Dennis, of New York; Bernard Corrigan, H. C. Flower, J. F. Downing, Stuart R. Knott, E. F. Swinney, L. E. James, Hugh C. Ward, J. J. Heim and P. E. Chappel, of Kansas City.

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, JANUARY 23, 1904 No. 4.

Published Every Saturday by the

McGRAW PUBLISHING COMPANY

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: 929 Chestnut Street.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York,"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Canada and Mexico......................$4.00 per annum

Single copies, first issue of each month, 25 cents; other issues, 10 cents.

To all Countries outside of the United States, Canada and Mexico.... { $6.00 £1-5s M 25 Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Growth of Interurbans

An indication of the growing popularity of the electric interurban railway is found in any comparison that may be instituted between the present condition of these properties in any part of the country and the facilities of the lines operated in the same section a year ago. Everywhere progress has been made, and in most cases the development has been warranted. It is true that isolated instances may be cited where the building of an electric road could only be explained by the ignorance or cupidity of some or all of the persons engaged in the project, but these are usually short-lived; few of them are ever completed, and, happily, they rarely exert any lasting influence on the industry in general.

Probably the most noteworthy feature of this development is the present increasing tendency to compete with established steam lines. The wisdom of such a course is questioned by many investors and practical railway men on the ground that very few electric systems have suitable equipment, terminal properties and other facilities for successfully engaging in a struggle with the powerful and resourceful combinations of capital, organization and influential connections that are commanded by steam railroads. There may be isolated instances where peculiar local conditions offer an excellent opportunity of this kind, but these are comparatively rare, and are not to be taken as fair examples of the experiences of projectors of such enterprises. The trouble is that promoters who lack practical experience hear complaints against the service of the steam roads in certain localities, and, knowing that more patronage would be forthcoming if improvements were introduced, assume that there is room for another railway, and find, when it is too late, that the disgruntled portion of the population is not sufficient to support the new enterprise. Then begins the struggle, which eventually ends in a consolidation of both properties or the complete effacement of one of them.

There are numerous cases, however, where existing steam railway facilities are entirely inadequate, and it seems impossible for many old lines to make the necessary extensions without facing an inevitable deficit. Here is a point where it would seem the part of wisdom in the steam railway management to establish electric lines for the local service, and for feeders to the main steam lines. But few steam railway men can break through the crust of tradition and prejudice in which they are encased, and thus it is that independent transportation projects are encouraged to enter this field, where they often find ample reward. When properly conducted and restricted within reasonable bounds, such enterprises are frequently developed into valuable properties, and, likewise, become a great benefit to the community.

The "Railroad Gazette," which has given considerable attention to this subject, and which looks upon it from the steam railroad standpoint, believes that railroads doing an important local or branch line business will probably find that their best recourse lies in control, or partial control, of all the lines in the competitive territory, following in general the policy of the New York, New Haven & Hartford Railroad. Its investigation as to the effect of electric competition indicates that while electric competition with a branch steam line may be serious, that between a main steam line and a parallel electric railway will not permanently affect the total amount of business done by the former company. While the local short-haul traffic is temporarily affected, the influence of the electric road in fostering the "traveling habit" more than makes up in a short time for the local business directly taken away from the steam railroad rival.

We have had occasion recently to refer to the work in progress in Indiana, and in another column this week we present, in a concise form, a recapitulation of the work done in that field during the last year. It will be found interesting and instructive, and, taken in connection with the interurban map of Indiana, published on Dec. 12, 1903, it presents a splendid opportunity of comparison with the map published in Aug. 30, 1902. The progress made in interurban operation in that State is fraught with interest to the steam railways as well electrical engineers, and this truth is receiving recognition. At present Indianapolis is one of the great interurban centers of the country, as it is likewise of steam roads. There are fifteen of the latter now centering in that city, and, with a single ex-

ception, all of these will be paralleled within a year for some distance by electrics. Even now most of them are feeling severe competition. How the problem will work out cannot be anticipated.

Crossing the Sierras

The announcement sent out from San Francisco that the Southern Pacific had laid aside the tunnel scheme and had substituted therefor a plan to build an electric line across the Sierras, comes strictly within the category of events that would be "interesting if true." The discussion of this subject on the Coast is not confined to electrical engineers, but is participated in by steam railway men and investors. The proposed plan, according to report, contemplates the laying of a third rail between Sacramento and Truckee, and the establishment of an electric plant which will utilize the water-power of the Truckee River. This would certainly be a very remarkable enterprise, involving a number of points which are practically new in heavy electric railroading, and the solution of these problems would call for a good deal of investigation and experimental work. Some idea of the magnitude of the undertaking may be gained from the fact that there will be a constant climb for the distance between Sacramento and Truckee—119 miles. Sacramento is 30 ft. above the sea, Truckee is at an elevation of 5819 ft., and Summit, a point 14 miles from Truckee, 7018 ft. above sea level, is the highest point on the San Francisco-Ogden division. These figures show that the average raise in elevation between Sacramento and Summit is 66½ ft. to the mile, while in some places it is about 100 ft. to the mile, or 2 per cent grade.

There has been no authoritative statement issued on the subject, but the fact that the utilization of electricity for this work is seriously contemplated by the management is evidence of the confidence that has been inspired by the heavy electric railroading already constructed and in operation on the Pacific Coast, as well as faith in the possibility of operating big traction enterprises electrically.

The Snow Problem

The recent continued cold weather and succession of snowstorms which have prevailed throughout the Northern States during the last two weeks, have put the snow handling facilities of the street railway companies to a crucial test. One hears so much about the passing of the good old-fashioned winter, that when it suddenly appears in its full rigor the effect is somewhat startling to say the least. But be it written to the credit of the street railways all over the afflicted district, that with few exceptions their tracks were kept open and the cars were kept running with some approximation to the appointed schedules. Here and there the snow came out victorious, but the showing made was vastly better than would have seemed possible a few years ago. The actual amount of snowfall was exceptionally great, and it tended to drift badly, which makes the record of the roads in fighting it all the more creditable. The means used in the struggle are not materially different now from what they have been in the past, but they were applied with exceptional vigor and effect. It is worth noting, too, that, as referred to briefly in a recent issue, the electric roads, upon the whole, came out of the fight much better than the steam suburban roads; which, in many places, were badly tied up. Even where they kept running it was with a total disregard of schedule and of the hopes of the passengers. All in all the schedule of a steam road is pretty easily demoralized, particularly around its termini where especial trouble is encountered in the yards. Half a dozen years ago we should have had a dismal tale of the trials of the electric roads under circumstances similar to those recently prevalent, but the managers have now learned the lesson of snow fighting pretty thoroughly, while the steam roads are as badly off as ever. And the reasons for the difference are not far to seek.

Eternal vigilance is the price of success in battling with a snow-storm. The snow machines must be ready to run out at short notice, and the men to do the fighting must be at hand when trouble is feared. Fortunately, the weather man generally gives at least a broad hint of coming trouble, so that everything can be made ready. Here is the first point where the electric road scores against its rival. Electric roads generally, even in these days, cover less territory than steam roads, and the equipment can readily be gotten at instead of being stacked up at points remote at least from some parts of the system. One plow jumped into service at the first sign of trouble is worth half a dozen dragged out of remote hiding places a few hours later. But far more important even than the readiness of the main equipment is the fact that on an electric railway system, with its relatively frequent service, cars are from the very first pushing through and helping to clear the way. Most of the track scrapers attached to individual cars are none too effective, but even a very poor scraper does an immense amount of good if it is applied every few minutes. The more frequent the service the less danger of its being interrupted, and we are more than half inclined to believe that the success with which the snow difficulty is generally met to-day, on city roads at least, as compared with former experience, is largely due to the greater frequency of the cars. For this reason individual scrapers on cars during the winter season are particularly useful. They cannot do much against a drift, but if the cars run frequently they can effectively prevent drifts from getting the advantage until the regular snow machines can get settled down to work. Once a blockade is well under way it becomes very difficult to break, since the snow machines may be blocked in behind it, and a plow at the end of a stalled procession of cars is of very little use. But ordinary systems, where cars pass over the track at the rate of a dozen an hour or so, can generally avoid the blockade entirely if work is begun as soon as the snow begins to threaten mischief.

The most troublesome case is found in dealing with the smaller interurban lines, on which cars run on a very open schedule, and whose tracks pass through the open country, where drifts have a first-rate chance to pile up in the intervals between cars. And, as we mentioned a couple of weeks since, it can, under these circumstances, make plenty of trouble, even though the car may keep moving after a fashion. And it is a rather difficult thing to determine what is the best defense in case of a half-hour schedule. Individual track cleaners are good as far as they go, but an interval of half an hour will often let drifts get beyond this remedy. A light nose-plow, attachable to each car at short notice, would get the better of the storm in ordinary case, and would, at least, keep the track clear after the heavier plows had opened a way. But in this sort of interurban case nothing short of powerful plows, used early and often, can cause immunity from blockades. A snow-storm in open country is no joke; we have seen drifts piled up on the line of an electric road 8 ft. or 10 ft. deep. The big rotary plows probably do better *in extremis* than any others, as has been amply proved on many a railroad, and here, as in other

respects, the interurban lines can hardly do better than to follow the example. But these special machines are heavy and costly, and, hence, less used than their merit deserves. We would like to see what could be accomplished merely by attachable nose or shear plows, used with vigor, not only on the regular cars but on as many extras as proper crews could be obtained for. Apparatus that would prove a failure on the basis of a half-hour schedule might do the work well if all the extra cars were pressed into service, and such a scheme might prove considerably cheaper on some lines than an equivalent number of large snow machines. We would like to hear of the various apparatus and expedients brought into service against the recent storms. Every manager of an interurban line was put to his best efforts, and the experience acquired most certainly would prove valuable to all the afflicted in the next storm. We hope our friends will step up and assist in an experience meeting on the snow-drift question, to the end that out of many counsels may come wisdom. For we are not out of winter yet and more storms may be brewing.

The Problem of Stoking

We are glad to present in the current issue a most interesting discussion of mechanical vs. hand stoking, from no less distinguished an engineer than W. C. Kerr. If our brief editorial comment of Oct. 24 on the "Question Box" served no other useful purpose, we congratulate ourselves on its having brought out so welcome a contribution. Mr. Kerr very properly pleads for the consideration of the whole question, on a broad basis, without attaching undue importance to particular instances of this, that or the other virtue or failing of the stoker, human or mechanical. As he very truly says, the obtainable data on steam generation in general are of a very erratic and unsatisfactory character, and one should be extremely cautious in jumping at conclusions. The discussion of the "Question Box," as we noted at the time, shows this fact very clearly in itself. But our correspondent errs in supposing that the information on which our editorial comment was based, was in any way circumscribed by the data of that discussion. On the contrary, it was based on the accumulation of data from many sources, extending over pretty nearly the whole history of the question, and we find ourselves, upon the whole, nearly at one with Mr. Kerr upon the issues involved. On one matter, however, we must take earnest exception to our correspondent's statement of the case. He remarks that the fact that an expertly hand-fired flat grate can equal stoker firing is about as irrelevant a consideration as could be deduced. We do not entirely agree with Mr. Kerr in this conclusion, so far as the general public is concerned, since the claim is often made by engineers of less broad knowledge and experience than Mr. Kerr that mechanical stoking can and does produce better evaporative results than hand firing.

In the long run such misstatements can only injure the cause of scientific and economical firing, and we are glad to put on record Mr. Kerr's unequivocal endorsement of our position as to the facts. Assuming this, it is certainly pertinent to inquire into the conditions that may in any given case determine the best and most economical procedure as to firing. On the one hand, mechanical stoking certainly should have the credit of whatever gain in average efficiency it may in fact have, and on the other it should not be given the advantage of charging against hand firing carelessness and stupidity in arranging the general coal supply. We do not agree that any commercial process should be judged solely by its performance under the best conditions, but rather it should be judged by what it does under average good conditions. It is the general, not the exceptional, which should be taken into account in a broad view of the case. And unless we greatly err, one of the most cogent reasons for the use of mechanical stokers lies in the fact that the human stoker's average performance is far below his best. His best is admittedly extremely good, quite up to the work of the machine. And similarly it is unquestionable that the average work of mechanical stokers at large is below their best performance. There are good stokers and bad stokers, both human and mechanical, and in neither case should the faults of individuals be charged up to the general state of the art as such. The vital question touches the comparative results attainable by the two methods, assuming in each case good design and good management in the plant. This is a question of fact, and its answer, probably, depends on a rather wide variety of conditions. As Mr. Kerr most pertinently points out, the size of the plant is an important factor in the situation, for the bigger the plant the harder it generally is to maintain a high average result with hand stoking, so that the managers of large plants find higher grade and better sustained results from mechanical stoking. This raises one of the very issues that was uppermost in the "Question Box"—the effect of size of plant on the desirability of mechanical stoking.

As we pointed out at the time, in a plant of 1000 hp or 1500 hp, which can be handled by a single fireman, automatic stoking is at a disadvantage on account of the cost, maintenance and attention required, and in larger plants these items must be balanced against the saving in wages of firemen. Of course, a lazy or drunken fireman would make a bad job even in a small plant, but so, too, would a bad mechanical stoker and a lazy or drunken attendant.

As regards the up-keep of mechanical stokers, Mr. Kerr rightfully calls attention to the general ignorance as to the repairs necessary on ordinary grates, and holds that for equal fuel burned the best stokers show "about the same" repairs as for flat grates. The very paucity of the data on both classes forbids certainty as to the facts, but on "form," as our sporting friends would say, the ordinary grate should have a considerable advantage in total maintenance, to say nothing of interest charges. The essence of the whole matter is reached by Mr. Kerr's statement, that based on rated horse-power of boilers repairs on the mechanical stoker are the higher. This amounts to saying that the mechanically-fired boilers, for one reason or another, are generally pushed harder or use lower grade fuel, or both. Obviously, the more fuel has to be burned to produce a horse-power at the engine the greater will be the relative advantage of labor-saving devices in handling that fuel, and it has been our consistent contention that the strong hold of mechanical stokers lies in their ability to compass this particular end of handling low-grade coal cheaply. If a given set of boilers is used with such fuel it may require burning double the fuel per horse-power that would be required with the best coal, and would have to employ twice as many firemen. Therefore, in any discussion as to the size of plant for which mechanical stoking pays, the essential point is really the amount of coal to be consumed rather than the rating of the boilers. We are firm believers in mechanical stoking in cases where it can improve the economic result, and we regret the heterogeneous character of the data on performance as keenly as does Mr. Kerr. But we hope that this discussion may tend to bring out a more complete array of the facts obtained in practice, upon which ultimately the judgment of engineers must be based.

INDIANAPOLIS AND NORTHWESTERN TRACTION SYSTEM

The Indianapolis & Northwestern Traction Company has recently completed an important the northwest from Indianapolis through Lebanon and Frankfort to Lafayette, with a branch from Lebanon to Crawfordsville. In mileage this road, when completed, will be the second largest of any of those now operating out of Indianapolis. The system, when finished, as shown on the map, Fig. 1, will have about 90 miles of track, including sidings, the main line mileage being about 88. The road, at present writing, is completed and in operation from Indianapolis to Lebanon, and almost ready to operate from Lebanon to Lafayette. The grading has been done between Lebanon and Crawfordsville, and this branch will probably be in operation soon. The Indianapolis & Northwestern Traction Company has issued $2,000,000 in stock and $3,000,000 in bonds, making the bond issue equal to $33,333 per mile of track. The population of the towns and villages passed through, according to the census of 1900, is as follows:

New Augusta	215
Zionsville	765
Whitestown	700
Lebanon	4,465
Frankfort	7,100
Mulberry	529
Dayton	500
Lafayette	18,116
Crawfordsville	6,649
Total, exclusive of Indianapolis	39,039

The rural population is large, as is shown by the fact that the postoffice has established free delivery over much of the territory covered by this route. A typical view of the country traversed is presented in Fig. 2. Most of the country is level and has been thickly settled for many years, while the roads are of the famous Indiana gravel, and this has been available for a liberal amount of ballast on the company's roadbed.

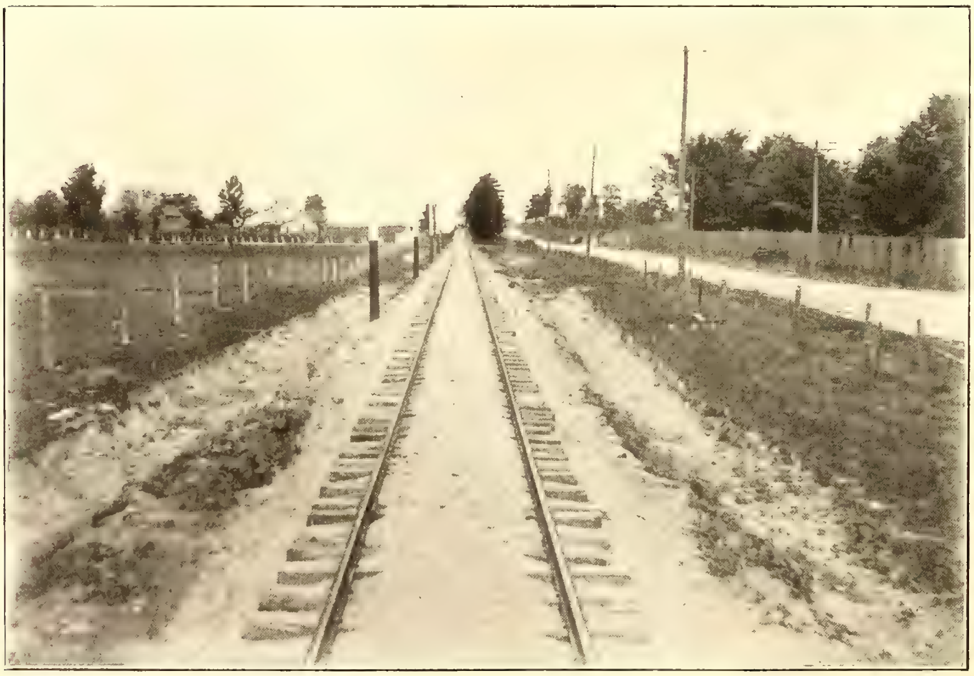


FIG. 2.—TYPICAL VIEW OF COUNTRY TRAVERSED

Although this interurban road is new, the part it is beginning to play in rural life is well shown by the fact that in several places farmers living near the line have provided shelter for teams and vehicles, so that those desiring to take the electric cars can drive in from a distance and leave their horses to be fed, sheltered and cared for while they take the electric road into town. This is a feature that has not been introduced commonly on other interurban roads, and serves to show that there is enough of this class of business, so that neighboring farmers feel justified in maintaining these stables.

TRACK AND ROADBED

The track is laid with 70-lb. standard T-rails on 6-in. x 8-in. x 8-ft. ties, spaced 2 ft. between centers. Oak ties were used on part of the road and cedar ties on the balance. The specifications call for 9 ins. of ballast under the ties, but in many places this is exceeded because of the raising of the track to a surface by putting in more ballasting. The ballast slopes directly away from the ends of the ties, and is crowned in the middle to give drainage, which can be seen in Figs. 2 and 3. Cuts and fills have a slope of 1 to 1, which is unusually steep, but is considered safe in soil which is encountered in this part of Indiana. Although the country is so level that there are few places requiring heavy grading, there is 1 mile just north of Indianapolis which calls for a large investment. This includes the crossing of the White River on a bridge of spans, seen in Fig. 4, the crossing of the White River bottoms on a long fill, and a deep cut directly through the bluff north of the river. Fig. 5 is a view looking toward this cut, and Fig. 6 a view taken from the top of the bluff, showing the cut, the fill and the pole line for a mile across the White River Valley. The cut is a maximum of 35 ft. deep, and the fill, just before entering it, about 20 ft. high. All of the right of way is owned by the company except in the villages passed through, where franchises were secured for the use of streets between Indianapolis and Lebanon. The right of way parallels a well-settled highway for some distance out of Indianapolis, but is several hundred feet back from the highway. This is an ideal arrange-

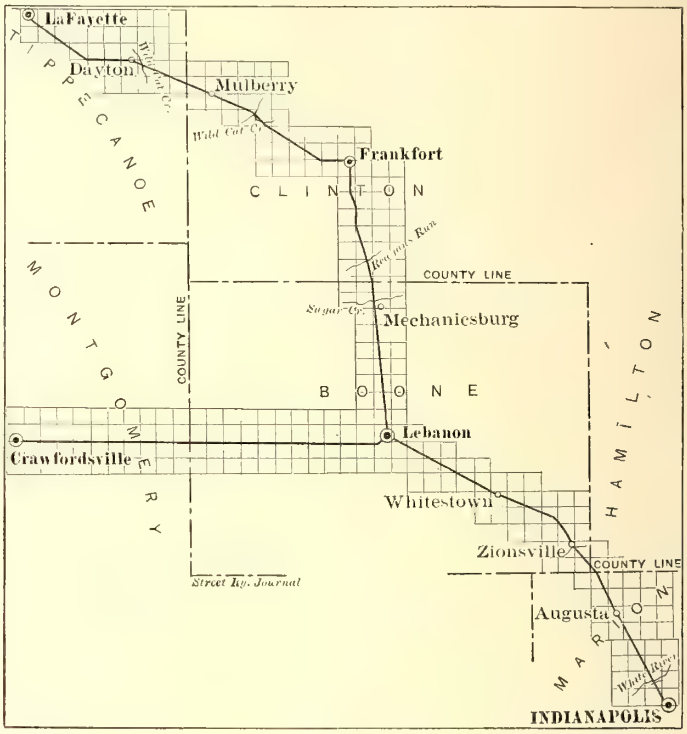


FIG. 1.—MAP OF INTERURBAN SYSTEM

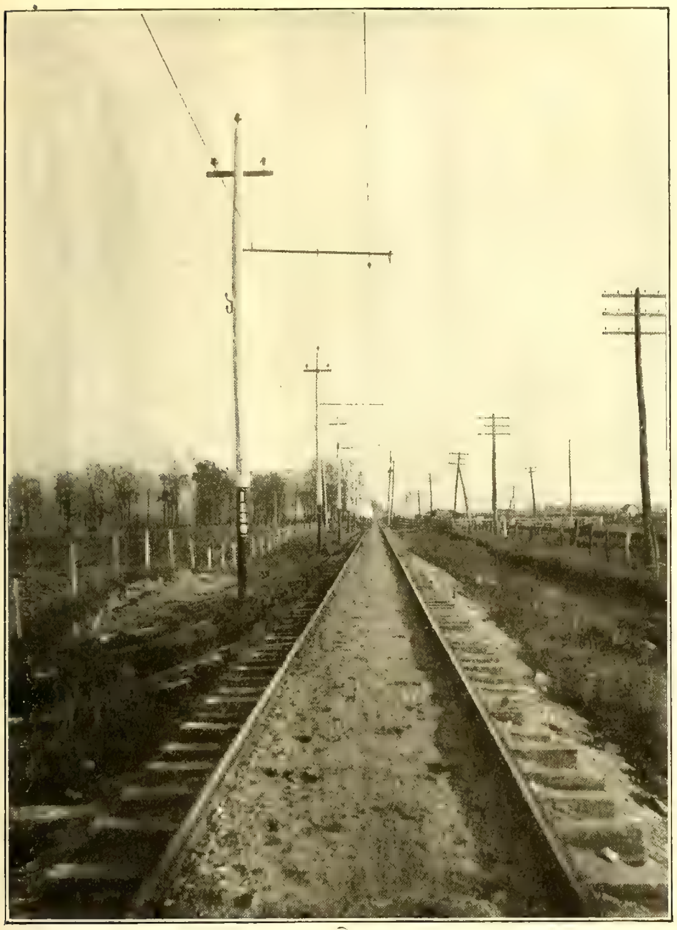


FIG. 3.—OVERHEAD LINE AND ROADBED CONSTRUCTION

ment in some respects and also has its drawbacks, especially from the standpoint of the right of way agent. By paralleling the highway at this distance the railway, of course, gets the benefit of the traffic from the population which is along the highway. However, farmers are likely to raise more than ordinary objections to a right of way which separates them from these farms, and many farms are likely to be separated from the owners' house by the railroad right of way. Another portion of the line between Indianapolis and Lebanon parallels the Big Four Railroad. A right of way of this kind is easy to obtain, and the location from an engineering standpoint is likely to be good. It does not reach the rural population as well as a right of way adjacent to a highway. One remarkable feature in railway location is to be found between Lebanon and Crawfordsville. Here the right of way follows a section line, making an 18-mile tangent directly on the section line, a peculiar set of conditions which probably is not duplicated anywhere in the United States. It goes without saying that it is a very level country which makes such location possible. All of the private right of way is 50 ft. wide. Turnouts, 500 ft. long, are provided for at intervals sufficient to provide for a half-hour schedule being maintained in each direction.

OVERHEAD LINE

The overhead construction shown in Figs. 3, 7 and 8 is one of the finest features of the road. It is doubtful if a better looking pole line is to be found anywhere. Poles were carefully selected as to straightness and uniformity of size. They are 12 ins. at the butt, 6 ins. at the top, and 36 ft. long where the high-voltage transmission line is to be carried. Where there is no transmission line they are 32 ft. long. They are set 6 ft. in the ground, 5 ft. from the gage line of the nearest track rail. Being painted black and white, as seen in engravings, and set to accurate alignment 100 ft. apart, they present a very fine appearance. Some of these poles are Northern cedar; the balance Southern juniper. The high-tension wires are of No. 4 phosphor bronze, spaced on a 36-in. triangle, using top pin and cross-arm conduction. The insulators are the 8-in. Locke porcelain single-petticoat pattern, carrying 30,000 volts. The trolley wire is grooved pattern No. 0000. It is hung on flexible brackets on insulators furnished by the Ohio Brass Company. Parallel with the trolley for the entire length of the road is a feed wire of 300,000 circ. mils. Taps to the trolley wire from this feeder are made every 1000 ft. General Electric lightning arresters are placed every 2000 ft. Every fifth pole is numbered for the convenience of the operating department in reporting troubles and making tests. The 26,000-volt high-tension transmission line between the main power house and the substations is carried on Locke brown porcelain insulators, placed 3 ft. apart on a triangle, as seen in Fig. 8. The telephone wires, two

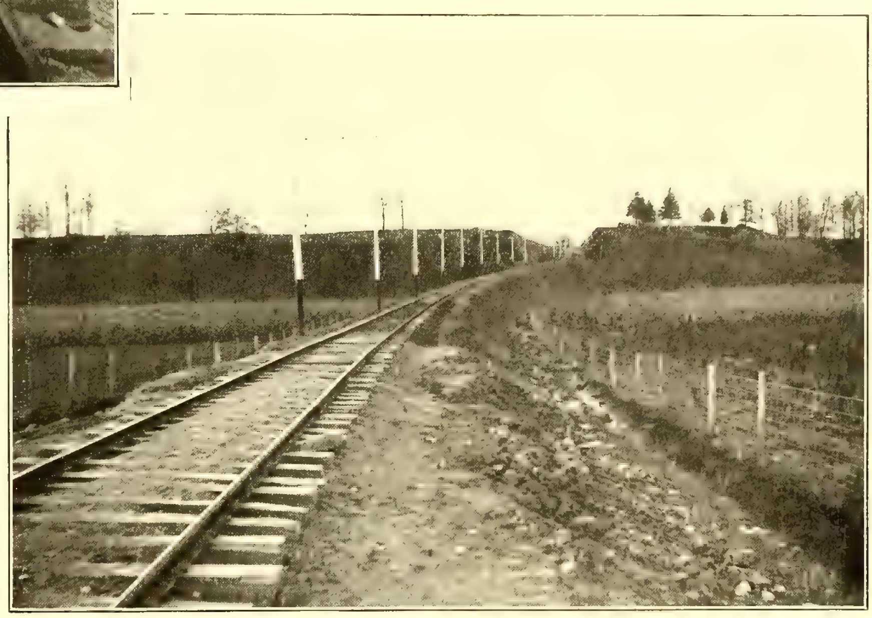


FIG. 5.—GETTING OUT OF THE WHITE RIVER BOTTOMS

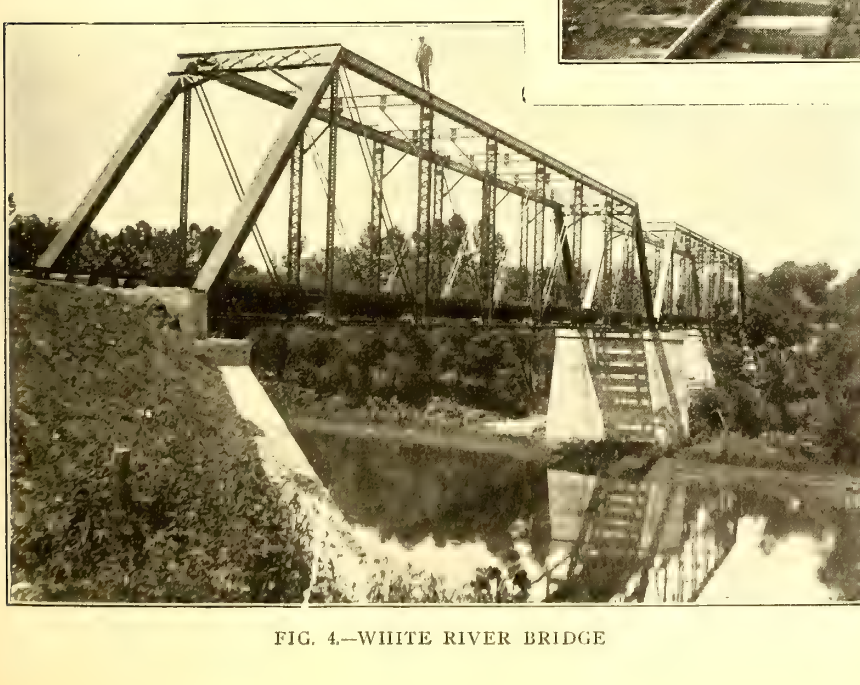


FIG. 4.—WHITE RIVER BRIDGE

in number, are carried on glass insulators mounted on an iron bracket opposite the trolley bracket. The diagram showing the power transmission and distribution scheme of the road is given in Fig. 9. The main power station is at Lebanon, with sub-stations at points about 16 miles apart.

POWER PLANT AND SUB-STATIONS

The power plant at Lebanon, Figs. 10, 11, 12 and 13, is a large fire-flash brick structure of the flat-roof type. The engine room is 60 ft. x 130 ft., and the boiler room has the same dimensions. There is a steel stack 155 ft. tall, 9 ft. at the base, and with a 6-ft. 6-in. opening at the top. The bottom section is 7-16 in., middle section 3/8 in., and top section 1/4 in. The engine room has two Hamilton-Corliss cross-compound condensing engines, 24 ins. and 48 ins. by 48-in. stroke. Each drives a General Electric 800-kw, 25-cycle, three-phase generator, running 107 r. p. m., having a 16-ft. fly-wheel weighing 90,000 lbs. These generators (Fig. 11) give 370 volts to 400 volts at their terminals, and this voltage is suitable to supply directly the alternating-current end of the rotary converters in the power station, which are used to feed the trolley line near the station.

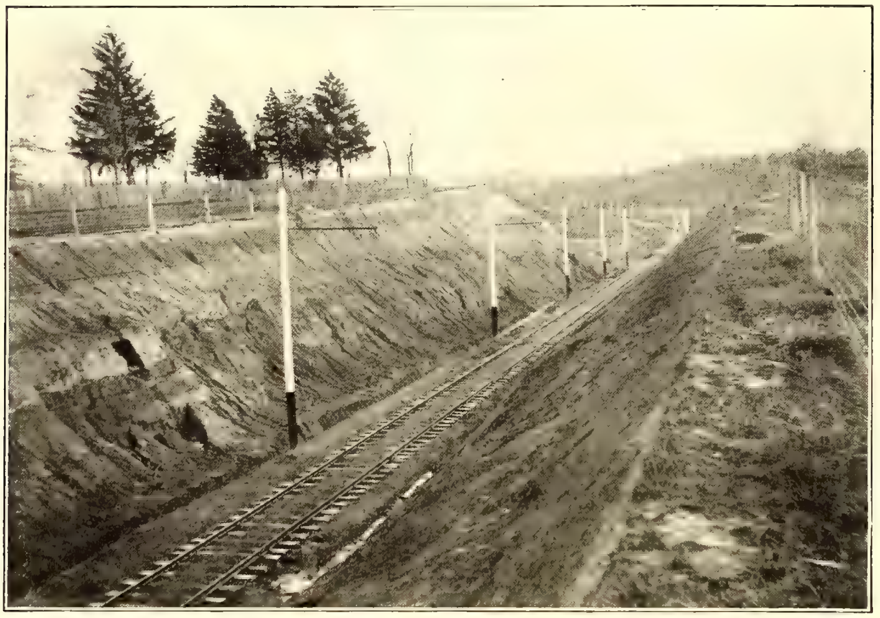


FIG. 6.—VIEW FROM TOP OF BIG CUT ACROSS WHITE RIVER VALLEY

The engine room is on a level with the boiler room, and its auxiliary room, or basement, contains three Wheeler surface condensers, designed to condense 22,000 lbs. steam per hour at 27-in. vacuum. The boiler feed-water is taken from a hot-well to the heater, and then pumped into the boiler at a temperature of 210 degs.

The Wheeler surface condensers for the two engines have air pumps 12 ins. x 22 ins., and circulating pumps 18 ins. x 22 ins. Water for condensation is supplied by a pond 3000 ft. away from the power house. The pond is above the level of the power house, and discharges by gravity into a cold well at the power house. Water is forced back to the pond by the circulating pumps of the condenser. A Cochrane hot-water heater takes the exhaust from the auxiliary steam apparatus. Besides the two main engines there is an Ide engine driving a 55-kw, 125-volt exciter. There is room in the power house for another 800-kw unit, which will probably be installed soon.

The engine room is served by a traveling crane of 40,000 lbs. capacity, made by the Case Manufacturing Company, of Columbus, Ohio. This crane and its tackle are worked by hand power. In installing the crane the tackle supplied with it was used to hoist it to its place. Two poles were used to support one of the roof girders, as seen in Fig. 14. The tackle was attached to timbers laid on the girders and hooked to the center of the crane. Fig. 14 shows the crane during the process of hoisting. It goes without saying that the hoisting was done much more quickly than if the tedious process of building up false work under the crane and jacking up had been followed.

In the boiler room (Fig. 13) are six Stirling water-tube boilers of 500 hp, built for a working pressure of 175 lbs. They are set in batteries of two, with a 27-in. fire-brick wall between them. Each boiler has 411 3-in. tubes, givin 5180 sq. ft. of heating surface, three 42-in. steam drums, and one 48-in. mud drum, 17 ft. long, 11-16 in. open hearth steel, 60,000 T. S. The gases from the boilers are carried in a 6-in. x 8-in. flue below the boiler room floor line, running at right angles to the boilers to the stack outside of the building, thus doing away with breeching above boilers. The steam header is of 12-in. extra heavy bends, connecting with each boiler and using 500-lb. Crane valves and fittings throughout. These boilers are fed with three Barr outside-packed-plunger feed pumps, 7½ ins. and 4½ ins. x 6 ins. Roney mechanical stokers are used under the boilers. Coal is shoveled directly from the railroad siding back of the boiler room in front of the boilers, and is then rehandled by the firemen, who shovel it into the hoppers of the stokers.

For supplying direct-current at 550 volts to the road near the station two 300-kw rotary converters (Fig. 12) have been placed in the main power station. These converters take current directly from the main generator leads at 370 volts. Massive oil switches are employed in the alternating-current leads of the converters.

For each generating unit there are three 300-kw step-up transformer in the main power house, raising the voltage from

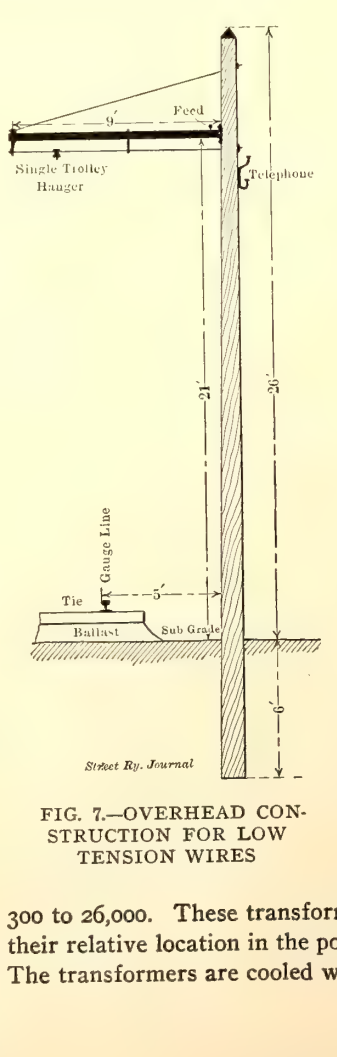


FIG. 7.—OVERHEAD CONSTRUCTION FOR LOW TENSION WIRES

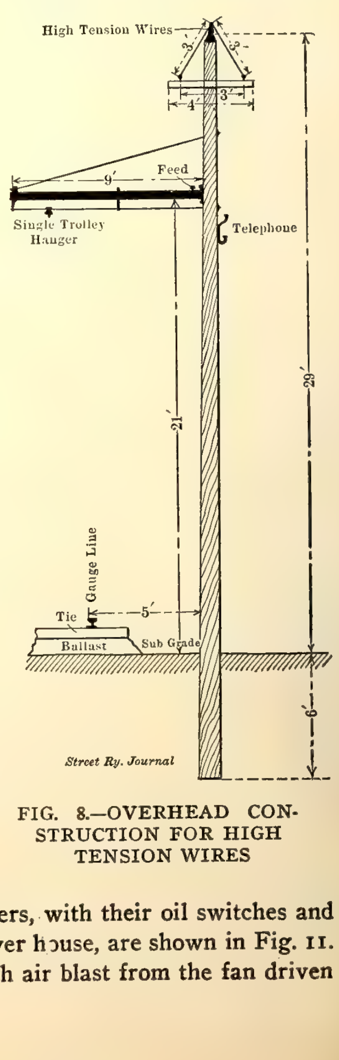


FIG. 8.—OVERHEAD CONSTRUCTION FOR HIGH TENSION WIRES

300 to 26,000. These transformers, with their oil switches and their relative location in the power house, are shown in Fig. 11. The transformers are cooled with air blast from the fan driven

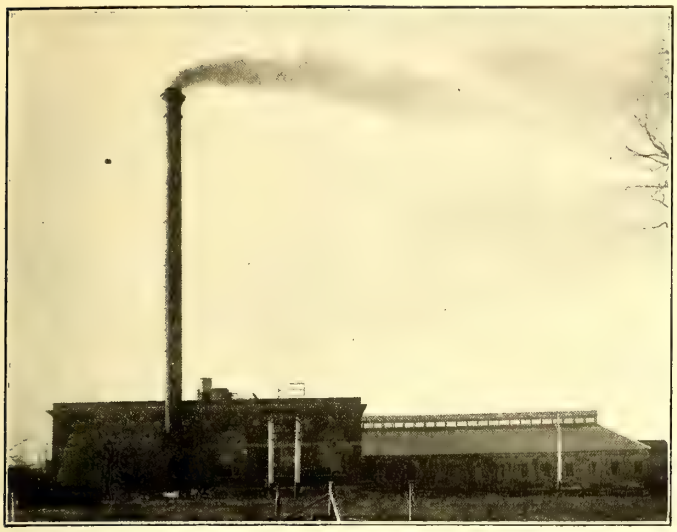


FIG. 10.—POWER STATION AND CAR HOUSE AT LEBANON

by an induction motor, seen in the foreground in Fig. 11. The high-tension oil switches are General Electric type-H, motor operated. Besides the engine-driven exciter before spoken of there is a 50-kw exciter driven by an induction motor. This is ordinarily used to excite the fields of the large alternators.

The switchboard in main station contains sixteen panels, each 16 ins. wide by 8 ft. high, arranged as follows: One engine-driven exciter panel, one motor exhaust panel, one generator exciter panel, three generator panels, three outgoing line panels, two rotary panels, two direct-current rotary panels, three direct-current feeder panels. There is also an auxiliary board, called a disconnecting panel, with each set of transformers, which allows two rotaries to be operated from either generator, thus freeing the switchboard of all large and cumbersome switches.

Each sub-station has two 300-kw rotary converters and a bank of three static transformers of 225 kw each, the latter being provided with two secondaries, so that the two rotaries can be run from one set of transformers. A view in the sub-station between Lebanon and Frankfort is shown in Fig. 15. One peculiarity of this sub-station is the omission of alternating-current rotary converter switchboard panels. This practice, while not entirely new, has only recently been introduced in sub-station work. The high-tension oil switch controlling the high-tension circuit to the bank of transformers is operated by a lever in front of the bank of transformers. The only switch in the 360-volt alternating-current circuit of the rotary converter is the switch which is mounted on the reactance coil, which serves as a starting switch when the rotary converter is being started with alternating current. This is the usual three-pole double-throw switch, which, when closed in one direction, connects the rotary converter with the transformers through the reactance coil, and when closed in the other direction connects the converter directly to the transformer secondaries, the upper portion being 160 volts alternating current, the lower position running positive or 370 volts. This arrangement allows the four panel switchboard to be a direct-current board. Two of the switchboard panels, seen in Fig. 15, are feeder panels, one feeding north and the other south from the sub-station. The other two panels

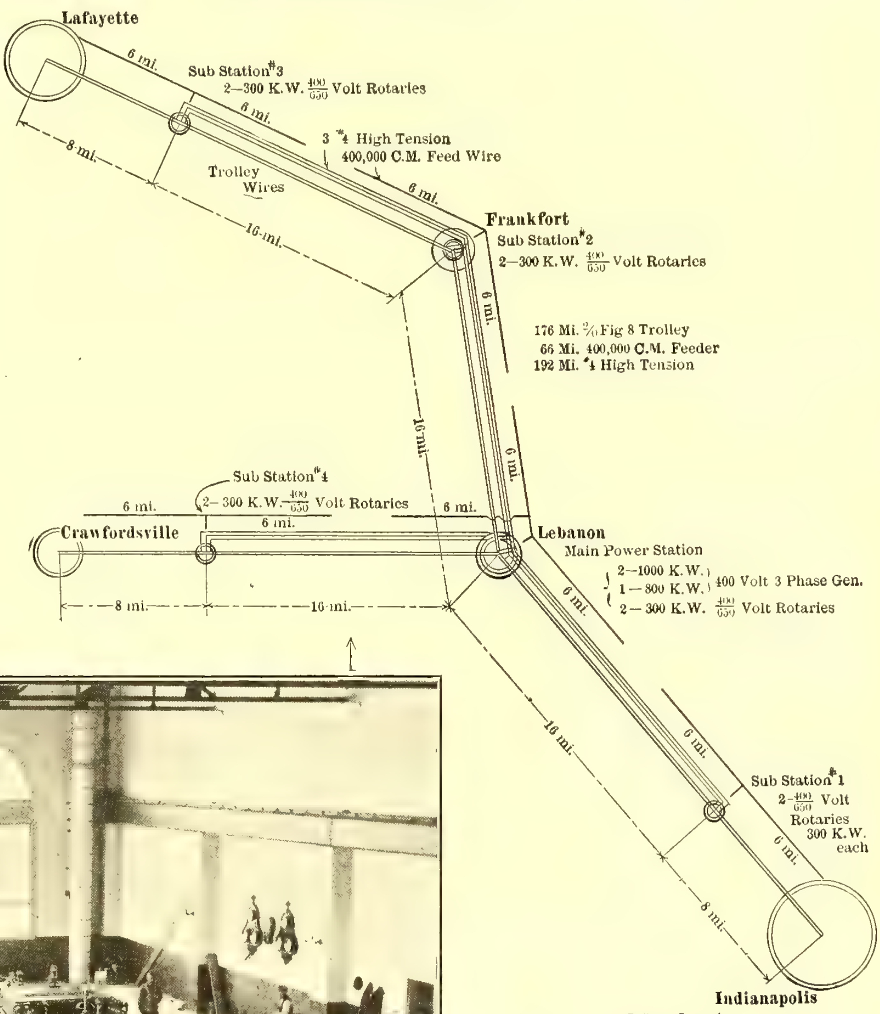


FIG. 9.—DIAGRAM OF POWER TRANSMISSION SYSTEM

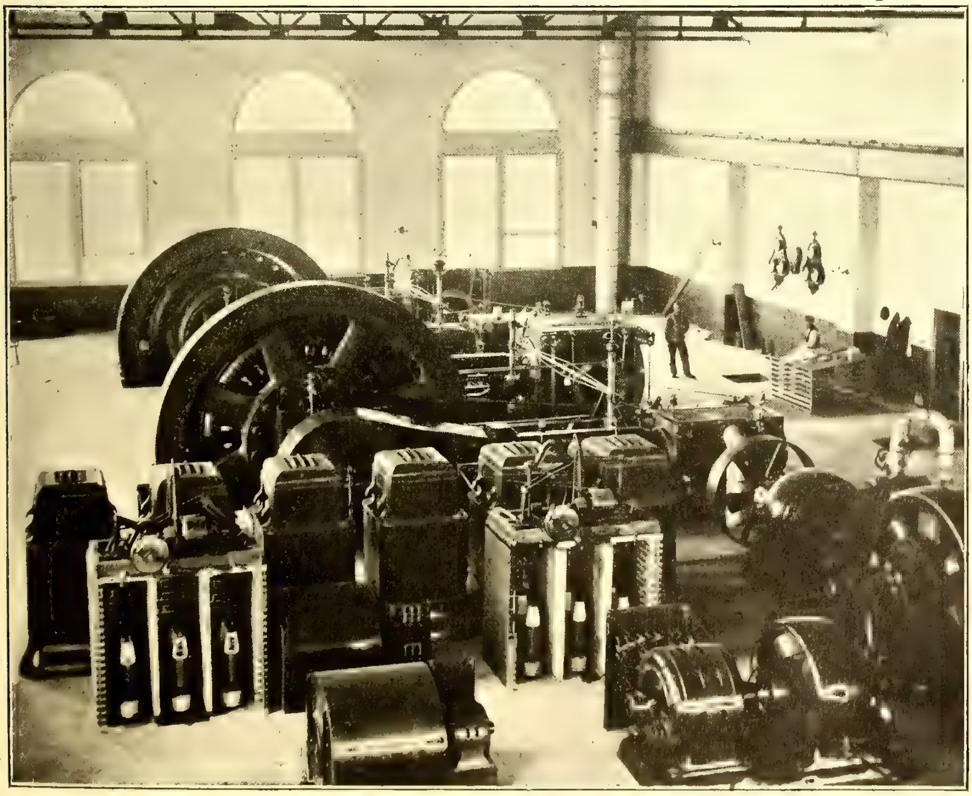


FIG. 11.—ENGINE ROOM

are for the direct-current end of the two rotary converters. The General Electric lightning arresters for the high-tension lines are seen at the left, Fig. 15. A Lincoln synchronizer is on the bracket of the switchboard for use in throwing the rotary converters in parallel. On the incoming high-tension line is a high-tension ammeter, power factor indicator and voltmeter. These are located on one of the pillars near the transformers, Fig. 15. At this sub-station oil switches and high-tension indicating instruments are also placed in the high-tension line as it continues on to the next sub-station.

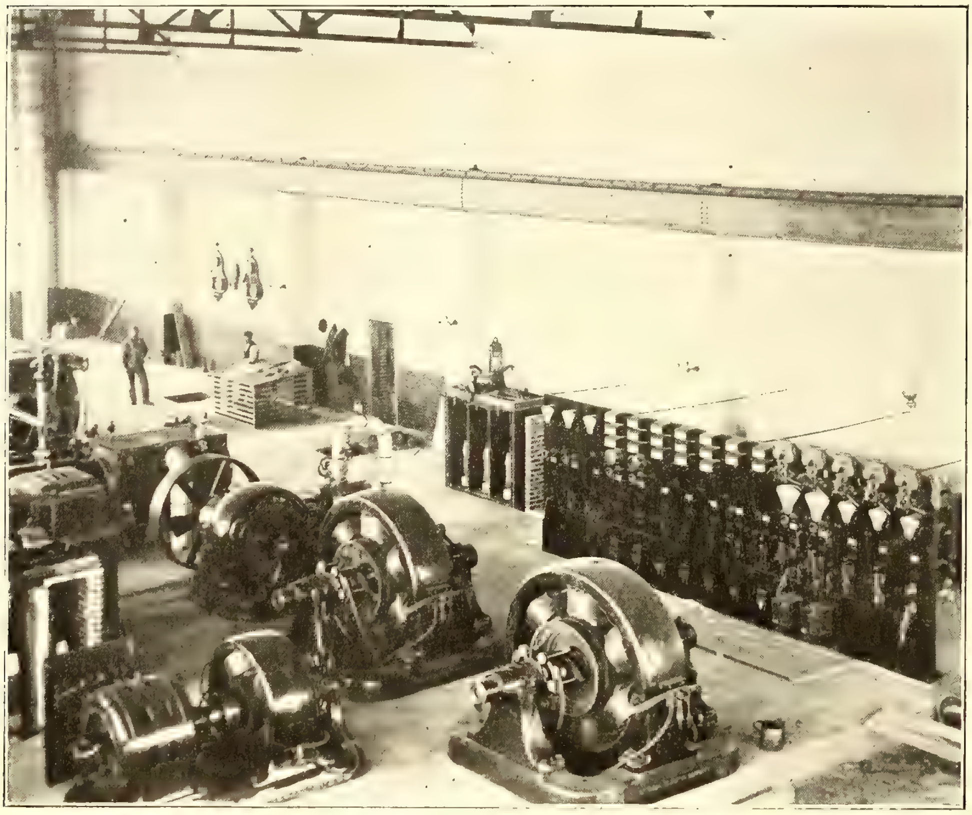


FIG. 12.—SWITCHBOARD AND CONVERTERS IN ENGINE ROOM

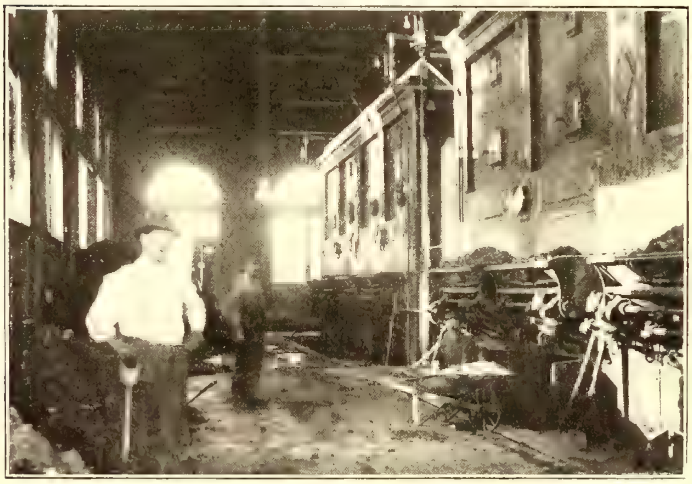


FIG. 13.—BOILER ROOM

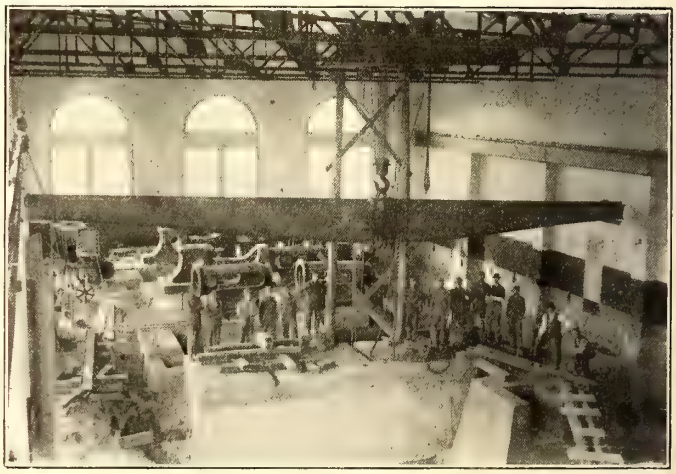


FIG. 14.—HOISTING TRAVELING CRANE WITH ITS OWN TACKLE

ROLLING STOCK

The regular passenger cars, Fig. 16, are somewhat longer than the average interurban car, being 60 ft. over all, with bodies 50 ft. long. The width is 8 ft. 8 ins. These cars seat sixty persons. Although equipped with controllers at each end they are intended to run ordinarily with the motorman's cab and baggage compartment at the front. As can be seen from Fig. 16 there is not platform space at the front end. What is usually the motorman's cab is enlarged to make a small baggage compartment. The smoking compartment in the front end of the car occupies the space opposite four windows. The seats are Hale & Kilburn reversible, with high backs, upholstered in green plush. The finish is mahogany with a small design inlaid in the panels between windows. These cars were built by the Jewett Car Company. They are heated by a Peter Smith hot-water heater, located in the motorman's compartment. The trucks are the Peckham M. C. B. type. The motor equipment consists of four General Electric 73 motors with type-M control. The gear ratio is such as to give about 42 m. p. h. maximum speed on a level. Steel-tired wheels are used exclusively. Twenty passenger cars and two express cars have been ordered.

CAR SERVICE

The cars now leave Indianapolis every hour, making all local stops. With the completion of the line to Lafayette and after the proper settling of the roadbed has taken place, it is proposed to run limited cars from Lafayette to Indianapolis in 2½ hours. The distance is 68½ miles, including the city mileage at each end. It is proposed to operate local cars, making this run in 3 hours. When the Crawfordsville branch is in operation it is expected to have a car leave Indianapolis every half-hour, the cars leaving on the even hours going to Lafayette and 30 minutes later to Crawfordsville. This, of course, will give a 30-minute service between Lebanon and Indianapolis. The operation of cars is controlled by a despatcher at Lebanon, who transmits his orders by telephone over the two wires provided for that purpose. Telephones are located in boxes at meeting points along the line. Telephone instruments were supplied by the Garl Electric Company. The conductor receives the despatcher's orders, writes a duplicate order on a blank provided for the purpose, and after receiving the order must give the duplicate to the motorman and read it to him, to be sure that it is understood. Train crews report to the despatcher only at terminals except in case the opposing car is not in sight when a crew arrives at a meeting point.

An elaborate system of tickets has been put in use. General Manager C. C. Reynolds is a former steam railroad man, and

has adopted many of the steam railroad forms of tickets, believing that special mileage and commutation tickets tend to produce more riding than a regular uniform cash fare. This is on the theory that a person having purchased a mileage or commutation ticket will think less about the expense of a trip than a person who must pay cash fare every time he rides. The regular one-way fare is slightly under 2 cents a mile. Round-trip tickets are sold at about 1½ cents per mile. Mileage books good for 1000 miles cost 1¼ cents per mile. School tickets, having forty-four rides, good only on school days, are sold at one-half the regular one-way cash fare. These are not limited to a given month, as is usual. One-way tickets between important points are small cards similar to those common in steam railroad practice. Round-trip tickets are cards with the going ticket in one color and the return ticket in another. These card tickets are kept in stock by ticket agents for use between the principal points. Ticket agents also have a supply of miscellaneous way tickets which can be filled in with ink to any way station for which tickets are not printed. National safety paper is used for these tickets. Trunks are checked for 25 cents each. Checks are printed in three parts, one to be attached to the trunk, the other to be given as a check to the customer, and the third retained by the company. Milk tickets, which include the return of the empty can, are made up in similar form. The stub of this ticket is attached to the can, to show to which station it is to be returned. The other two parts are good for the going and return trip of the milk can.

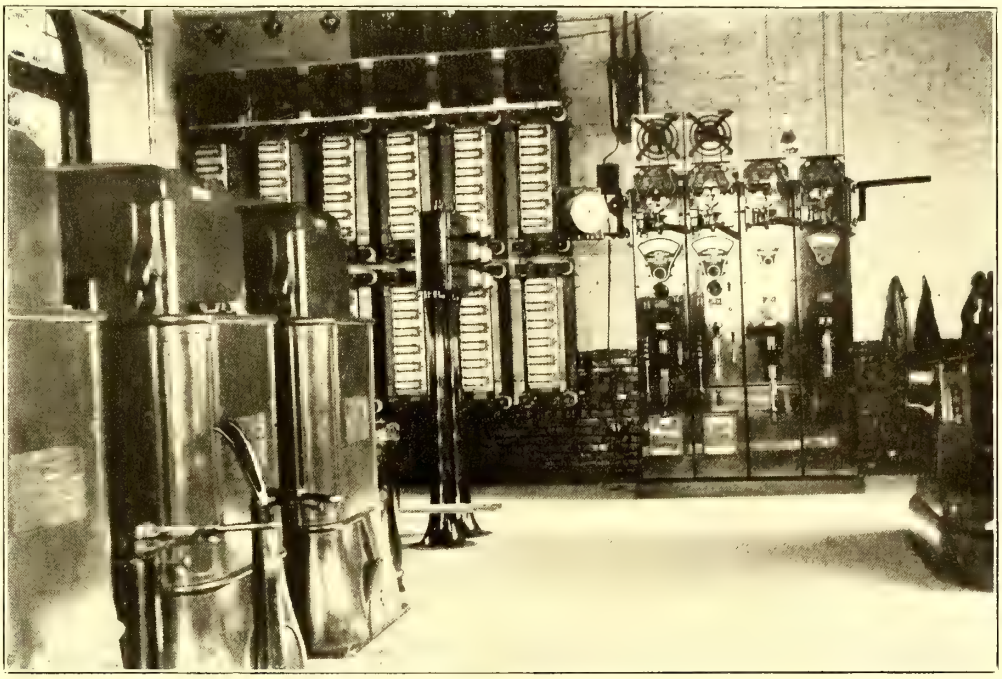


FIG. 15.—SUB-STATION EQUIPMENT

FIG. 16.—STANDARD INTERURBAN CAR

The officers of the Indianapolis & Northwestern Traction Company are: George Townsend, president; Phillip L. Saltonstall, vice-president; Winthrop Smith, secretary; Chauncey Eldridge, treasurer; C. C. Reynolds, general manager, the latter having direct charge of the operation of the road. Townsend, Reed & Company, of Indianapolis, built the road under contract for Tucker, Anthony & Company. The engineering work was done under the direct supervision of Messrs. Townsend and Reed, assisted by Robert P. Woods, civil engineer. William M. Moran, mechanical and electrical engineer, had personal supervision of all foundation work and the erection of boilers, engines, generators and electrical apparatus. F. W. West acted as steam engineer, and Henry Senecal as superintendent of track construction. During the past year Thomas Pettigrew has been on the ground as engineer, representing Tucker, Anthony & Company.

INTERURBAN DEVELOPMENT IN INDIANA IN 1903

The mileage of interurban lines radiating from Indianapolis increased during the year just closed from 273 miles to 525 miles, and the number of roads increased from seven to ten. This does not include the Crawfordsville branch of the Indianapolis Northwestern, the Indianapolis-Cincinnati line and the Consolidated line, all of which expect to complete their lines and begin operation early in the spring. These will add nearly 100 miles to the 525 now in operation. At this time there are 153 interurban passenger cars in and 153 passenger cars out of Indianapolis every day, making a total of 306 cars daily. In addition there are twenty freight cars in and out daily. A conservative estimate of the number of people brought into and taken out of the city during the year 1903 is placed at 2,250,000.

The gross earnings of all the companies operating into Indianapolis during the year are estimated at $1,850,000. This is the total business over their 525 miles of track. The officials place the operating expense at 45 pei per cent of the gross receipts. The total outstanding capitalization of these roads and those now building is $54,005,000. It is estimated that the interurbans entering Indianapolis did a freight business of $155,000 during the year.

Thirty miles of interurban road were built in Northern Indiana and 40 miles in Southeastern Indiana connecting Evansville and Princeton. A number of extensions were built by the Indiana Union Traction Company, which are included in the estimate given.

A notable event of the year was the awakening of the interurban spirit all through Southern Indiana. With the improvement of the Ohio and the White River water powers a number of companies have been organized to build interurban lines and promote systems. Lines are now being extended into the coal fields, and as a basis of operation a number of traction men have purchased large tracts of coal land, with a view of mining and transporting coal. The effect of the interurban operation of the lines was noticeable in all lines of business conducted in the towns and cities connected. It is claimed that the interurban roads now operating, together with their

connections, have added to Indianapolis a shopping population of 1,000,000 people.

A notable feature of 1903 was the connection of the Indiana and Ohio lines through Richmond. Arrangements are now being made for a through service from Indianapolis to Columbus and Zanesville, Ohio, a distance of 250 miles. This service is only held in check by an obstructive bridge at Richmond, which will be removed in a short time. The introduction of buffet cars and the Holland palace sleeping cars was not only a feature of the history of Indiana interurbans, but it marked an epoch in the history of transportation facilities calculated to bring the interurbans into closer competition with steam roads for long distance as well as local travel. The outlook for the year 1904 is very bright.

REPORT OF TECHNICAL COMMISSION ON THE PARIS UNDERGROUND ACCIDENT

The Technical Commission, appointed by the prefect of police in Paris to investigate the accident last August on the Metropolitan Underground Railway, and to suggest reforms in the service and equipment on the line, have completed their investigation and have made a number of recommendations. The committee was composed of Messrs. Mascart, a member of the Institute, president; Hospitalier, secretary; Picou, Blondel and Emile Gautier. They were assisted by Messrs. Walckenaer and Victor Gauthier, engineers of the police department. The recommendations made were as follows:

(1) Good mechanical protection of the car wiring in metal conduits, connected electrically with the framework of the car.

(2) Improvements in the construction and arrangement of the wiring to the controllers.

(3) Employment of all necessary means to limit the heating of the motors and ensure their being cool when put into service.

(4) Installation of apparatus permitting the motorman to raise the third-rail shoe without leaving his compartment.

(5) Employment of fireproof material as far as possible and slow-burning material in all other places.

(6) Sub-division of the third rail into a number of sections so that the number of trains on each section is considerably reduced.

(7) Supply of each section by direct feeders from the sources of supply, as well as automatic means for cutting off the current in case of short circuit.

(8) Installation of special apparatus at a number of different points along the track by which the power station or sub-station can be notified to cut current off the third rail, without recourse to the telephone, in case passengers have to leave the cars and walk through the tunnel to the nearest exit.

(9) All light circuits in the tunnel to be kept entirely separate from power circuits. The light circuits should also be especially protected and supplied by feeders outside the tunnel.

The Metropolitan management has already undertaken the introduction of most of these recommendations.

REPORT OF THE INTERNATIONAL RAILWAY EMPLOYEES' ASSOCIATION

The treasurer's report of the International Railway Employees' Association, which is an organization of the employees of the International Traction Company, of Buffalo, has recently been rendered. The Association shows a membership of 1320, an increase of 200 over last year. The total receipts for the thirteen months ending Oct. 31, 1903, were $9,873. On Oct. 31, 1903, there was a profit and loss surplus of $1,664.

MECHANICAL STOKERS VS. HAND FIRING

New York, Jan. 8, 1904.

EDITORS STREET RAILWAY JOURNAL:

Sirs.—The editorial on stokers in your issue of Oct. 24 suggests several considerations in stoker practice which relate to the standpoint from which the subject is viewed. Discussions and the interchange of facts and data are beneficial in proportion to their breadth, accuracy and the point of view from which they are approached.

Your editorial summarizes in a practical way the comparatively limited substance with which it deals, but the main difficulty in reaching conclusions from the discussion, as contained in the report of the Pennsylvania Street Railway Association and the summary of your editorial, is the same as would be found in riding to San Francisco on a ticket purchased from New York to Philadelphia.

As it is nearly impossible to compress sufficient data for wise conclusions into a brief discussion, certain advantage can be gained from partial information by clear definition of the art, and the true relation which the apparatus under discussion bears to it.

The whole art of combustion for steam making is full of anomalies, influenced as it is by many conditions and more limitations. Results, therefore, scatter through about 100 per cent, and usually fall short of the possibilities. This, therefore, admits of 10, 20, 30 and even 50 per cent savings, which may be variously attributed to causes, conditions or apparatus.

A little data obtained from a few plants, therefore, gives the material necessary for almost unlimited discussion and wide variance of opinion. The most important fact omitted from records is the information as to how well the plant is operated. This is difficult to determine and state, but it can often be exemplified by proceeding to operate 10, 15 or 20 per cent better than heretofore with little or no change in conditions. This is not infrequent where mechanical stokers are in operation with mediocre results and the right man takes charge of the boiler room, promptly showing a substantial increase of efficiency and a large reduction in labor. The eternal vigilance which is the price of economy is then allowed to wane until another period of reformed operation is instituted.

In the midst of such conduction various tests are made with conditions of operation more or less perfectly recorded. The difference between these results form fertile sources of discussion and opinion. Any one, therefore, approaching this subject should get firmly in mind that this is a widely variable art, rather more at the mercy of conditions than many other forms of mechanical service, and judgment should be suspended so long as information is comparatively meager. It is fair to credit any special device with its best performance, and exert all reasonable influences to produce conditions in which such performance can be perpetuated. This will enable any art to advance.

The status of mechanical stokers is quite different from that of engines, generators, motors, etc., in their respective arts. An engine fed with steam and oil, a generator supplied with power, or a motor furnished with electric current will perform certain characteristic functions comparatively unaided. Such machines contain within themselves the intrinsic ability to render certain results in capacity and efficiency with comparatively little outside assistance.

Stokers, however, belong to a class of apparatus which does not contain intrinsically such ability. They are rather in the nature of aids to intelligent manipulation, and the human element, therefore, enters largely into their performance. Such apparatus may, therefore, be considered in one sense as a convenience or as a device or instrument, the intelligent manipulation of which will yield results. The labor they save

is the ordinary manual labor of the many, not the skilled oversight of the few.

It is well known by those best informed that with suitable draft and manipulation a nearly perfect combustion of coal can be obtained, and through suitable heating surface a large proportion of its thermal capacity can be transferred to water or steam for useful service. The laws of combustion are in no wise connected with hand-firing, flat grates, mechanical stokers, or other manipulative functions, and, therefore, the fact that an expertly hand-fired flat grate can equal stoker firing is about as irrelevant a consideration as could be deduced. It would be strange if this were not true.

The problem is that knowing such combustion can be produced, and should be produced quite continuously, what constitutes the most practical method of obtaining it?

The conditions and limitations vary considerably with the size and engineering excellence of the plant and the available labor. It is not impossible to operate satisfactorily a small plant with a few good firemen who do their work carefully and intelligently with a keen eye to their employer's interest. The 50,000-hp plant must, on the other hand, depend on a different class of labor, ever changing, and which has no personal interest in the employer's welfare. Here it becomes a practical necessity so to equip as to insure the best obtainable results under rather severe limitations. There are all kinds and sizes of plants between these extremes. Under such widely varying conditions it will be obvious that a mere statistical comparison of tests is of no importance, and the judgment of men skilled in operating properties becomes of vastly greater weight. Thus it has come that the managers of fairly large plants have found that they get higher grade and better sustained results from mechanical stoking than hand firing.

It should be remembered that the practical point for consideration is not so much a mechanical stoker, considered as a machine, as the adoption of a mechanical stoking system with all it entails, beginning with the facility which a stoker offers for receiving coal by gravity from storage, operating with closed doors, offering means for slicing, and finally removing refuse by mechanical means—representing a practical means for fuel and labor saving proportioned to the quality of the management.

If, therefore, a broad view is taken of the opportunities offered by mechanical stoking systems, the results of good management are carefully studied, and the results of bad management deservedly condemned, it will be found that mechanical stoking has been productive of more good than any other one thing introduced of late years in steam generation.

The use of poorly designed apparatus, and more often to the placing of stokers with insufficient engineering knowledge and consideration of the conditions under which they are to operate, have led to certain failures which should be charged to their true causes and not to the general stoker art.

In the early days of mechanical stoking the construction was too light, grate areas too small, arches too large, combustion chambers cramped, ash pits shallow, boiler settings poor, and altogether the limitations were multiplied resulting unfavorably; nevertheless, scarcely more unfavorable than followed the flat grate practice of the same dates. The new thing, however, always is charged with all of the evils in sight, while an older one with long-suffered attendant evils is tolerated.

The attention given to the proper installation of mechanical stokers has brought much good engineering thought to bear upon boiler settings, flues, drafts and the general structures which tend to benefit the end for which the device offers opportunity. The whole art is by no means perfect but has vastly improved. Flat grate practice remains much the same as ever—always competent to produce a nearly perfect combustion under conditions which it practically never gets, or if it does then only on so limited a scale as to be insignificant.

Some engineers persuade themselves that, knowing the possibility of good combustion with flat grates under certain conditions, they will produce these results without the assitance of various devices. Others avail themselves of such devices as in their best judgment will aid economy. The result often is that the former course leads to results falling short of intentions, supplemented with explanations which do not improve the facts. The latter course approaches fairly close to intended results, yielding a satisfactory service with still some room for improvement, and, above all, maintaining such results with a degree of constancy which the former method rarely or never obtains.

Too much importance is often attached to certain details which vary through a wide range, and which are not clearly indentified; for instance, the amount of repairs or maintenance. It is rare that suitable accounts are kept of furnace repairs. Some records show abnormal repair charges, scarcely explainable until an investigation finds that repair parts sufficient to last a year or two have been ordered, put in stock and charged up to the plant within a short time.

Again, certain plants seem to have a peculiar faculty of using up a considerable number of parts of which other plants use none. This is prima facie evidence of bad management or specific defect, either of which can be remedied.

Again, excellently operated plants on which repairs are comparatively low show a variation of 100 per cent in actual amount of repairs per annum.

It is nearly impossible to get satisfactory records of repair of flat grates and their settings made on exactly the same basis in one plant as the basis employed in another where stokers are used, but out of a very large number of such records during the last fifteen years I am convinced that the repairs on the best handled stoker plants are about the same as on flat grates when measured in terms of coal burned. Any other measure is obviously fictitious.

As a rule, stoker repairs show a higher rate when measured in rated horse-power of boilers, and that is merely because they do more work, it being rare to find any stoker plant that is not running at a much higher rate than hand-fired plants—a condition favorable to additional wear and tear. This, of course, is permissible for the same reason that certain classes of rolling stock are entitled to wear out more wheels than others. They make more miles per year at higher speeds and earn more money.

The question of repairs, therefore, is one that cannot be justly considered alone, and inasmuch as the consideration of such items involves a more or less complicated situation than is usually presented by some simple statement, the real facts become clouded, misinterpreted, and form the subject of more or less fruitless discussion.

Again, some one objects to the hot stoker fires, mentions tube and arch burning, and quotes half-baked statistics on the quality of slow fires. Space does not permit discussion of these subjects. Suffice it to state that ample experience proves that hot, but not too hard-driven fires, are essential to economy, capacity and smokelessness. A coal fire cannot be built on a boiler grate that will burn clean tubes containing water. Proper arches will stand any coal fire that can be built on cast-iron grates. Many other such matters can be dismissed from discussion as remnants of early ignorance.

Any one undertaking to make an investigation of the practice of combustion under boilers has, considering the error of many quoted results and the incompleteness of others, a very nearly impossible task, and thus it is that whoever wishes to arrive at fair conclusions along this line needs to first determine, in his mind, the attitude from which he will view it. A proper attitude will benefit the consideration of any one, whether he be much or little skilled in the art.

Engineering judgment is, after all, the only medium through which correct decisions will be reached in an art in which available data scatters over so wide a field as that of the practical application of various appliances to aid the combustion of coal.

In conclusion, I therefore suggest that those who are interested in the subject of boiler furnace combustion, would find it well to think over the whole subject, broadly, in the light of all the surrounding conditions and limitations; take their eye off any specific device; line up their judgment on the total performance of all things required in the various types of plants than minutely studying tests covering wide ranges of results, conditions and unknown management. By this process and observation of the best installations of the respective kinds I think they will get a clearer idea of what will yield their plants most benefit, and they will be aided by the point of view thus gained when required to hold discussion based upon limited data.

WALTER C. KERR.

FREIGHT TRAFFIC TO BE CONTINUED ON THE MAUMEE VALLEY.

THE MAUMEE VALLEY RAILWAYS AND LIGHT COMPANY

Toledo, Ohio, Jan. 18, 1904.

EDITORS STREET RAILWAY JOURNAL:

The statement in your last issue that this road is to confine itself to the passenger business in the future is incorrect. We are still doing freight business and expect to continue doing so. Please make the necessary correction.

L. E. BEILSTEIN, General Manager.

There is no truth in the daily press reports that the Delaware & Hudson Railroad is to equip its line between Wilkesbarre and Carbondale with the third-rail system to compete with the Westinghouse Company's new third-rail system between Wilkesbarre and Scranton. A prominent official of the Delaware & Hudson Railroad Company said to a representative of the STREET RAILWAY JOURNAL that there was absolutely nothing in the story.

ANNUAL REPORT OF THE NEW YORK STATE BOARD OF RAILROAD COMMISSIONERS

The annual report of the Board of Railroad Commissioners of New York State for the year ending June 30, 1903, was submitted to the Legislature Jan. 11. Certain of the statistics contained in the report, as well as a tabulated list of the gross and net earnings of the different companies, were published in the last issue of this paper. Other statistics, published in the report, are summarized below.

The percentages of sub-divisions of operating expenses to gross earnings and to total operating expenses for all the companies are shown in Table I.

TABLE No. I.—PERCENTAGES OF SUBDIVISIONS OF OPERATING EXPENSES

For Year Ending June 30	To Gross Earnings		To Total Operating Expenses	
	1902	1903	1902	1903
Maintenance of way and structures...	4.19	3.99	7.09	6.92
Maintenance of equipment..........	6.78	5.94	11.51	10.29
Operation of power plant...........	8.04	9.42	13.67	16.33
Operation of cars....................	27.52	28.13	46.72	48.74
General expenses	12.38	10.22	21.01	17.72
	58.91	57.70	100	100

Table No. II shows statistics of receipts and expenditures per passenger and cost of operation per car mile of some of the principal companies for the year ending June 30, 1903:

PHYSICAL CONDITION OF PROPERTIES

The electrical expert of the board reports generally on the physical condition of street surface railroads as follows:

"The improvement in construction and reconstruction of electric railroads in the State, mentioned in last year's report of the board, has been continued during the past year. The extensions of existing roads and the construction of new ones have been made with not less than 60-lb. T-rail or 9-in. girder rails. In cases of suburban and interurban roads, rails generally have been laid on first-class ties with track properly

TABLE NO. II. STATISTICS OF RECEIPTS AND EXPENDITURES PER PASSENGER AND COST OF OPERATION PER CAR MILE OF SOME OF THE PRINCIPAL COMPANIES FOR THE YEAR ENDING JUNE 30, 1903.

NAME OF ROAD	Number of Passengers Carried, Including Transfers	Total Car Mileage	* Based Upon Gross Earnings from Operation and Operating Expenses		* Based Upon Receipts from All Sources and Total Expenditures, Including Fixed Charges		Per Car Mile		
			Average Earnings per Passenger	Average Cost of Operation per Passenger	Average Receipts per Passenger	Average Expenses per Passenger	* Gross Earnings	* Operating Expenses	* Total Expenses Including Fixed Charges
Operated Wholly or in Part by Mechanical Traction			Cents	Cents	Cents	Cents	Cents	Cents	Cents
Albany and Hudson	1,241,306	696,659	13.89	8.96	17.20	18.89	24.75	15.96	33 66
Auburn and Syracuse †	1,825,644	423,767	1.45	2.86	4.47	4.45	19.19	12.18	19.16
Brooklyn Heights ‡	300,892,437	49,389,361	4.07	2.44	4.18	3.93	24.84	14.89	23.98
Binghamton	5,643,496	1,165,780	3.96	2.24	4.01	3.45	19.16	10.86	16.70
Coney Island and Brooklyn	38,684,152	6,296,662	4.13	2.61	4.15	3.30	25.40	16.02	20.32
Crosstown Street (Buffalo)	14,601,860	2,449,889	3.42	1.88	3.44	3.11	20.38	11.23	22.59
Geneva, Waterloo, Seneca Falls and Cayuga Lake	1,544,744	434,450	4.70	2.63	4 73	3.97	16.71	9.36	14.11
Forty-second St., Manhattanville and St. N. Ave. (N. Y. City)§	19,869,643	2,862,866	4.01	2.39	4.19	4 52	27.82	16.62	31.37
Hudson Valley	3.599,464	1,613,467	8.77	9.39	9.70	14.53	19 57	20.97	32.42
International (Buffalo)	77,709,791	14,577,871	4.07	2.25	4.15	3.22	21.71	11.99	17.18
Interurban (New York City) ¶	422,909,442	45,303,499	3.54	1.67	3.61	3.69	33.05	15.60	34.36
Jamestown	4,326,992	724,633	3.18	2 12	3.22	2.90	19.01	12.67	17.30
Kingston Consolidated	2,425,509	491,489	4.61	2.66	4.62	4.26	22.80	13.13	21.01
New York and Long Island	717,609	231,645	4.78	4.91	4.83	4.96	14.80	15.22	15.36
New York and Queens County	14,672,125	3,207,323	4.17	2.47	4.22	3.78	19.09	11.35	17.31
Rochester	33,663,165	5,829,584	3.84	2.06	3.93	3 23	22.15	11.88	18.63
Schenectady	7,942,147	2,264,898	6 62	4.49	8.17	6.00	23.20	15.75	21.04
Syracuse and Suburban	1,493,876	404,962	4.98	2.95	5.02	4.72	18.39	10.90	17.43
Syracuse Rapid Transit	18,944,315	3,770,292	3.95	2.23	3.91	3.45	19.85	11.19	17.32
Third Avenue (New York)	50,835,205	6,520,284	4.33	2.33	5 83	5.74	33.73	17.95	44.74
United Traction (Albany and Troy)	31,693,596	8,080,144	5.07	3.40	5.21	4.34	19.88	13.32	17.03
Utica and Mohawk Valley	13,337,569	3,012,009	4.64	2.76	4.66	3 89	20.55	12.23	17.13
Union (New York)	45,149,750	6,849,201	2.51	1.82	2.52	2.47	16.57	11.98	16.28
Operated Wholly or in Part by Animal Power									
Central Crosstown (New York City)	18,517,929	1,612,326	2.62	1.67	2.65	2.28	30.09	19.17	26.23
Dry Dock, East Broadway and Battery (New York)	14,123,925	2,082,924	3.97	3.08	4.01	4.06	26.93	20.91	27,57

* Includes earnings and expenses of freight, express, mail and all other business. † For nine months ending June 30, 1903. ‡ Includes all lines operated by Brooklyn Heights not making separate reports. § Includes portion operated by horses. ‖ Includes all lines operated by Interurban not making separate reports, and also includes lines operated by horses.

ballasted and ditched. The increased weight of cars and the speed at which they are at present operated has been, in most cases, kept pace with by railroad managers in improved track construction, and more attention has been given to maintenance. In this connection there has been a decided improvement in the matter of structures. A number of wooden bridges have been replaced by steel ones and concrete abutments have been adopted by nearly all roads for replacing trestle, mason work and mud-sill abutments. Concrete is also being extensively used in the construction of culverts and other openings for waterways. A number of the companies have placed crossing-signs at crossings of highways, the views of which were obscured. With the present methods of operation on interurban and suburban roads, this is a matter of importance and safety of operation would be increased if all of the obscure crossings were equipped in this manner. Considerable attention has been given to the subject of runaway cars on heavy grades, and several of the roads have equipped tracks with devices for preventing serious accidents from this cause. These consist, in some instances, of derail switches; in others of obstructions placed at the foot of grades, for preventing cars from running onto other railroad tracks or into dangerous places. In a number of cases grades are sanded by men employed for that purpose, during times of slippery rail.

"The improvement in the construction of cars, both in appearance and comfort, has been continued during the past year, and, at present, some of the roads are being equipped with cars which, in both these conditions, compare favorably with first-class steam road equipment. An improvement in reference to the strength of cars should be made. In a number of cases collisions result in loss of life and serious injury to passengers for the reason that the present car construction is such that the sill of the one car rides over the sill of the other (in cases of collision) and cuts the woodwork above the flooring, and, in most cases, extends a considerable distance into the body of the second car. Uniform height of the buffer from the rail for different classes of cars should be adopted, and stronger construction above sills is required. A number of roads have added to their power brake equipment. This is an important element in preventing accidents, and all cars operated in the State at a speed to exceed 15 m. p. h. should be so equipped."

OTHER RECOMMENDATIONS

The recommendations in regard to high-voltage transmission lines and train despatching were published last week.

The board renews to railroad managers its general recommendations made in its annual reports for several years, as to the operation of street surface railroads, especially in the following particulars:

First.—Every street car which crosses a steam railroad at grade shall be equipped with a red flag for use during the day and a red lantern for use at night. When approaching such crossings the car shall come to a full stop at least thirty feet from the crossing, and shall not proceed until the conductor has gone upon the steam railroad, carrying the flag or lantern, and after ascertaining that the way is clear, given the proper signal for the car to proceed. The Board also recommends that at all grade crossings by overhead-trolley railroads of steam railroads, a V-shaped trough of metal be constructed over the trolley wire or wires to insure the motor retaining the current while the crossing is being made.

Second.—That where two or more street car lines cross, or where they merge, an agreement shall be made as to which line shall have the right of way. The car that has not the right of way shall come to a full stop before crossing the tracks of the other line, or entering on the joint track, and the car which has the right of way shall slow down before crossing the tracks of the other line, or entering on the joint track.

Third.—That cars passing in opposite directions shall not meet on street crossings.

Fourth.—That the speed of cars be reduced to the minimum on all curves where the view is obstructed.

Fifth.—That passengers be prohibited from riding on the running boards or side steps of open cars.

Sixth.—That passengers be not permitted to stand on the front platforms of open cars, and that only as many passengers be permitted on such platforms as can be conveniently seated. In the case of open cars that have no seats on the front platforms, passengers shall not be permitted to ride on the platform, and the side gates shall at all times be kept closed. Under no circumstances should passengers be permitted to ride on the front platforms of closed cars.

It may be said that the first of these recommendations, as to flagging across steam railroads, has been generally adopted. It may also be said that at very many of such crossings the V-shaped trough referred to has been adopted. It may also be said that the second recommendation has been generally adopted. While the third recommendation has not been so generally adopted, it has been in some instances.

ANNUAL REPORT OF THE MASSACHUSETTS BOARD OF RAILROAD COMMISSIONERS

The thirty-fifth annual report of the Board of Railroad Commissioners of Massachusetts for 1903 was made public last week.

The mileage owned, exclusive of that in the subway, is 2159 miles of main track, 364 miles of second main track, and 148 miles of siding. This is an increase of 155 miles over last year.

The Commissioners call attention to the inadequacy of the existing laws giving street railway companies right to construct track on private land. A street railway, in the Massachusetts laws, is defined as a railway "usually constructed in, under or above the public ways and places," and the statutes permit such companies to take private land in order "to avoid dangerous grades or curves existing in the highway," or for "other similar purposes incident to" operation in public ways. Except in cases thus provided for, the building of street railways on private land is expressly prohibited. The board states that in several cases which have arisen recently it has ruled that where no heavy grades, sharp curves or other physical condition make the highway unfit for use by a railway, and where the only purpose in departing from it for long distances is to obtain a more direct route and an opportunity for higher speed, it cannot properly approve construction on private lands. Such use of private lands is not fairly "incident to the use of the highway," or within the purposes of the statute; and the board, therefore, has no authority to approve it, no matter how meritorious the undertaking.

The board believes, however, that where the building of an interurban railway is justified by the public demands for such convenience, the law should encourage and not discourage the enterprise; and there seems to be no good reason why companies should not be given greater freedom of choice as to construction upon highways or private lands. It may be very desirable that an interurban road should be constructed for long distances between communities apart from the highway. A more direct route is secured, there is less interference with other uses of the highway, and a higher rate of speed is possible—three very good reasons why, under suitable conditions, such construction may be permitted in the public interests. The essential purpose of the street railway is still preserved, as it resumes its place upon the highway to take up its distinctive and all-important work of carrying people from door to door and from street to street. This authority to build at the option of the company either upon the highway or upon private land has been granted under special acts in several instances, and the board recommends there should be general legislation granting this in all cases where it is decided by the proper tribunal that the public interests are better served in this way.

The report then discusses fenders, and states that it is of far greater importance to adopt safeguards which will prevent cars from running into people than to make a choice between different devices for tripping or picking them up without injury.

The Commissioners are not yet satisfied that any fender has been devised which is entitled to use above and beyond all others, nor do they consider the fenders now used so eminently satisfactory that there is no need of experiment with new types. They say that it is the duty of every street railway management to offer a reasonable opportunity for testing the value of different new devices in connection with the equipment of new cars.

CAPITAL STOCK AND DIVIDENDS

The aggregate capital stock of the 100 operating companies, Sept. 30, 1903, was $68,404,479.50—a net increase of $8,368,-152 over the preceding year. The total amount of dividends declared the last year was $3,586,248—an increase of $447,537 over the preceding year. Forty-four out of the 109 companies at the beginning of the year paid dividends ranging from 1 per cent to 10 per cent, and sixty-five companies declared or paid no dividends. One company paid 10 per cent, seven paid 8 per cent, one paid 8 per cent on preferred and 7 per cent on common, one paid 7.22 per cent, one paid 7.20 per cent, sixteen paid 6 per cent, eight paid 5 per cent, one paid 4.5 per cent, two paid 3.75 per cent, two paid 3 per cent, two paid 2 per cent, one paid 1.25 per cent, and one paid 1 per cent. The average percentage of dividends on total capital stock for the year was 5.24.

INCOME AND EXPENDITURES

The total income of the companies from all sources was $27,027,651; the total expenditures (including dividends) were $27,010,982, leaving a net balance of $16,669. The items of expenditure were as follows:

TOTAL EXPENDITURES, 1902 AND 1903

Expenditures	1902	1903	Increase
Expenses of operation	$15,912,852	$17,519,367	$1,606,515
Interest on debt and loans..	2,161,160	2,350,391	189,231
Taxes....	1,611,851	1,725,312	113,461
Rentals of leased railways...	1,403,225	1,394,283	8,942*
Other charges on income....	440,222	435,382	4,840*
Dividends paid............	3,138,711	3,586,248	447,537
Total expenditures.....	$24,668,021	$27,010,983	$2,342,962
Surplus for the year.........	250,140	16,668	233,472*

* Decrease

The gross earnings and expenses of operation the last year are classified and compared with those of the previous year, in the following table:

GROSS EARNINGS AND EXPENSES OF OPERATION, 1902 AND 1903

Earnings and Expenses	1902	1903	Increase
Revenue from passengers ...	$22,989,002	$24,921,452	$1,932,450
" from mails and merchandise...............	65,698	82,837	17,139
Revenue from tolls, advertising, etc...............	431,774	536,522	104,748
Gross earnings from operation...............	$23,486,474	$25,540,811	$2,054,337
Operating expenses	15,912,852	17,519,367	1,606,515
Net earnings from operation	$7,573,622	$8,021,444	$447,822

The ratio of operating expenses to earnings was 68.59 per cent, as compared with 67.75 per cent last year.

CAPITAL INVESTMENT AND COSTS

The total capital investment (capital stock and net debt) of the street railway companies of the State advanced the last year from $113,071,113 to $122,666,365—an increase of $9,595,252. The average cost per mile of main track (including the cost but not the length of side track), as it stood on the books of the companies Sept. 30, 1903, was $26,014.49 for construction, $9,994.30 for equipment, and $12,546.29 for lands, buildings (including power plants) and other permanent property—making a total average cost of $48,555.08 per mile of main track.

VOLUME OF TRAFFIC

The total number of passengers carried during the last year on the railways of the 109 companies making returns to the board was 504,662,243; the car-mile run was 107,506,812.

The following table gives for each of the last ten years the average gross earnings, operating expenses, and net earnings from operation, (1) per total mile of main track owned, (2) per car mile run and (3) per passenger carried, thus showing more in detail the changes from year to year in the earnings, cost and net results of operation:

YEARS	Average per Mile of Track Owned			Average per Car Mile			Average per Passenger		
	Gross Earnings	Expenses of Operation	Net Earnings	Gross Earnings	Expenses of Operation	Net Earnings	Gross Earnings	Expenses of Operation	Net Earnings
				Cents	Cents	Cents	Cents	Cents	Cents
1894..	$11,972	$8,321	$3,651	30.28	21.05	9.23	5.04	3.50	1.54
1895..	12,127	8,359	3,768	30.20	20.82	9.38	5.07	3.50	1.57
1896..	11,627	8,274	3,353	27.69	19.70	7.99	5.08	3.61	1.47
1897..	11,187	7,713	3,474	25.68	17.71	7.97	5.12	3.53	1.59
1898..	10,998	7,589	3,409	24.80	17.11	7.69	5.11	3.52	1.59
1899..	10,459	7,132	3,327	24.74	16.87	7.87	5.09	3.47	1.62
1900..	10,452	6,878	3,574	24.46	16.10	8.36	5.06	3.33	1.73
1901..	9,998	6,690	3,308	23.40	15.66	7.74	5.02	3.56	1.66
1902..	9,609	6,510	3,099	23.42	15.87	7.55	5.05	3.42	1.63
1903..	10,124	6,944	3,180	23.76	16.30	7.46	5.06	3.47	1.59

ACCIDENTS

The whole number of persons injured in connection with street railway operation, as reported by the companies for the year ending Sept. 30, 1903, was 3974, of whom eighty-four received fatal injuries, and 3890 injuries not fatal. The number of passengers injured was 2568, of whom sixteen were injured fatally. The injuries to employees were 161 in all, nine of which were fatal. The number of injuries to travelers and others on the street was 1245, of which fifty-nine were fatal.

THE WETZIKON-MEILEN INTERURBAN RAILWAY

In the description of the Swiss interurban electric railway, which has recently been completed between Wetzikon and Meilen, and which was published in the STREET RAILWAY JOURNAL for Dec. 26, the statement should have been made that the rotary sub-station is equipped with apparatus from the works of Brown, Boveri & Company, of Baden, who were also the contractors for the power station at Beznau, from which power to operate the line is obtained. The car equipment and overhead line, as stated in the article, were furnished by the Oerlikon Machine Works.

SNOW REMOVAL ON THE BOSTON & WORCESTER.

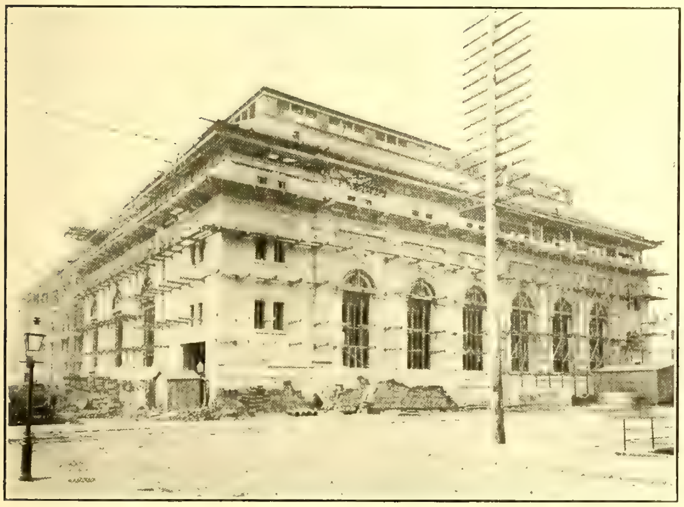
The Boston & Worcester Street Railway Company, operating between Boston and Worcester, Mass., made an excellent showing in the severe snow-storm that visited the East on Jan. 3. Steam railroads connecting with Worcester were seriously crippled, and service on the lines between Worcester and Boston was very unsatisfactory. But the electric railways survived in great shape. Its line was kept open all the time, its schedule was maintained very well, and many regular patrons of the steam roads between the cities journeyed on the electrics.

Through service, without change of cars, between Richmond, Ind., and Indianapolis was inaugurated on Jan. 4. The cars run every 3 hours, and the fare is $1.30. The run is made in 2½ hours, distance 50 miles.

POWER STATION OF THE INTERBOROUGH RAPID TRANSIT COMPANY OF NEW YORK

One of the features of the fifty-first annual meeting of the American Society of Civil Engineers, at New York, was the visit, on Jan. 20, to the main power house of the Interborough Rapid Transit Company, now under construction. This structure occupies the block between Eleventh and Twelfth Avenues and Fifty-Eighth and Fifty-Ninth Streets, and is now pretty well advanced. In order to facilitate the inspection of the new plant the Interborough officials furnished a brief description of the structure and equipment to visiting members of the society, containing the following data, with a plan and cross-section of the engine and boiler room, which are reproduced herewith:

The substructure of this power house consists of Portland cement concrete, in the following proportions: One part cement, two parts sand and five parts broken stone. This proportion is used for all column bases, engine beds and wall footings, and all these foundations have been taken down to bedrock, all concrete work being brought to elevation + 1.5 ft. above mean high water (city datum). The rock elevations vary from + 12 to —33 ft., thus showing a very irregular bottom. There are 397 columns and 12 engine beds, the bases of each being enlarged to meet the deflection in the rock. To carry the column loads, there is a granite cap-stone on the surface of



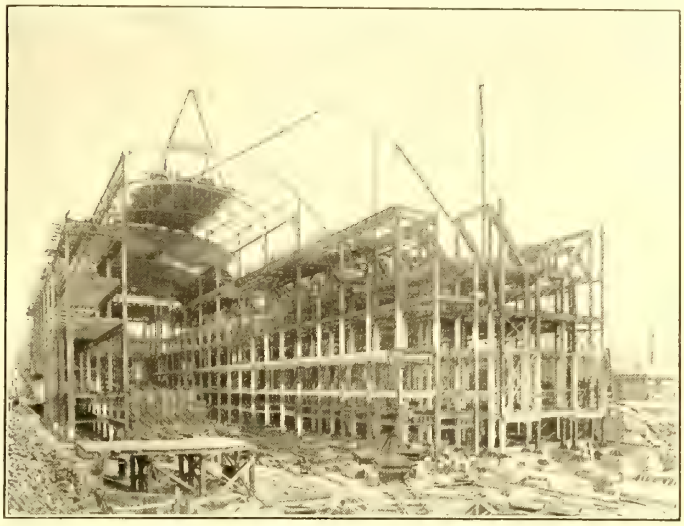
EXTERIOR OF POWER STATION ON OCT. 2, 1903

each concrete pier, and these are of various sizes. On these cap-stones are set cast-iron bases, into which the steel columns are set. All engine-bed footings are of concrete from bedrock to elevation + 1.5 ft. At this elevation the forms are put up, and the anchor bolts, washers and nuts (for engines or generators) are set. Corrugated steel bars, placed horizontally and vertically, are also built into these monoliths. Each bed, above elevation, + 1.5 ft., contains 1,350 cu. yds. of concrete. All wall footings are of similar construction, and are taken from the rock to elevation + 1.5. The walls are of hard red brick to elevation + 17.75, and from this point to the top of the water table granite facing is used.

The intake and return-water conduits for condensing purposes are of concrete, reinforced on the river end by corrugated steel bars. This is also true of the coal-conveyor tunnel. The bottom of the intake conduit rests on piling, driven to bedrock, extending out to the city dock line and cut off at elevation —19.5 ft.

All foundations for feed pumps, air pumps and circulating pumps are of concrete. The basement floor also will be of similar construction.

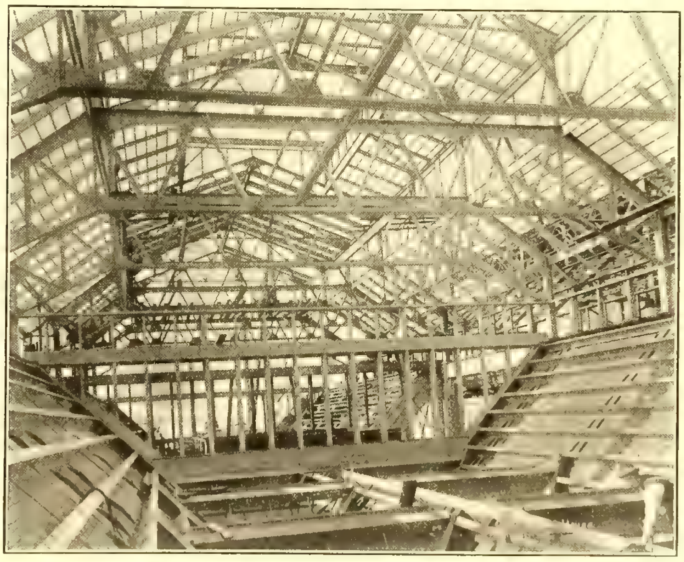
The steel in the building is independent of the exterior walls, which are self-supporting, so that the integrity of the structure would remain if the walls were removed. The weight of the steel will approximate 12,000 tons, and in this respect it is one of the heaviest structures on record. Some of the columns sustain 750 tons. A feature of the design is the bracing required to withstand the strains caused by the chimneys and by the excessive loads carried high in the structure. Each chim-



VIEW TAKEN JULY 15, 1903, SHOWING IRON STRUCTURE

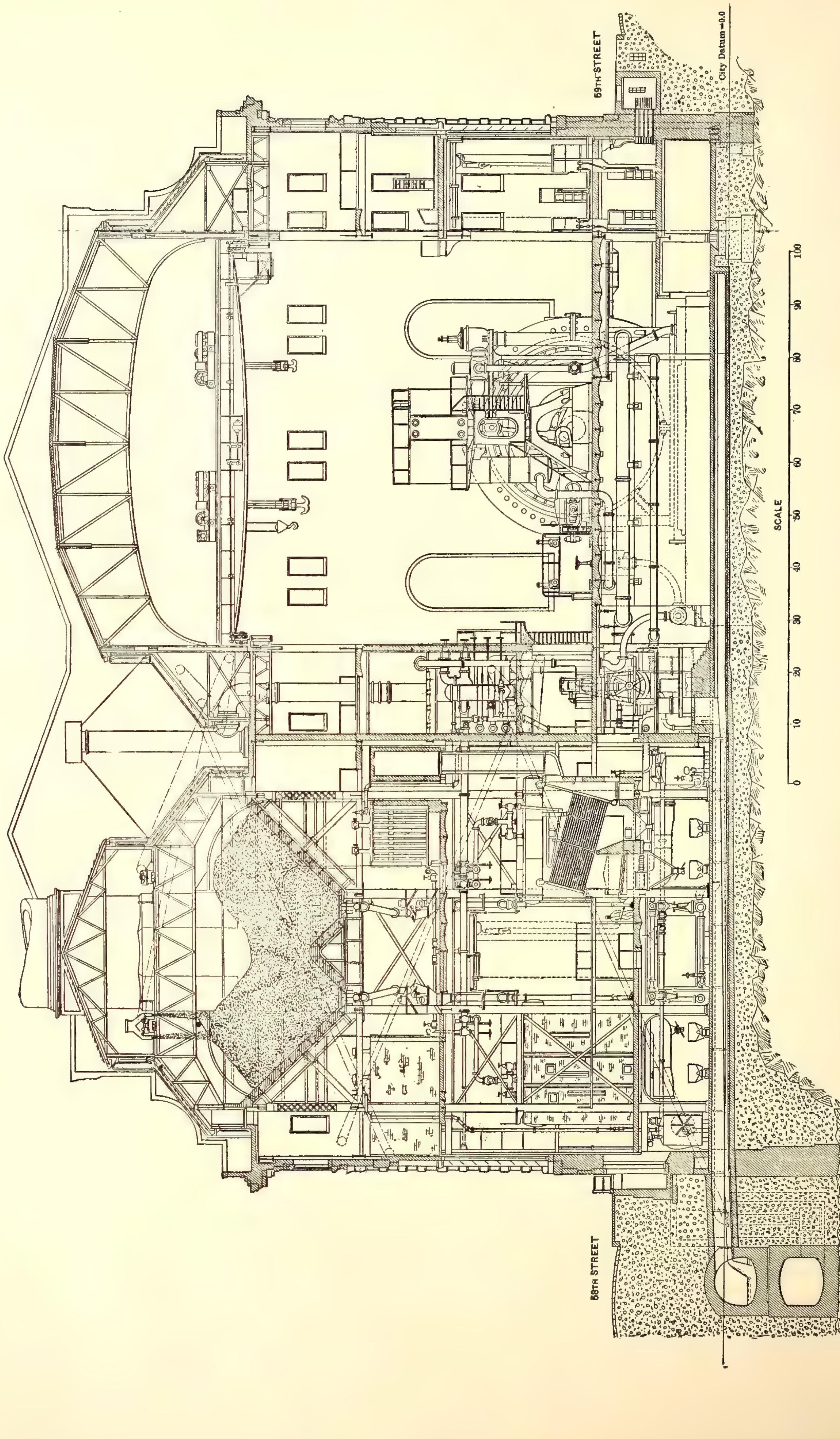
ney is supported on six columns which carry a platform of plate girders 8 ft. deep, over which is placed a grillage of 20-in. beams, placed at 2-ft. centers and filled solidly with concrete. The base of the masonry, resting on the grillage, is reinforced by a steel frame 3 ft. deep, with steel rods running in both directions through the base of the brickwork.

The base of the exterior walls is finished with cut granite up to the water table, above which the facework is of light buff pressed brick, enriched with terra-cotta. The general treatment of the design may be termed Italian Renaissance, and is rather ornate. The structure will be one of the most attractive in New York City. All window sash and framework is of cast iron, glazed with ribbed glass, and all exposed trimwork on the roof is of copper. The flat portion of the roof is of concrete (expanded-metal construction), and the sloping sides of the roof are of terra-cotta covered with green enameled tile of a



CONSTRUCTION OF COAL BUNKER

Spanish roll pattern. The chimneys are faced with brick of the same quality as used in the facework of the structure. The interior of the operating room is faced with brick of a light buff color, and the trim of all doors, sash, etc., is covered with kalamein iron or sheet copper. This trim is reduced to a minimum, so that the building is fireproof in the strictest sense.



CROSS SECTION OF THE NEW POWER STATION OF THE INTERBOROUGH RAPID TRANSIT COMPANY AT FIFTY-NINTH STREET AND NORTH RIVER, NEW YORK

EQUIPMENT

The power house is 200 ft. wide on Eleventh Avenue, and extends westward 694 ft. Its height, from the basement floor to the highest point of the roof, is 125 ft. The structure is divided into two main sections: A boiler house on the south, or Fifty-Eighth Street side, and an operating house on the north, or Fifty-Ninth Street side, each extending the full depth of the building.

On the Eleventh Avenue end is extended a track connected with the main line of the New York Central Railroad, and this is used in bringing machinery and materials into the building. Coal, however, is conveyed into the building with a belt conveyor. This conveyor extends to a pier in the North River, at the foot of West Fifty-Eighth Street, 700 ft. in length. From the pier the coal is conveyed underground to a point at the southwest end of the building, where it is raised by an elevating belt system to the coal bunkers constructed in the roof. The bunkers have a capacity of 25,000 tons. From the bunkers the coal is conducted to the points of requirement at the boilers.

A new feature is the use of a distributing coal conveying system under the bunkers, by which coal of a high grade stored in any one bunker can be distributed to all boilers without handling, thus permitting the use of two or more grades of coal when needed at different times of the day. The ashes from the ash hoppers are removed from the building to the front by a system of trackage with storage-battery haulage.

The condensing water is taken through the river wall at the pier, and passes through a masonry conduit to the several suction wells adjacent to the structure. From the wells it is piped to the circulating pumps, and thence back to a second masonry conduit, from which it is delivered at a point about 200 ft. outside the river wall. The intake conduit is oval in cross-section, 10 ft. wide and 8 ft. 6 ins. high, the bottom of the opening being at 19.5 ft. below mean high water.

For the immediate installation under construction, the boiler plant will consist of sixty safety water-tube boilers, each having 6,000 sq. ft. of effective heating surface, placed in two rows, with a firing space between. The grates are 12½ ft. wide and 8 ft. deep.

The boilers are set higher from the floor than in older practice, and a continuous operating platform extends in front of each row of boilers, thus separating the boiler tenders from the firemen. The level of the operating platform is continuous with the floor of the operating room.

The boiler backstays form a part of the structural steel of the building, and a steel floor, with railings, is constructed over the tops of the boilers, thus preventing radiation of heat and avoiding accidents to the men.

The gases from the boilers pass upward through round steel smoke uptakes, lined with brick, to steel smoke flues, also lined with brick, arranged so that the gases can pass to the chimney directly, or first through economizers.

The immediate installation includes five radial brick chimneys 162 ft. high from the base, and 15 ft. in diameter at the top, which is 236 ft. above the street level.

Each chimney weighs about 1200 tons, and its base is carried on girders and columns, the division between the steel substructure and the masonry superstructure being 74 ft. above the basement. This construction permits the use of the space under the chimneys for boilers. Each chimney is connected to twelve boilers, arranged symmetrically with respect to its center.

On the north side of the operating room there is an area for the electrical work, and on the south side an area for the steam auxiliary machinery. Extending through the operating room is a row of nine 8000-hp to 10,000-hp engines, direct connected to 5000-kw alternators, the row being broken at the center of the structure by an installation of four 2000-hp turbo-generators for lighting purposes.

The total capacity of the nine engines, together with the turbo-generating plant, will be 80,000 hp when operating at their best efficiency, but it will be possible to operate this plant at 100,000 hp. To this should be added 30,000 hp proposed for a future generator equipment in the 108-ft. extension at the western end, now in process of construction. Thus the total generating capacity of the completed plant can safely be placed at 130,000 hp.

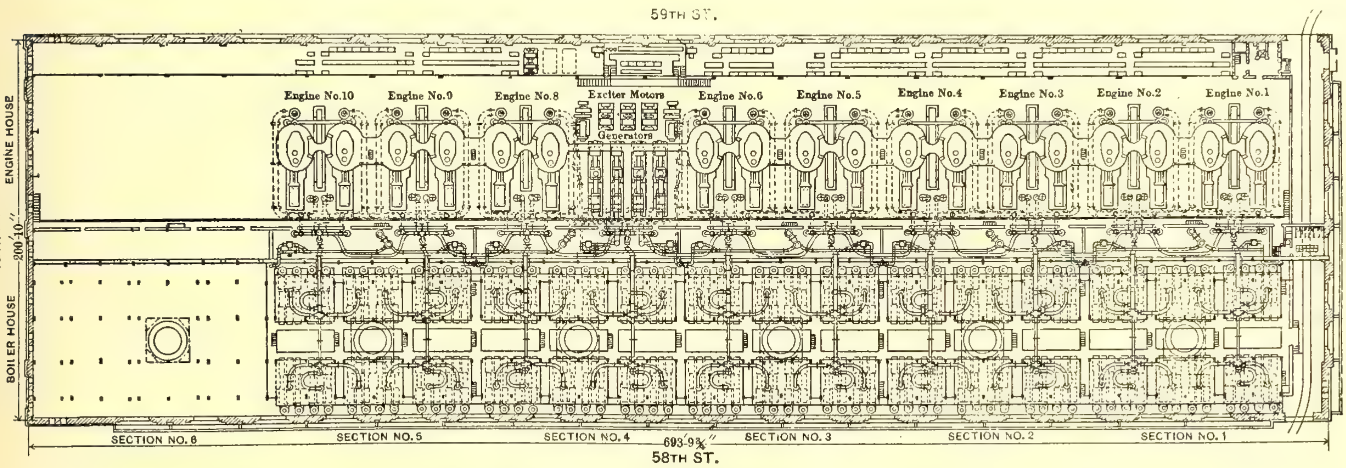
The engines are of the twin-compound type, having horizontal high-pressure cylinders and vertical low-pressure cylinders; the high-pressure cylinders being provided with mushroom or poppet valves for superheated steam. Each low-pressure cylinder is placed in direct relation with the condensing chamber of a barometric tube-condenser.

Six boilers are provided for each engine, and the entire plant is designed on a unit or sectional basis, the design of each section being identical with that of the others; that is, each section will consist of one chimney, twelve boilers and two engines, in connection with the respective auxiliary equipment for each engine, consisting of one boiler feed-pump, one feed-water heater and one condensing outfit.

Each section can be disconnected from the general system by power-operated valves, thus permitting each section to be thrown out or operated independently. Power-operated valves are also supplied for each boiler and engine.

The steam main for each engine connects with six boilers by bent pipes, then passes straight to a center, back of the engine; thence it divides and connects to the twin-engine cylinders. At the point of division a manifold system of curved equalizing pipes connects all the several mains when desired.

All the pipe fittings are heavier than the so-called extra heavy fittings, all pipe being designed for the strains incident to



PLAN OF NEW POWER STATION OF INTERBOROUGH RAPID TRANSIT COMPANY

200 lbs. pressure, with steam superheated to 500 degs. F., as all boilers ultimately will be provided with superheaters.

All the main features of the piping system are located within the area for the steam auxiliary machinery, and are enclosed above. All manipulations required in operating the piping system can be conducted from an exterior gallery running along the south side of the operating room.

The atmospheric exhaust system is unusually ample, as one 48-in. exhaust pipe is provided for each section of two engines, so that the entire plant can be run on atmospheric exhaust.

A new feature is the location of the auxiliary pump equipment for each engine. This is placed back of the engine, and is controlled from the point where the engine throttles are located.

All the electrical apparatus on the north side of the operating room is designed on the unit basis, and is controlled from a main operating pulpit in the center of the building, from which radiate all the wires, or "nerves," controlling the entire electrical equipment.

The nine 5000-kw alternators generate energy at 11,000 volts, the alternators being of the three-phase, revolving-field type, for 25 cycles.

An exciter plant of three motor-driven and two engine-driven exciters will be provided.

PROPHETIC CHRONOLOGY OF SAN FRANCISCO

In its "Twenty Million Edition" of Jan. 1, so-called because it prophesies a population of 20,000,000 people in California in the year 2004, the "San Francisco Chronicle" gives a prophetic chronology of things that are likely to happen within the next century. The following happenings predicted are in the line of electric railway improvements:

December 1, 1905.—In this year there was not a wire left above the surface of the ground upon any of the streets in the business section of San Francisco.

1908.—Completion of electric car system from San Francisco to San Jose and from Oakland to San Jose.

1910.—Running of electric freight cars over the street railroads of San Francisco.

1912.—Completion of subway under Market Street, extending from sidewalk to sidewalk. Construction feature was overhead steel beams to carry the surface traffic. The subway itself had tracks for rapid transit, and was so arranged that electric wires, gas and water pipes and other conveniences were accessible at all times for inspection and repair.

1915.—The Santa Barbara-Guadalupe local electric line was completed, making it possible to go from Eureka to San Diego by a continuous chain of electric roads.

1923.—Work commenced on another Market Street subway for underground railway transportation.

1962.—San Francisco had in this year 11 miles of wharves and docks, with a four-track elevated railway extending along the entire water front and operated with electric engines.

1972.—Opening of the great Ocean Boulevard, extending from the Golden Gate to Monterey Bay, with electric train service the entire length.

EXPRESS BUSINESS TO BE EXTENDED IN CLEVELAND

The Electric Package Company, of Cleveland, whose freight station and methods of operation were described in a recent issue of the Street Railway Journal, is very much alive to the possibilities for future development, and is planning a number of extensions which may be put into operation during the coming summer. As outlined in the previous article, the company maintains delivery wagons in all the leading towns served by the interurban systems radiating from Cleveland. Now it is proposed to branch into the business of local package delivery in these towns, the object being to aid merchants in the delivery of their goods to customers at a nominal cost. At present the company has regular delivery routes in the larger cities. By increasing the number and scope of these routes it could make frequent deliveries of goods for down-town merchants, thus increasing the income without materially increasing the mileage or hours of delivery wagons.

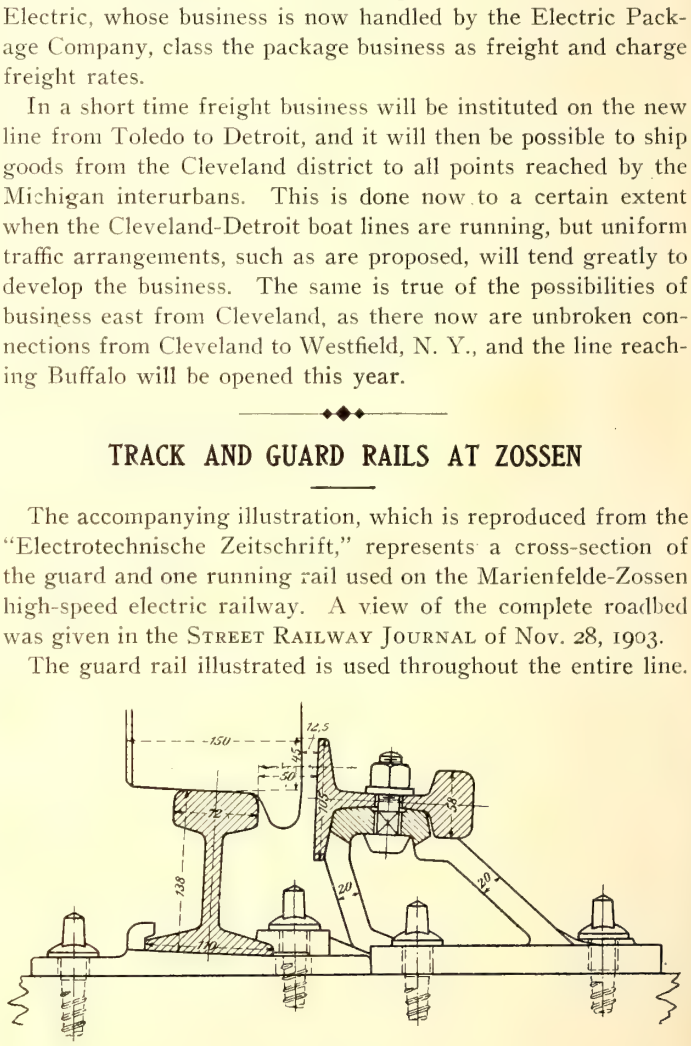
The plan will first be tried in Cleveland, and it is probable that a warehouse will be erected near the present interurban express station. In connection with the warehouse would be the stables for the delivery wagons and horses. The company also aims either to extend its service to other interurban roads in the Central West, or else perfect traffic arrangements for shipping express or freight to distant points. At the present time goods are shipped from Cleveland to points in Michigan, but such packages have to be reshipped at Toledo, as all the Toledo interurbans, with the exception of the Lake Shore Electric, whose business is now handled by the Electric Package Company, class the package business as freight and charge freight rates.

In a short time freight business will be instituted on the new line from Toledo to Detroit, and it will then be possible to ship goods from the Cleveland district to all points reached by the Michigan interurbans. This is done now to a certain extent when the Cleveland-Detroit boat lines are running, but uniform traffic arrangements, such as are proposed, will tend greatly to develop the business. The same is true of the possibilities of business east from Cleveland, as there now are unbroken connections from Cleveland to Westfield, N. Y., and the line reaching Buffalo will be opened this year.

TRACK AND GUARD RAILS AT ZOSSEN

The accompanying illustration, which is reproduced from the "Electrotechnische Zeitschrift," represents a cross-section of the guard and one running rail used on the Marienfelde-Zossen high-speed electric railway. A view of the complete roadbed was given in the Street Railway Journal of Nov. 28, 1903.

The guard rail illustrated is used throughout the entire line.



SECTION SHOWING SERVICE AND GUARD RAIL

The track rails are laid in sections, 12 m (39.5 ft.) long, and weigh 41 kg per meter (82 lbs. per yard). They are inclined as in the usual German construction, and mounted on a base plate screwed to the ties.

The dimensions shown on the cut are in millimeters. The following table gives approximately the principal dimensions of both rails in inches:

	Guard Rail	Running Rail
Width of base	4.15	4.35
Width of head	2.29	2.84
Height of rail	....	5.45

Other dimensions are: Width of wheel tread, 3.95 ins.; width of flange at throat, 1.48 ins.; clearance between guard rail and wheel, .5 ins.

SINGLE-PHASE CAR EQUIPMENT AT EAST PITTSBURG

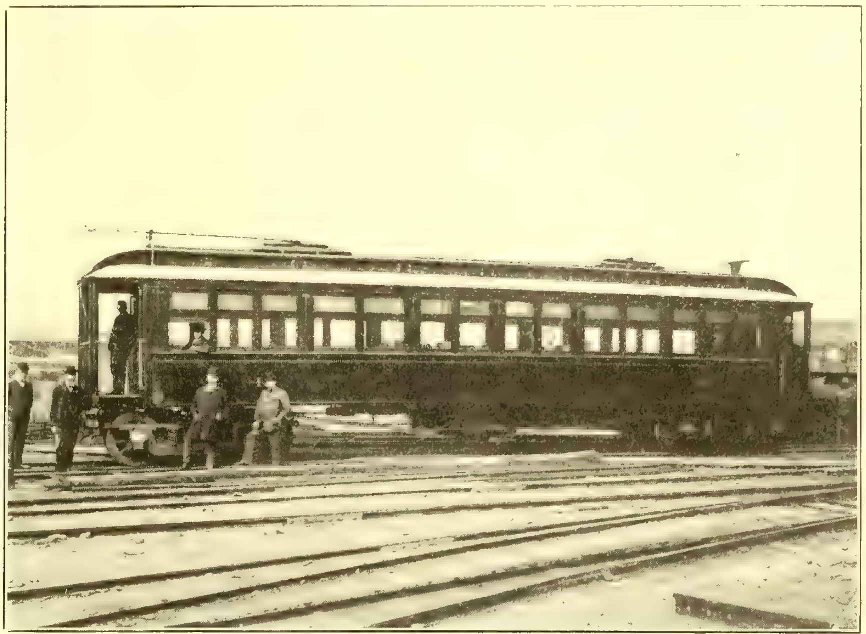
The accompanying engravings illustrate the truck and car now in operation on the Interworks Railway of the Westinghouse Electric & Manufacturing Company, at East Pittsburg, Pa., and equipped with the company's new single-phase series-wound motors. Starts are made easily and without jar, acceleration is rapid and smooth (a rate of 1¼ m. p. h. per second and over may be easily obtained), and a high rate of speed may be secured.

The electrical equipment of the car consists of four single-phase series wound motors of the commutator type, mounted two to a truck, and the following auxiliary apparatus:

Two master controllers.
One main-auto transformer.
One lighting transformer.
One balancing transformer.
One induction regulator.
One main switch.
One reversing switch.
One motor cut-out switch.
One circuit breaker.
Two resistance grids.
Three junction boxes.
Four 7-point connectors.
One 7-point connection jumper.
One storage battery, 14 cells.
One motor-driven air compressor.
Complete air-brake equipment.

The motors are of the iron-clad type, with circular frames, and in general appearance resemble the ordinary direct-current motors. The mechanical details follow existing standard practice. They are mounted on the axle with a modified "nose" suspension, and single-reduction gears, encased and run in oil, connect the armature shafts and axles. The supports for the armature bearings are cast solid with the motor end brackets, and the upper caps of the axle bearings are cast solid with the motor frames. All bearings are babbit lined, and possess large wearing surfaces. The axle bearings are divided. The motors are wound for a potential of 225 volts, and have a nominal rating of 125 hp each.

The four motors are connected in pairs, each pair consisting of two fields in series and two armatures in series, as shown diagramatically herewith. A balancing transformer is connected across the two pairs of armatures, and the point of connection of the armatures of each pair is joined to the middle point of the transformer winding. This arrangement serves to equalize the voltage on the armatures.



SINGLE-PHASE MOTOR CAR—EAST PITTSBURG

A master controller on each platform controls all the operating switches, and may be used to operate either a single car, or a train made up of a number of cars, similarly equipped. Its working parts consist of a metal drum made in one casting, with contact points spaced to give the proper combinations, with stationary contact fingers supported on the controller frame. As only a low-potential current from the storage battery is handled, there is practically no burning or other trouble with contacts, but the fingers are removable and easily replaced.

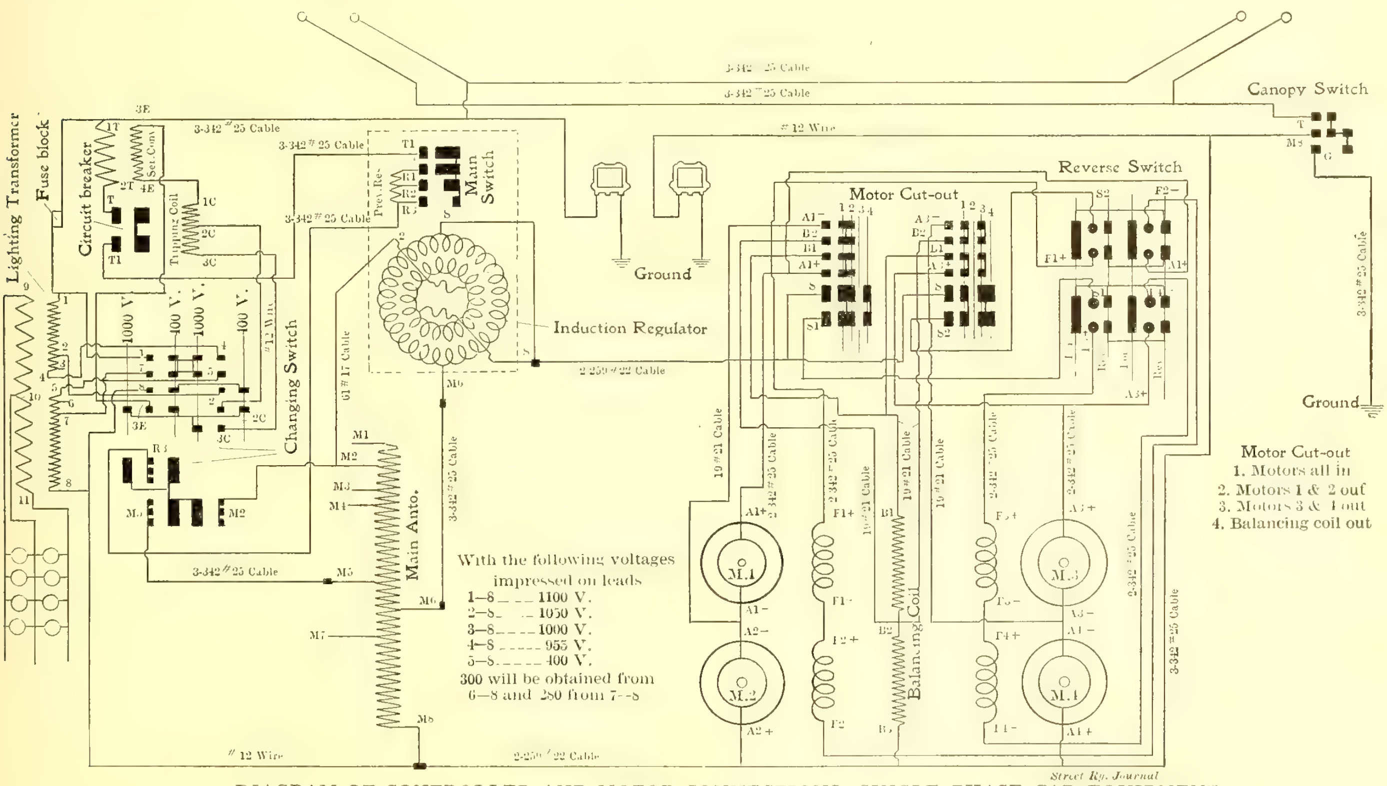
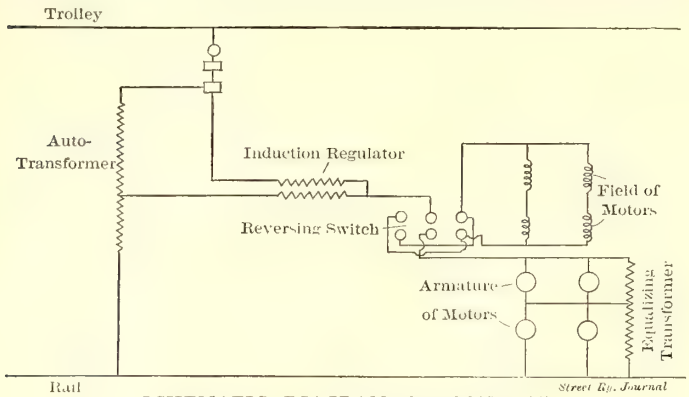


DIAGRAM OF CONTROLLER AND MOTOR CONNECTIONS, SINGLE PHASE CAR EQUIPMENT

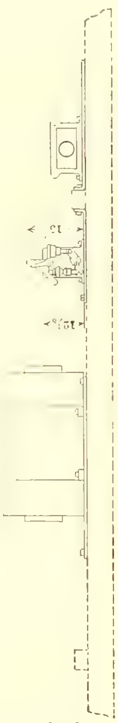
The main auto-transformer and lighting and balancing transformers are of the shell type, with laminated cores outside the



SCHEMATIC DIAGRAM OF CONTROL

coils. Their construction follows the lines of standard Westinghouse practice.

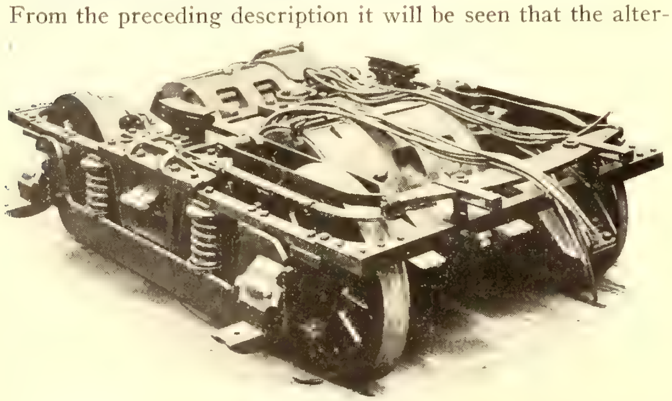
The induction regulator is of the usual type, and consists of two coils, shown diagramatically on page 141, one fixed the other movable about its axis, and voltage variation is obtained by change of the relative angular position of these coils. The regulator is wound for a secondary potential of approximately 100 volts. This may be either added to or subtracted from the secondary voltage of the auto-transformer, giving at the motor terminals a range of approximately from 200 volts to 400 volts. The regulator is operated by a pneumatic mechanism controlled by magnet valves. These magnet valves are actuated by low potential currents from the storage battery, and governed by the master controller.



All switches are of the drum type. The main and reversing switches are operated pneumatically, and controlled by magnet valves similar to those used with the induction regulator. The motor cut-out switch is operated by hand.

The air compressor is of a type standard for air-brake equipment, and is driven by an alternating-current series wound motor, similar in design and construction to those mounted on the trucks. From this compressor air is supplied both for the brakes and the operation of all pneumatic switches, including those of the induction regulator.

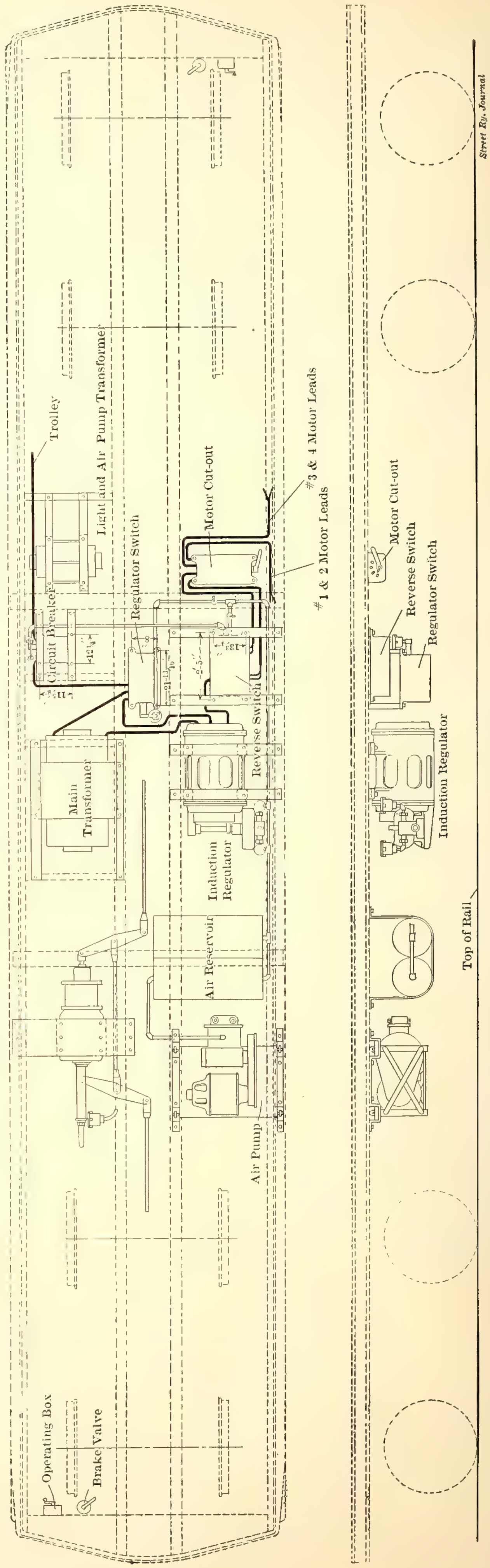
From the preceding description it will be seen that the alter-



MOTOR TRUCK

nating-current system is well adapted for multiple-train control. As the controlling mechanism is operated by current from a storage battery, it is only necessary to carry a low-voltage circuit from car to car. This is conveniently accomplished by the use of seven-point connector plugs and sockets.

By the simple device of bringing out a few loops from the secondary of the main transformer it also is practical to oper-



PLAN AND ELEVATIONS OF CONTROLLING APPARATUS ON CAR

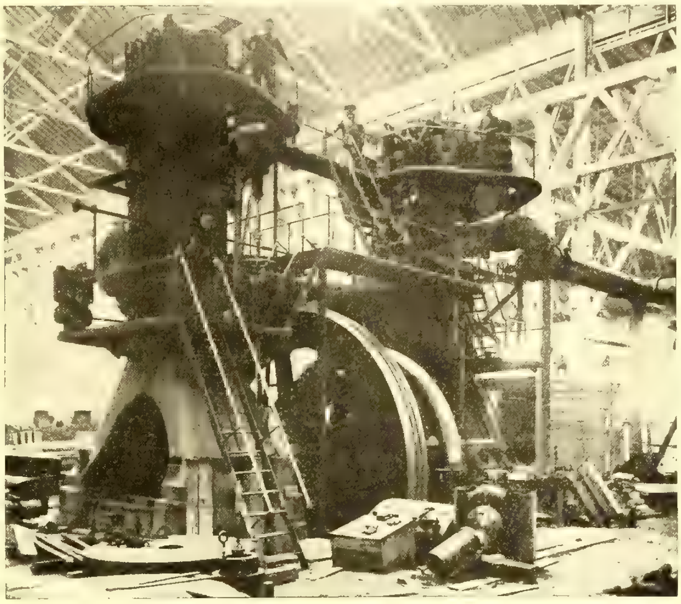
ate the same car from different trolley potentials without change in equipment. For example, an interurban line may use a trolley potential of 1000 volts or over through its country sections, and 500 volts, or even lower, within city limits. With either voltage on the trolley the same voltage will be always possible at the motor terminals. A similar arrangement will permit a high motor voltage and high speed through scarcely settled districts, and a low motor potential and reduced speed, economically obtained, in crowded city streets.

Alternating-current railway motors are now manufactured by the Westinghouse Company in several sizes. Detailed descriptions of the mechanical construction of the No. 91 motor, which is the one now in use on the car at East Pittsburg, will be published in an early issue.

THE SERVICE POWER PLANT AT THE ST. LOUIS EXPOSITION

In the accompanying engravings several views are given of the Palace of Machinery at the Louisiana Purchase Exposition at St. Louis, showing the present condition of the work. As is generally known, street railway apparatus at the St. Louis Exposition will form part of three main exhibits, being divided between the Transportation Building, Palace of Electricity and Palace of Machinery. The first mentioned will contain those exhibits pertaining to maintenance of way and rolling stock; in other words, the mechanical side of the system outside of the power station equipment. In the Electricity Building the student of the electric railway problem will find those appliances which relate to the electrical side of his subject. That is, in this building the electric railway will be treated from the generators through the transmission system, the transforming device, the sub-station and the storage battery, through the motors to the car axle. In the Machinery Building, or the Palace of Machinery, as it is called in the official documents, with the adjoining Steam and Fuels Building, will be grouped the power apparatus, such as the boilers, condensers, steam fittings, engines, steam turbines, etc.

Although a large amount of power for the use of the Louisiana Purchase Exposition will be derived from exhibition in the Machinery Building, with boilers located in the Steam and Fuels Building near by, it was decided by the authorities that it would be best to erect under contract a service power plant for the use of the Exposition which would be more directly under the control of the Department of Works than exhibit apparatus could be. Such a plant is needed for the service of the Exposition, and it is essential that it should be completed and in operation before the Exposition opened without any of the uncertainties attending the completion of exhibits. It was finally decided to award the contract for such a plant, with a capacity of 8000 kw, to the Westinghouse Electric & Manufacturing Company. This contract covers the entire power plant equipment with the exception of the buildings and stacks. The engines and generators will be placed in Machinery Hall in a space set aside for the service plant. The boilers will be located in the Steam and Fuels Building, 100 ft. distant, which is the building in which all boilers and gas producing apparatus will be placed.

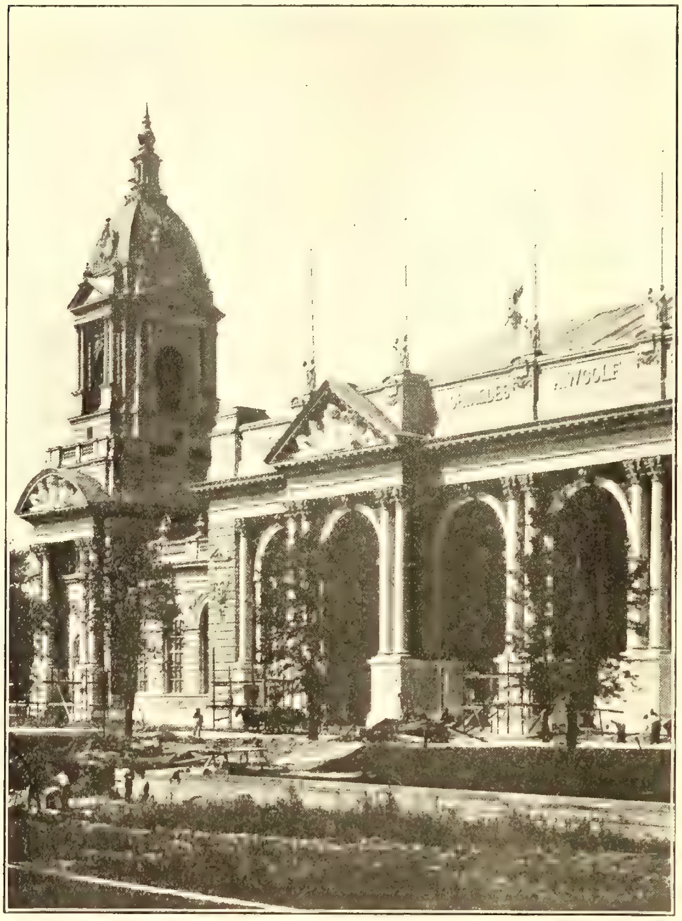


ONE OF THE 2000-KW UNITS IN THE SERVICE POWER PLANT

PALACE OF MACHINERY, ST. LOUIS EXPOSITION

Although this is a service plant in name, it will, of course, be an interesting exhibit. While there will be nothing radically new in its essential elements, it will represent good modern power house engineering practice. The reasons urged for the award of this contract to the Westinghouse Electric and Manufacturing Company were that, on account of the many allied

Westinghouse interests, it would be possible for this company to handle a large part of the contract without going outside of the Westinghouse companies, and chances for coherent design and prompt completion were better than if the contract were

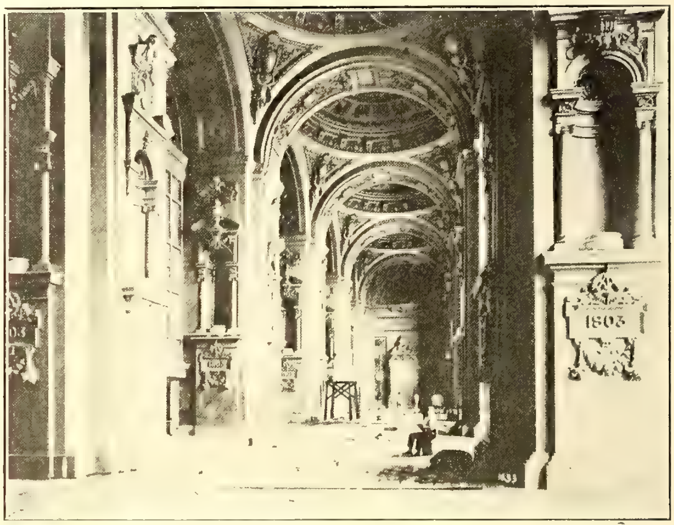


SOUTHEAST ENTRANCE, PALACE OF MACHINERY

awarded to several companies. Thus, the steam engines will be furnished by the Westinghouse Machine Company, and the engineering and construction of the plant will be done under the supervision of Westinghouse, Church, Kerr & Company. The plant will contain four units of 2000 kw each. These will be 25-cycle, three-phase, 6600-volt generators, direct connected to Westinghouse-Corliss engines. The generators will weigh, without the bed, 132,000 lbs., and with the bed, 190,000 lbs. The efficiency guarantee is 96 per cent at full load, 95 per cent at three-quarters load, and 93 per cent at one-half load. They will operate at continuous full load, with not over 35 degs. C. rise in temperature. The engines will be Westinghouse vertical, cross-compound, condensing Corliss, running 83 r. p. m. They are rated at 2800 hp, and have a maximum overload capacity of 5200 hp, the latter capacity being reached at three-quarters cut-off in the low-pressure cylinder. The cylinder diameters are 38 ins. and 76 ins., with 54-in. stroke. The shaft will be hollow forged steel, 31 ins. in diameter. In addition to the fields of the generators the engines will have a fly-wheel of 175,000 lbs. weight. The total weight of the engine is 750,000 lbs. It is guaranteed to operate on 13½ lbs. of steam per indicated horse-power-hour. Water for condensation will be supplied from a cooling tower having fans driven by electric motors to furnish air circulation.

The boilers in the Steam and Fuels Building which will supply this plant are sixteen in number, of 500 hp each, of the Babcock & Wilcox water-tube type. Smoke flues will be placed under the floor and led to stacks built by the Exposition. In addition to the natural draft fans will be installed to produce artificial draft when needed, in accordance with Westinghouse practice. Roney mechanical stokers will be used under these boilers. That part of the Machinery Building devoted to the service power plant is spanned by a 40-ton traveling crane. Besides the main units, there will be three 80-kw exciter units, any one of which is sufficient for the entire power plant. These units will be direct connected to vertical cross-compound, condensing Westinghouse engines, running 300 r. p. m. The weight of a unit complete is 38,000 lbs.

The switchboard will consist of three exciter panels, four generator panels, two main load panels, two incoming feeder panels and twenty-four outgoing feeder panels. The incoming feeder panels are for the current which is to be purchased by the Exposition from the Union Electric Light & Power Company. The two load panels will pass the entire load; one panel being used for each of the two sets of bus-bars. Solenoid-operated oil switches are to be used for the high-tension alternating current, and these will be controlled in the usual manner by low-tension circuit, with switch handles on the various panels. On each generator panel will be three switches, one controlling an oil switch connecting the generator with one set of bus-bars, the other connecting it with the other set of bus-



MAIN ENTRANCE, NORTH SIDE, PALACE OF MACHINERY

bars, the third being in the generator loads in series with the two just mentioned. The switches will be equipped with time limit release for automatically opening the circuit. Each generator panel will have one power factor indicator and three type-F ammeters. Each feeder panel will have three oil switches, two of which are in multiple for connecting to either set of bus-bars, and the third in series with the other two, or the reverse of the generator switching arrangement. Each feeder panel will have also three type-F ammeters and one integrating wattmeter.

Although not a part of this service plant, another interesting contract which this company is filling for the operation of the Exposition is for the 2000-hp induction motors to be direct connected to Worthington centrificial pumps, to supply the cascades with 90,000 gals. of water per minute. This will be a remarkable installation, not only on account of the size of the induction motors, but on account of the size of the pumps and the high head to which water must be raised, which is approximately 150 ft.

MIRRORS TO ANNOUNCE APPROACHING CARS

Saloonkeepers in Harlem, a suburb of Chicago, have been installing large mirrors, so placed that their patrons can get a reflected view of the street, so as to see the approach of a car. This gives the thirsty race-track followers a chance to spend their money while they wait in the saloon, without running risk of missing a car.

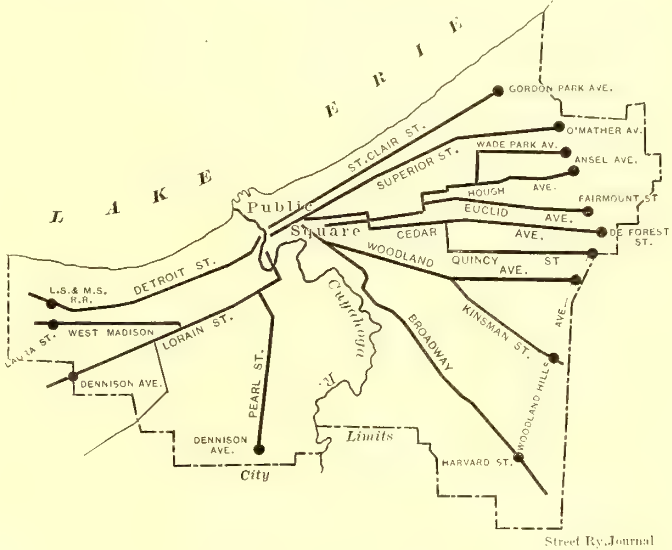
THE ZONE PLAN FOR CLEVELAND

There is every probability that the zone plan of fare will be tested by the Cleveland Electric Railway Company. The efforts of Mayor Tom L. Johnson, of Cleveland, to secure 3-cent fare for the suffering public of that city have, in a measure, proven successful, and the Cleveland Electric Railway Company has agreed to turn over its system for a thorough trying out of the much discussed low fare under the zone plan. The company does not commit itself to adopt the plan should it prove unsatisfactory, but upon the acceptance of the plan, or at least some form of the plan, will depend the granting of a twenty-year franchise to the company by the present Council. A number of concessions will be made to the company which will militate in its favor, and if the calculations made by Mayor Johnson prove correct, the plan may not prove such a bad proposition for the company. Time alone can demonstrate these points.

As outlined in the last issue of Street Railway Journal the Cleveland Council, on Jan. 11, passed three ordinances of vital importance to the future of the Cleveland Electric Railway. Two of them granted rights to the so-called 3-cent fare company over a number of routes now held by the old company; the time of the expiration of the grants held by the old company being a question that is in dispute by reason of conflicting ordinances. The third ordinance mentioned established a zone within which the old company was required to establish a 3-cent fare.

These ordinances, of course, forced the company to some action, and at a meeting of directors on Jan. 12, it was agreed that a compromise on some form of a zone plan should be effected. President Horace Andrews, of the company, was instructed to carry on negotiations with the city government. The zone proposed by the McKenna ordinance is shown in the accompanying map, the 3-cent limits being indicated by black dots. As will be seen the zone has an irregular boundary, touching in some points the city limits, while in others it is three-quarters of a mile from the limits. President Andrews proposed that the zone limits be made a 3-mile circle from the Public Square, but Mayor Johnson refused to acceed to this change, although he conceded several other points of importance to the company. After a week of conferences a compromise was effected on Jan. 18. It is probable that the McKenna ordinance will be repealed, and that a new ordinance granting the Cleveland Electric Railway Company a twenty-year blanket franchise extension will be passed. The terms of the franchise will be practically the same as those of the McKenna ordinance, so far as rates of fare and zone are concerned, and the company will be given three months in which to test the practicability of the plan from a financial standpoint, while the public will be given an opportunity to withdraw from the agreement if it sees fit. In a word, the agreement amounts to an option so far as the company is concerned, and if it decides to withdraw from the option it stands where it does at the present time, and Mayor Johnson will be free to start new legislation to carry out his hobby of 3-cent fare if he sees fit. However, be it said to Mayor Johnson's credit, he seems to be taking a fair view of the situation, and has repeatedly stated in interviews that if the Cleveland Electric Railway Company demonstrates after a fair trial that the public cannot be given good service with a fair profit under the 3-cent fare zone plan, he will feel convinced that the 3-cenc fare proposition is impractical, and will admit the error of his ways.

The proposition that is up to the company is briefly as follows: All passengers within the zone limits will pay 3 cents for a continuous ride to the center of the city—or, in case the line which they happen to take extends through the city—to the zone limit on the other side of the city, the longest possible ride for 3 cents being about 9 miles. This is under the present arrangement of lines. Since the consolidation the company has coupled up several lines, although not authorized to do so by ordinance, and it is quite possible that it will divide some of these through lines, making them radiate from the center of the city, and in this way the possibilities for 3-cent fare rides will be reduced on these lines. Passengers going beyond the zone limits will be required to pay 5 cents, a 2-cent fare being collected at the zone limits. Passengers boarding a car beyond the zone limits will be required to pay a straight 5-cent fare, and if they desire a transfer will pay 2 cents additional, making 7 cents. A person riding from a point beyond one zone limit to a point beyond another zone limit by means of a transfer will probably be required to pay 9 cents, but this is a point



THREE-CENT FARE LIMITS IN CLEVELAND

which is still under discussion. Mayor Johnson desires to make 7 cents the extreme limit of fare from one point to any other point. Free transfers will be given from any line to cars going to the Union Passenger station.

The chief point conceded to the company is the remittance of all special taxes. This includes the car license of $10 per car, amounting to about $10,000 per year; paving, repaving, bridge maintenance and grade crossing taxes. This last item is a very important one, as the city has started on a campaign for the elimination of all grade crossings, a change that will cost many millions, and the railway company was slated for one-fourth the cost of all crossings on streets used by its tracks, some thirty or more. The maintenance of paving has also been a heavy expense, as the company has been forced to pay for repaving its portion, whether the work was necessitated by the company itself or by the city. It will readily be seen that the elimination of these items will considerably reduce the operating expenses. The Cleveland Electric Railway will acquire all the property and franchises of the Forest City Railway Company, including the 2 miles of track laid on Dennison Avenue, and franchises over several other routes, which could be added to the Cleveland Electric system to good advantage. There would also be the advantage that there would be little or no danger of further competition. It is understood that the price to be paid for the Forest City property is a very reasonable one, which indicates what has been generally believed since the first—that Mayor Johnson was the whole thing in the 3-cent fare company.

Some interesting figures have been compiled regarding the probable earnings of the company under the new scheme. Some one has figured that the average sum received from each passenger will be 3.36 cents. This result was arrived at in the following manner:

Basis of average, 100 passengers.

Eighty-five passengers at 3 cents	$2.55
Twelve passengers at 5 cents	.60
Three passengers at 7 cents	.21
Total	$3.36

Average 3.36 cents for each passenger.

Mayor Johnson, however, arrives at this conclusion in a different manner. He says that in all computations of this nature, based, for instance, on the number of passengers carried free on transfers, a transferred passenger is considered as entirely distinct from the paying passengers. Viewed in this light the twelve 5-cent passengers and three 7-cent passengers would have to be counted twice, as they represent the transferring passenger. On the second count, each of these fifteen would be counted as paying a 2-cent fare. The table would then be as follows:

Eighty-five passengers at 3 cents	$2.55
Twelve passengers at 3 cents	.36
Three passengers at 5 cents	.15
Fifteen passengers at 2 cents	.30
Total	$3.36

Average 2.9 cents for each passenger.

This is figured on a basis that each of the 5-cent and 7-cent passengers are transferring passengers, as is necessarily true of the 7-cent class. Of the 5-cent class a small portion will not be transferring passengers, but passengers from outside the 3-cent zone. This raises the average somewhat above the 2.9 cents, and according to the computations by the Mayor the average fare will be 3.07 cents.

Mayor Johnson claims that the Detroit rate at present is 4.01 cents and that the present rate in Cleveland is 4.32 cents. This last figure is probably not correct, because it is a well-known fact that the system of six tickets for a quarter and universal transfers, inaugurated by the company last June, has been a most complete failure, so much so that it has been generally understood that the company proposed to go back to the old plan of eleven tickets for 50 cents and limited transfers. It was thought when the new system was inaugurated that the lower fare would increase traffic, one of Tom Johnson's pet arguments, but the results do not bear out this statement. The number of transfers issued since the universal system went into effect has been 70 per cent greater than those issued before the system went into effect; in other words, 25 per cent of the passengers formerly asked for transfers, while at present 38 per cent to 40 per cent use them. This condition has been improved somewhat by the rule requiring passengers to ask for transfers when they pay their fare, but the condition is still a terrible drain upon the company's receipts. At the time of the consolidation of the two systems the earnings of the combined properties had been increasing at the rate of $40,000 per month, or at the rate of $480,000 per year. Since July 1 the receipts of the company have shown a gain of only $10,612 for the entire six months. As the latter half of the year is always the better half in Cleveland, the next six months would show a large loss in gross earnings, indicating that the concessions granted last July are costing the company at least $480,000 a year on a very conservative basis.

Even with the old rate of fare of eleven tickets for 50 cents and limited transfers, the proposition in Cleveland has not been as attractive as in many other large cities, because of the large area of the city and the surrounding suburban towns that have been given the same rate of fare as the city, thus making possible extremely long rides; in some cases a continuous ride of nearly 20 cents is possible for one fare. Some of these long runs, passing through sparsely settled districts, have been a decided loss to the company, and on these runs the zone plan will work greatly to the advantage of the company.

Of course, the chief anxiety of the company is to have its franchises extended. The continued attacks of the city government on existing franchises, and the possibility of the opening of rival lines have been extremely harrowing to the company, and have had a tendency to force the value of its securities down to a point considerably lower than would prevail were conditions otherwise. In the face of these attacks the company has made constant renewals of equipment, and has maintained its service at a very good standard, in addition to voluntarily reducing its fare and giving almost unlimited transfer privileges. In view of these facts it is quite natural that the company should be dissatisfied with its position and willing to grasp this opportunity of securing franchise extensions and a settlement of many annoying conditions. Whether the change will be a jump "from the frying-pan into the fire" is a question.

There is one phase to the present situation to which Mayor Johnson does not seem to have given due consideration. That is, public opinion. While there are undoubtedly many of the working class that will be benefited by and will be in favor of 3-cent fare inside the zone, it is undoubtedly the opinion of the majority of well informed and thoughtful persons that the advantages to be derived from the zone plan will not compensate for the disadvantages of handling pennies, the disputes arising from the confusion of several varieties of fares, and the increased cost for those who desire to ride from one portion of the city to another and make transfers.

The other day an old colored man stopped President Andrews on the street and said:

"Mistah Andrews, I hopes you ain't goin' give that 3-cent fare they're tellin' about in the papahs?"

"Why not?" said Mr. Andrews, "you live inside the zone, don't you? If we make a 3-cent fare you will only have to pay 6 cents a day to go to and from work."

"Dat's all right, boss," was the reply, "but I'se got seben chillen, and ebery Sunday I takes 'em out to de pawk to hear de band concert, an' if you goes an' makes me pay 7 cents apiece for each of 'em each way, I reckon dey will have to stay at home."

The public has been doing a lot of figuring during the past week, and they reach about the same conclusions as the old colored man. The writer has put the question to several hundred people during the past few days, and he has yet to find one who can find much merit in the proposed change. It would result in the crowding of the city inside the zone district to the detriment of the property outside. The thousands of poor people who have built homes in the outlying districts, in order to secure ample yards and fresh air for themselves and children, will be forced to pay a premium for the luxury.

Already the suburban towns are up in arms at what they claim is an unjust attack by the city government. Several of the surrounding towns that have granted franchises to the city company have clauses that provide that the rate of fare shall be the same as it is in the city. The mayors of these towns state they will make a fight for any reduction given the city people. The company admits that it is likely to have trouble on this point, but it is believed that no court would compel the company to grant a concession to people at a distance from the city simply because a concession had been granted persons who require but a short haul.

Altogether the situation in Cleveland is a most interesting one, and one that will be carefully followed by traction people all over the country. So far as the STREET RAILWAY JOURNAL is concerned, we are inclined to believe that the rate of fare and the limits of the zone have been fixed at points that will result in too much of a loss in gross earnings to make it practical. The facts in the case, however, can only be reached by the trial which the Cleveland company has the courage to undertake.

The Georgia Railway & Electric Company has installed thermometers in its cars to prove to passengers that the cars are heated to the proper temperature.

CAR HOUSE DESTROYED BY FIRE IN BROOKLYN

The car house of the Coney Island & Brooklyn Railway Company, at De Kalb, Myrtle and Central Avenues and Stockholm Street, Brooklyn, was completely destroyed by fire Friday morning, Jan. 15. The building which was destroyed was one of the largest used for that purpose in the city, and adjoined one of the power houses of the company. It was 8:30 a. m. when the fire was discovered in an old car on the De Kalb Avenue side of the building. This car was used for storage purposes, and it is not known definitely how the fire originated. The employees made an effort to quench the flames before turning in an alarm, but the fire made headway very rapidly, and soon the entire interior of the structure was in flames. In the meantime alarms had been turned in to the fire department, but the water pressure was low, and while the firemen were prompt in getting streams on the building the water only reached as far as the second story. It soon became evident that the building was doomed, and the firemen immediately turned their attention to saving the power house and nearby dwelling houses. The power house was separated from the car house by a thick brick wall, and it was this that prevented the flames from breaking through. The rapidity with which the fire spread is shown by the fact that in half an hour after it was discovered the roof of the building fell in. This hampered the work of the firemen, as they had to abandon the lines proposed. In order better to combat the flames the firemen ascended to the structure of the elevated railway on Myrtle

RUINS OF DE KALB AVENUE CAR HOUSE

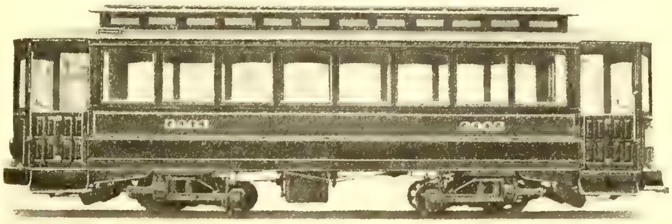
Avenue, and directed streams on the flames from that point.

Fortunately, there were but a few cars in the car house at the time of the fire, for it was during the rush hours, and none of the open cars were stored there permanently. An effort was made to save the few cars that were in the car house at the time of the fire. The accompanying cut shows how the fire overtook the rescuers as they were running the cars out of the car house, and compelled them to abandon the work.

The building was erected in the old horse car days, and at one time the company had its general offices there. A few years ago, however, it was decided to remove the general offices, and an office building was erected at Franklin and De Kalb Avenues. The plan of the company was soon to abandon the old car house, and in order to do so construction was begun several months ago upon a car house at Covert and De Kalb Avenues. This later structure is built strictly in accord with the specifications of the fire underwriters, and it is expected that it will be ready for occupancy in about three months. Patrons of the line were not inconvenienced any by the fire. The loss on the building and material stored therein is estimated at about $200,000.

VESTIBULED CARS FOR INTERNATIONAL TRACTION COMPANY

The accompanying illustration shows one of a lot of fifty cars recently shipped to the International Traction Company, of Buffalo, N. Y., by the G. C. Kuhlman Car Company. This car is built according to the Buffalo standard with monitor deck, concave and convex panels, dropped platforms and vestibules open on both sides, equipped with the Buffalo wooden folding gates. The car is furnished with longitudinal spring seats of



VESTIBULED CAR FOR BUFFALO

rattan. The length of car body is 26 ft., length over vestibules, 35 ft. 5 ins.; length over all, 36 ft. 5 ins., and width over all 8 ft. The interior finish of these cars is in cherry, rubbed to a satin finish and ornamented with highly polished bronze trimmings. The head linings are of plain maple, three-ply veneer dull finished and neatly decorated.

CAR VENTILATION

Several electric roads and steam roads have recently been testing a device for providing fresh air in cars without draft, and at the same time expelling the vitiated air from them. In tests made on the Brooklyn Heights Railroad by the Department of Health, Dr. Walker said that after the cars had been filled with smoke, the ventilators were opened by his orders, and the smoke was entirely replaced with fresh air in 2 minutes and 30 seconds without draft. The Camden & Suburban Electric Railway has been experimenting with the device, and after four months' trial Vice-President and General Manager W. E. Harrington says that "the results obtained have been exceedingly satisfactory and far beyond our expectations. There seems to be an entire absence of drafts, such as is the case usually with ventilating devices in the roof of cars.

The ventilators comprise two airways in the deck sash, and an outside extension of two wings between them. The airways are fitted with louvres that deflect the intake of air toward the roof of the car. The wings intercept the air, eliminating dust, smoke, cinders and moisture. The action of the air in the forward airway produces a partial vacuum behind the wings, providing a strong suction, which draws out the foul air through the rear airway. If the direction of the car changes the action of the ventilator reverses. The airways are fitted with shutters which regulate the intake of air, and can be easily adjusted when there are decided changes in weather conditions. The action of the device does not depend on any moving part, however, and this, it is claimed, makes it much more reliable in operation.

In steam and interurban cars where smoking compartments are a feature of the service, the air can be entirely changed and without draft in 1 minute. This was demonstrated in tests made on the New York Central and the Central Railroad of New Jersey. So satisfactory have been the tests on the latter road that it has formally adopted this system of ventilation, making it standard for its entire service. In a letter of endorsement to the Automatic Car Ventilator Company, which manufactures this device, the Jersey Central official says: "We have definitely determined to adopt this device for our passenger equipment and for future equipment which we may expect to purchase."

AUTOMATIC CAR SWITCH

The accompanying illustrations are taken from photographs of a new automatic car switch, invented by W. K. Smith, of Denver, Col., and handled by the American Automatic Switch Company, of Pueblo, Col. This switch has been in practical operation for some time on the lines of the Pueblo & Suburban Traction & Lighting Company, where it has been giving ex-

FIG. 1.—COMPLETE TRACK DEVICE

cellent satisfaction in spite of snow and ice and the mud, dirt and gravel so abundant in Pueblo on account of the unpaved condition of its streets.

Practical railway men will readily understand the principle involved in this switch, namely, that when a car runs toward the butt end of a switch the flange of the car wheel in running through the switch forces the point over. Fig. 1 shows the complete track device, made with a water-tight box enclos-

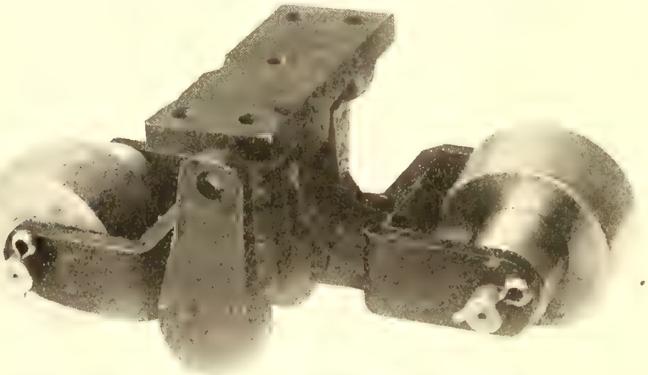


FIG. 2. OPERATING ARRANGEMENT BENEATH CAR

ing the rod connected to the switch point. The base plate and box are made in one casting. The only place where freezing is possible is between the two planed surfaces on the bottom of the sliding plate and the top of the base plate. The effect of freezing at this point would be the formation of a thin frost coating, which could be easily broken loose by the small operating wheels used in connection with this device.

The rod connection carries two springs between rigid lugs.

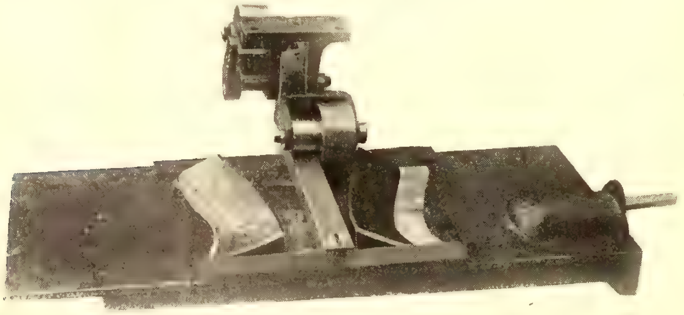


FIG. 3.—OPERATING WHEEL THROWING SWITCH

These springs are stiff enough to throw the switch point without compressing the springs. The flanges on the operating wheels are 2½ ins. wide, and will throw a switch point of that or less width of throw. If the 2½-in. wheels are run through a 1½-in. switch point, the point is thrown 1½ ins., and the spring compresses 1 in. The same spring prevents breakage if the point happens to be clogged.

Fig. 2 shows the operating device—two small wheels with flanges on the opposite ends, hung in a frame under the front of the truck. By throwing either one or the other of these wheels down on the center rail, as shown in Fig. 3, the car is sent to the right or left, as the case may be. When in an inoperative position these wheels hang about 4 ins. above the ground. In attaching to a standard Brill truck the frame is bolted to the angle-bar forming the front of the truck, and even where the motor is carried by the front axle of the car

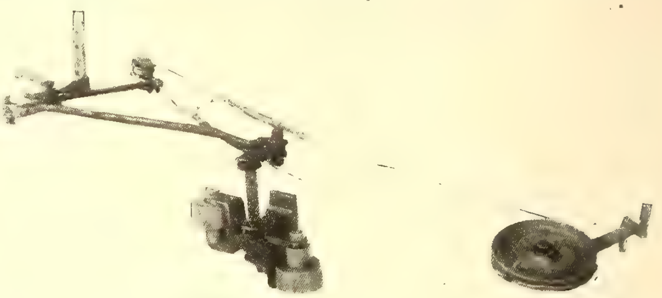


FIG 4.—SHOWING METHOD FOR ATTACHING TO CAR TRUCK.

the wheels have sufficient room to tip without striking the motor casing, and they hang directly behind the snow-plow.

Fig. 4 shows the method used in attaching the device to a Brill truck. The hanger, brace and sheave pulley, behind, are attached to the bolts already in use on the trucks, and it is only

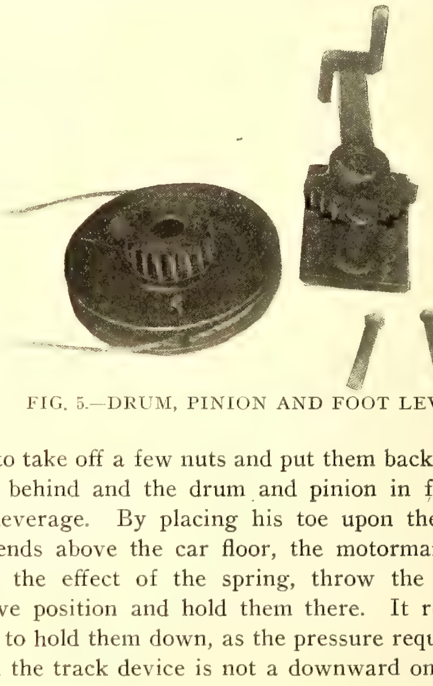


FIG. 5.—DRUM, PINION AND FOOT LEVER

necessary to take off a few nuts and put them back again. The long lever behind and the drum and pinion in front, give a powerful leverage. By placing his toe upon the foot lever, which extends above the car floor, the motorman can easily counteract the effect of the spring, throw the wheels into an operative position and hold them there. It requires very little force to hold them down, as the pressure required to shift the ribs on the track device is not a downward one, but is exerted by the side of the wheels pressing against the center rail and the ribs.

A coil spring is carried between the jaws of the hanger, with its lower end resting and bearing on the tipping frame carrying the wheels. This spring throws the wheels back into an inoperative position after they are used.

The drum, pinion and foot lever (Fig. 5) are fastened by their hanger with two bolts through the sill, under the car vestibule, bringing the foot lever just to the right of the motorman's foot. The top of the lever is formed into two treadles, extending to the right and left. If the car is to take the right-hand switch the motorman presses the right lever, or if to the left the left lever.

NEW CARS FOR CHICAGO UNION TRACTION COMPANY

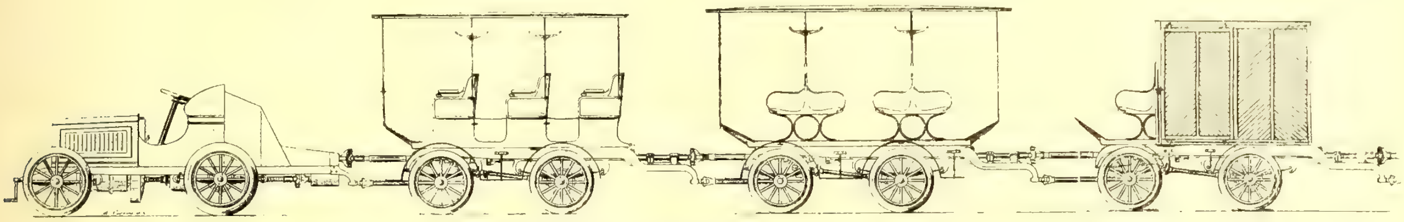
The Chicago Union Traction Company has received five new double-truck Brill semi-convertible cars, which will be put in service on North Side lines.

The 100 semi-convertible cars ordered from the St. Louis Car Company are also well along. They are the first of that type to be ordered by the Union Traction Company.

AUTOMOBILE TRAIN IN PARIS

A great deal of attention has been attracted in Paris to a system of automobile trains, invented by the well-known Colonel Renard, who was the first pioneer of modern aeronautic experiments in France. An experimental train of this kind was tried for the first time in Paris on Dec. 24. The invention was designed to overcome the necessity of having a very heavy traction engine, heretofore found requisite in automobile train operation. These trains have been tried on the splendid highways of France, but have been found so destructive to the roadways that their use has been forbidden by the authorities.

Colonel Renard's invention consists in composing the trains of motor cars having their own driving-wheels, but not their own power. This is done by placing a powerful motor in the leading car, and transmitting its power by means of flexible couplings the entire length of the train, to one axle of each car, generally the rear axle, as is usual in automobile work.

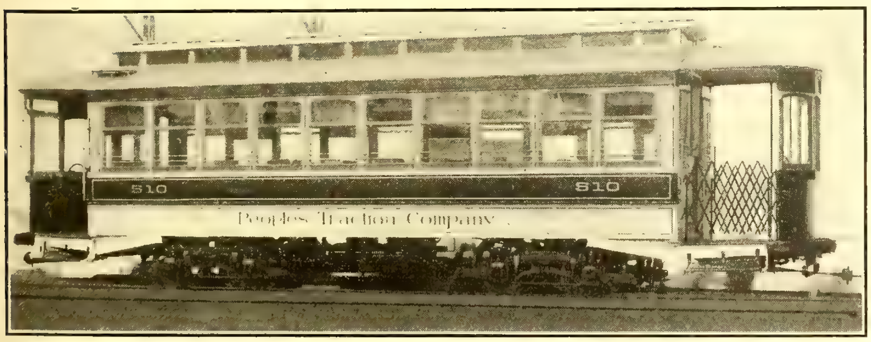


CASOLINE AUTOMOBILE TRAIN IN PARIS

To make the rear cars track properly, an important feature in street operation, each car is equipped with a lengthened end frame, which is coupled to a corresponding shaft connected to the front axle, and by properly proportioning these extensions the desired result is secured.

SEMI-CONVERTIBLE CARS FOR PEOPLE'S TRACTION COMPANY, NEW JERSEY

The J. G. Brill Company has lately furnished three of its semi-convertible cars to the Inter-State Construction Company, of Philadelphia, for use on a new section of its extensive system, nearly completed, between Burlington and Mt. Holly, N. J. Burlington is an important manufacturing city on the Delaware River, about 25 miles northeast of Philadelphia, and Mt. Holly is directly to the south of Burlington. Both cities are on divisions of the Pennsylvania Railroad, and the line will be of great convenience to travelers wishing to go to and from cities on one division or the other without the necessity of going to Philadelphia. The cars are similar in general dimensions and in some particulars to a lot of cars built last year for the Burlington County Traction Company, which is under the same management; the differences being that these cars had smoking compartments and the Philadelphia Rapid Transit Company's style of windows, that is, composed of single sash and removable. The windows of the new cars are raised into roof pockets when not in use.



SEMI-CONVERTIBLE CAR FOR PEOPLE'S TRACTION COMPANY

The length of the cars over end panels is 28 ft., and over crown pieces 38 ft.; from panels over crown pieces, 5 ft.; width over sills, 7 ft. 10½ ins., and over posts at belt, 8 ft. 2 ins.; sweep of posts, 1¾ ins.; from rail over roof, 12 ft.; from center to center of side posts, 2 ft. 8 ins. The corner posts are 3¾ ins. thick, and the side posts, 3¼ ins. Long-leaf yellow pine side sills are 4 ins. x 7¾ ins., having sill plates on the inside, 12 ins. x ⅜ ins. The end sills are 5¼ ins. x 6⅞ ins. The interiors of the cars are finished in ash with decorated birch ceilings. The seats are 36 ins. long and have walk-over backs. One of the features of this type of car is its extra interior width, obtained by not having wall window pockets. Thus, with a width over all of 8 ft. 2 ins. and 36-in. seats, the aisles are 22 ins. wide. The platform timbers are reinforced with angle-iron and capped with angle-iron bumpers. The platform steps are 15⅛ ins. from the rail to the tread of the step, 13 ins. from the step tread to the platform, and 9 ins. from the platform to the car floor. Among other of the builder's specialties are folding gates, portable vestibules, radial draw-bars, Dedenda gongs and Dumpit sand-boxes. Three-bar window guards extend from corner post to corner post for protection to the passengers' arms, as the window sills on this type of car are extra low. The trucks are the Brill No. 27-G, having 4-ft. wheel base, 33-in. wheels and 4-in. axles. They are equipped with 35-hp motors.

FINANCIERS TAKE TRIP THROUGH NEW YORK SUBWAY

On Jan. 19 a party of well-known financiers took a hand-car trip through the New York subway. The cars were started from the City Hall station some time after 2 o'clock, under about 150 ft. headway. The first car, in charge of August Belmont, contained Jacob H. Schiff, J. W. Alexander, Robert Bacon, A. J. Cassatt, Frederic Cromwell and James H. Hyde.

The second car, in charge of John B. McDonald, carried Valentine P. Snyder, president of the Bank of Commerce; George J. Gould, James Henry Smith, Cornelius Vanderbilt, John D. Rockefeller, Jr., and Alfred Skitt.

On the third car, in charge of Perry Belmont, were Robert H. McCurdy, Charles M. Jacobs, Andrew Freedman, Clarence H. Mackay, James Speyer, William Barclay Parsons, the subway engineer, and George Wickersham.

The fourth-car passengers were George W. Young, DeLancey Nicoll, Elliott Gregory, John F. O'Rourke, Samuel Rea and F. S. Curtis.

The subway was a pleasant relief from the zero weather above ground, the air seeming several degrees warmer. The way was well lighted with gas and electricity, and those who had been on the previous trip called attention to the progress that had been made since Mayor McClellan's trip on New Year's Day.

The Brooklyn Rapid Transit Company has closed a contract with the Peckham Manufacturing Company for 400 maximum traction center-bearing trucks of special design.

FINANCIAL INTELLIGENCE

WALL STREET, Jan. 20, 1904.

The Money Market

Last Saturday's bank statement was noteworthy for two things—it showed one of the largest gains in cash holdings ever recorded for a single week, and with another extremely heavy loan expansion it brought the loan item up to within $16,000,000 of the highest level in the history of the Clearing-House. The reasons for the increase in cash are well enough understood; the usual return flow of currency from the interior, which reaches its maximum in the early part of January is now in progress, and besides this the treasury is a considerable debtor on its regular transactions with the New York banks, while gold engaged some time ago, both in Europe and the Orient, has been arriving. These several movements have now added no less than $28,000,000 to the local cash supply during the last fortnight. It is far more important, however, in calculations for the future to consider the rise in the loan account. Within the last three weeks the tremendous sum of $55,000,000 has been added to the outstanding credits of our city institutions, and the serious question is raised whether the money market is not in danger of repeating the experience of previous years when similar enormous borrowings so severely mortgaged the market's resources. There is no doubt that the main cause for the recent loan expansion lies in the requirements of railway and industrial corporations, which for various purposes require new capital at this time. These funds are raised, of course, by issues of new securities. But the money being usually needed for immediate use, while the sale of the securities requires at the very least a considerable period, it is the practice to borrow the sums required in the meantime. It appears from this that the question whether the increase in loans is to be a temporary increase or not is wholly a question of the willingness of the investing public to absorb the new issues offered for sale. Under similar circumstances, both in 1902 and 1903, outside investors resolutely held aloof, and as a natural consequence, the most critical phase of last year's situation developed—the inability of the market under the necessity of curtailing its credits to realize on these corporate borrowings. There is much reason to believe that the investment position has improved sufficiently this season to prevent the recurrence of such a crisis. Nevertheless, the uncertainty suggested by the present loan movement, raises the most important problem ahead of the market. With the rapid accumulation of bank reserves, rates for money have continued to decline, call loans being easily obtained now on the stock exchange at 2 per cent, and time loans at 4 per cent, even for the longer periods.

The Stock Market

The progress of the negotiations between Russia and Japan has continued during the week to occupy the first place in financial attention. Neither at home or abroad, however, have the markets been as much affected by the crisis as they were during the previous fortnight. Europe has ceased to sell our securities, and while prices have not advanced materially, outside of a few selected issues, they stand generally at a higher level than a week ago. The action of the markets confirms the belief which well-informed observers have held all along, that a war in the Far East has already been taken into account in the financial reckoning, and that announcement of the event would not cause much of a shock. Locally the trading has been dull, and confined mostly to professional operators. The Steel securities have been the strongest on the active list, owing to the conviction borne out by all the recent reports that the steel trade has finally turned the corner, and is distinctly on the mend. With the announcement of the long-expected refunding plan and the decision to confine the present issue of bonds to only $15,000,000, the Rock Island securities have recovered sharply and have been the most active features of the railroad department during the last few days. Sharp advances have also occurred among a number of the minor specialties, in which pools are active once more. Elsewhere the market has hardened, but has shown no particular energy. Discerning critics are disposed to take the view that there are other causes which have quite as much, if not more to do with holding the market in check than the foreign war scare; of these the three most important are the decision in the Northern Securities case expected during the next two months, the misgivings as to the credit position occasioned by the recent enlargement of bank loans, and the doubt by no means relieved by the late improvement in the iron trade, as to whether the tendency is still toward a further contraction in general business. Against all this, however, the extremely easy money rates, the excellent railroad earnings, the comparatively low level of stock prices, and the better investment demand as reflected in the more active dealings in the bond market, are influences powerful enough to insure against much of a decline if they do not directly point to a further advance.

In the general revival of market activity during the last few days, the local traction stocks have taken a prominent part. In all instances the operations in this group have been obviously speculative, and plainly due to the manipulation of pools, which for some time past have been active. Speculative sentiment is bullish on the traction stocks first, because of their increasing earnings, and, second, and more particularly, because of the mystery which surrounds the gossip regarding the possibility of some sort of a deal between the properties. The rumor, which has several times done service, to the effect that Brooklyn Rapid Transit is to be taken over on a guaranteed dividend by the Interborough Company, has been brought forward again during the week. This is the basis for the buying of Brooklyn Rapid Transit stock. The rise in Manhattan seems to be mainly the work of professional speculators more or less identified with the inside interests in the company.

Philadelphia

Higher prices have been recorded in most of the active Philadelphia specialties during the week. The two most active issues have been Philadelphia Electric and Union Traction. The former sold up from 6⅛ to 6 9-16, but fell back to 6⅜; the latter rose to 47, which is the highest figure in some time. To-day the call for the assessment on Philadelphia Rapid Transit falls due. The stock has been dealt in at 8¼ up to 9, and at 13½ for the shares with the full $15 paid in. In Philadelphia Company issues no further efforts have been made to renew operations for the rise. An unpleasant report has circulated that the company is "squeezing" its earnings for stock market effect and while this has a strong suggestion of a speculator's canard, it nevertheless has served to check the advance in the shares. The common fell from 40¾ to 39¾, and then rallied to 41; the preferred has changed hands at 45. Other transactions for the week comprise Chicago Union Traction common at 6⅞, Railways General at 2, American Railways from 44 down to 43¼. City Passenger "ex" dividend at 196¼, Consolidated of New Jersey at 64, and Fairmount Park Transportation, which rose on purchases of a few hundred shares from 19 to 20½.

Chicago

The reduction of the dividend on North Chicago stock has been followed by a further decline in the price to a new low record of 75. Offerings, even at this figure, have failed to attract buyers. Union Traction shares were depressed by this dividend cut, the common selling down to 5, and the preferred to 29½. But later both stocks rallied, the common to 5¾, and the preferred to 32¾. A favorable decision is now expected in the ninety-nine-year franchise case, which will come up for hearing, either in the latter part of February, or early in March. If this is the outcome, the Union Traction management will lose no time in proceeding with their comprehensive plans for improving the property. The City Railway has offered to the city in return for a renewal of its franchise privileges, 5 per cent of its annual gross receipts, and a bonus besides—the whole payment being calculated at $800,000 per year. If this offer is accepted it will make the company liable for no other public charges than the tax on its tangible property. West Chicago stock has sold in odd lots between 47 and 46. South Side has changed hands between 92½ and 92. Metropolitan common made a new low record during the week, selling down from 17½ to 16½. Northwestern preferred also made a new low price at 47. Northwestern common sold from 16 to 16½, Metropolitan preferred from 51 to 52, and Lake Street receipts from 2 to 2⅜, and back to 2⅛.

Other Traction Securities

What appears to be a strong speculative movement has developed in the Massachusetts Electric issues during the week. No news has accompanied the buying, which is evidently based on the simple conviction that these stocks are a good speculation at present prices. The common advanced from 21 to 23½, and the preferred from 76½ to 79½. Other Boston securities have been in-

active. Elevated sold between 140 and 140½, West End common sold between 90½ and 90, and the preferred at 109. In Baltimore the United Railways stocks and bonds are unchanged on the week. The common stock has sold at 8¼, the income bonds at 56¼ to 56, and the general 4s from 91½ to 91, with quite heavy trading at the lower figure. Other sales include Atlanta Consolidated 5s at 103 to 103½, Baltimore Traction 5s at 113, Baltimore Traction convertible 5s at 101¼, City and Suburban (Baltimore) 5s at 112¼, Norfolk Street Railway 5s at 105½, Knoxville Traction 5s at 101, Lake Roland Street Railway 5s at 119, Pittsburgh Traction 5s at 110⅜ and Anacostia & Potomac 5s from 92½ to 93. The feature of the New York curb dealings has been the extremely rapid rise in Interborough Rapid Transit, which, starting at 93 reached 106½ yesterday. Reports of a general "traction deal," in which the company is to take the central part, are the explanation for this advance. About 3500 shares of the stock have been dealt in in the course of the movement. Other traction sales on the local curb comprise Brooklyn Rapid Transit 4s from 77½ to 76½, one hundred shares of New Orleans common at 9⅝, St. Louis Transit (500 shares) from 11¾ to 12½, United Railways of St. Louis preferred (200 shares) at 52, Washington Traction common at 12⅞ to 13⅛, the preferred from 47 to 47½, and the 4 per cent bonds from 75¼ to 85⅝. North American stock has had a further sharp advance on the Stock Exchange, which is ascribed mainly to the benefits which the company will enjoy from its contract to light the St. Louis Exposition grounds and buildings.

Traction bonds were active in Cincinnati last week. Cincinnati. Dayton & Toledo 5s sold to the extent of $17,000 worth at 81 and 81½. Northern Ohio Traction consolidated 5s brought par and then sagged to 96½ on sales aggregating $10,000. Cincinnati Newport & Covington second 5s brought 106½. The preferred stock of this company ranged from 82 to 83½, while the common brought 30. A few sales were made in Cincinnati Street Railway with a range of from 133 to 134½, the latter a high mark for several months. Detroit United brought 68½ and then sagged to 66.

At Columbus the Columbus Railway & Light was quite active, with a range of from 34⅛ to 35. The Columbus Railway common was in good demand at 85¼, while the preferred brought 104. Rochester Street Railway common was active, and several hundred shares sold at a range of from 75½ to 80¾, the latter the close.

At Cleveland the indications that the Cleveland Electric might secure a twenty-year franchise under the terms proposed by Mayor Johnson, caused a sharp advance in that stock. Sales totaled 873 shares, all in small lots, opening at 68⅛, advancing to 77¾ and then declining to 74½ on news that the terms of the proposed franchise extension might not prove so favorable as had been anticipated. Miami & Erie Canal was quite active and advanced from 6 to 11½, the high figure, however, was under the buyer's privilege for ninety days on the delivery. Northern Ohio Traction advanced to 14½, and very little is being offered at anywhere near this figure. Northern Texas Traction sold at 32. A lot of Northern Ohio Traction & Light 4s sold at 56, and are in strong demand at this figure. Cincinnati, Dayton & Toledo 5s sold at 78½, several points lower than they have been selling for in Cincinnati.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid Jan. 12	Jan. 19
American Railways	a44	43
Aurora, Elgin & Chicago (preferred)	a55	a55
Boston Elevated	140	140
Brooklyn Rapid Transit	49⅛	50
Chicago City	160	160
Chicago Union Traction (common)	6	5½
Chicago Union Traction (preferred)	30⅝	31¾
Cleveland Electric	66½	74
Consolidated Traction of New Jersey	a65¼	63
Consolidated Traction of New Jersey 5s	105½	105½
Detroit United	65½	64¾
Elgin, Aurora & Southern	—	a30
Lake Shore Electric (preferred)	a42	a42
Lake Street Elevated	2⅛	2⅛
Manhattan Railway	142	144⅞
Massachusetts Electric Cos. (common)	21¼	23
Massachusetts Electric Cos. (preferred)	76	79
Metropolitan Elevated, Chicago (common)	17	16
Metropolitan Elevated, Chicago (preferred)	51	51
Metropolitan Street	120½	122½
Metropolitan Securities	87	90
New Orleans Railways (common)	9⅝	9⅝
New Orleans Railways (preferred)	29	29½
New Orleans Railways 4½s	79	78
North American	85	87½
Northern Ohio Traction & Light	13¼	14
Philadelphia Company (common)	40	40¾
Philadelphia Rapid Transit	8½	8⅜
Philadelphia Traction	97½	97½
St. Louis Transit (common)	a13⅝	10½
South Side Elevated (Chicago)	91	92
Third Avenue	122	121
Twin City, Minneapolis (common)	89	91
Union Traction (Philadelphia)	46	46¾
United Railways, St. Louis (preferred)	55	52½
West End (common)	89½	90
West End (preferred)	108½	108

a Asked.

Iron and Steel

It is now admitted on all sides that a decided improvement has occurred during the past six weeks in the general iron situation. This improvement consists, on the one hand, of a very heavy decrease in the output of pig iron, which has brought down the monthly furnace capacity from a maximum of 1,550,000 tons last summer, to an estimated total of only 800,000 tons for January. Reserve stocks have ceased to increase, indicating that at length the desired equilibrium has been restored between production and consumption. On the other hand a much better demand has recently been noticed in many of the finished products, the results of which are seen in a slight advance in the wire trade, and a better inquiry for structural material and steel plate. Although the crucial question as to whether prices are low enough to permanently hold consumers, is still uncertain, the market is plainly moving to the advantage of the producing interests. Quotations are as follows: Bessemer pig iron $13.75 to $14, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 13 cents, tin 29¼ cents, lead 4½ cents, and spelter 4 15-16 cents.

BUSINESS IMPROVEMENT IN GERMANY

Frank H. Mason, Consul-General at Berlin, writes in a recent report that the German manufacturing industries are enjoying a gradual recovery from the hard times experienced during the last three years. He attributes part of this returning prosperity to the fact that several of the leading electrical manufacturing companies have secured some important contracts for lighting and power plants, street-railway installations, etc., in foreign countries, notably Mexico and South America. At a recent meeting of representatives from all the electrical manufacturing companies, it was found that they were, almost without exception, running on full time and with orders booked that will keep them occupied for several months to come. Many of these orders have been taken at what in the United States would seem low prices, but the German electrical industry is enormously developed, is equipped with up-to-date machinery, has an abundant supply of cheap, docile, skilled labor, and can turn out electrical machinery, cables, and similar work at minimum cost.

DISTRIBUTION OF PREMIUMS AT BOSTON

The Boston Elevated Railway Company has distributed about $60,000 in gold among its blue uniformed employees who made creditable records in the service of the company during the year just closed. Approximately 4000 men received $15 each. This payment was made in fulfilment of a promise contained in a general order issued January, 1903, when the wages of the greater portion of the car service men were readjusted. The section upon which the present action was based is as follows:

"At the end of the calendar year a payment of $15 will be made to each blue uniformed employee of either surface or elevated lines, including station masters, who has rendered continuous and satisfactory service throughout such calendar year. This will apply to first year men who have been six months or more in such continuous employment prior to the end of the calendar year. It is intended as a reward for meritorious service only."

NEW PENNSYLVANIA INTERURBAN LINE

The Hazleton, Weatherly & Mauch Chunk Railway Company, recently incorporated, and which has been financed by R. E. Loper & Company, of Philadelphia, contemplates the construction of a most important interurban electric railway in Pennsylvania. The line will have its northern terminus at Broad and Wyoming Streets, Hazleton, where it will connect with the Wilkesbarre & Hazleton Railway Company's high-speed electric road, with its frequent train service, which brings Wilkesbarre and Scranton, and, in fact, the whole Wyoming and Lackawanna Valleys in close touch with Hazleton. Also at this terminus connection will be made with the Lehigh Traction Company's system. From Hazleton the line will operate over private rights of way, and nearly parallel with the Lehigh and Susquehanna turnpike, crossing the Delaware, Southern & Susquehanna Railroad under grade, passing within easy reach of Coleraine to the main street of Beaver Meadow, at the easterly end of which, crossing the Beaver Meadow branch of the Lehigh Valley Railroad, with an over grade crossing, continuing down the Beaver Creek Valley to and along Main and Hudsondale Streets in the borough of Weatherly, to the southerly line of said borough; thence by private right of way and maximum grades of 3 per cent to Hudsondale, where the Quakake, Little Quakake and Dark Hollow Creeks, and the Mahanoy branch of the Lehigh Valley Railroad are crossed overhead, with a single embankment, and an arch bridge with a steel span over the railroad, continuing to the summit of Broad Mountain, with a 3 per cent grade; the road will then descend to Nesquehoning with a 3½ and 4 per cent grade to a crossing of the Nesquehoning Creek, Nesquehoning branch of the Central Railroad of New Jersey, and the breaker tracks of the Lehigh Coal & Navigation Company, with three steel spans, entering Main Street, Nesquehoning, to a connection with the Mauch Chunk, Lansford & Tamaqua Electric Railway. This road extends from Mauch Chunk to Lansford, passing through Nesquehoning, Lansford, Summit Hill and Coaldale. At Tamaqua it has a connection with the Pottsville & Tamaqua Electric Railway, and at Mauch Chunk with the Carbon County Electric Railway, with lines to East Mauch Chunk and Lehighton.

The new line will thus connect the Carbon County Electric Railway, and the Mauch Chunk, Lansford & Tamaqua Railway with a contiguous population of 35,000, with the Lehigh Traction Company system, with its contiguous population of 50,000 people. The new line will have a contiguous population from and including Hazleton, Beaver Meadow, Weatherly and Nesquehoning, of 33,000 people.

The road will be 19½ miles in length, and there will be no heavy grades. The work will be done according to the best method of railroad construction, the heaviest and best materials being used, and there will be few or no grade crossings. The electrical equipment will be of the very best. There will be eight cars, capable of maintaining a speed of 25 m. p. h. on the maximum grades. The road will offer a thirty-minute service, requiring six motor cars. The time of the trip will be 1:15.

The completion of this road will form a connecting link of a complete system of electric street railways between Carbondale and Philadelphia, with the exception of about 6 miles between Lehighton and Slatington, which will be built during this year.

STATEMENT OF MILWAUKEE COMPANY FOR TAX PURPOSES

President John I. Beggs, of the Milwaukee Electric Railway & Light Company, has filed with the Controller of Milwaukee a statement of the taxes to be paid on gross receipts by the Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company. The two companies will pay a total of $129,064 taxes, of which the former company will pay $120,657, and the latter $8,407. The Milwaukee Electric Railway & Light Company, under the State law, pays 4 per cent on its gross receipts, and the Milwaukee Light, Heat & Traction Company 2 per cent. The following table shows a comparison of the taxes of the two corporations since 1898, the figures showing that the taxes of the company have more than doubled in six years:

	T. M. E. R. L. Co.	M. L. H. T. Co.	Total
1898	$62,460.01	$1,509.08	$63,969.09
1899	79,087.73	4,650.00	83,737.73
1900	87,654.40	5,836.38	93,490.78
1901	95,540.99	6,426.71	101,967.70
1902	108,259.89	7,023.58	115,283.47
1903	120,657.03	8,407.05	129,064.08

The following is a statement, as required by law, of the gross cash receipts derived from the operation of the railways and electric lighting plants of the Milwaukee Electric Railway & Light Company for the twelve months immediately preceding Dec. 1, 1903, viz:

Gross cash receipts railway system	$2,546,102.80	Tax at 4 %	$101,844.11
Gross cash receipts, lighting system	470,323.02	Tax at 4 %	18,812.92
Total	$3,016,425.82	Tax at 4 %	$120,657.03

Apportioned as follows:

	Railway Actual Mileage	Railway Tax Mileage	Taxes
Milwaukee, city	115.48	346.44	$87,188.74
South Milwaukee	2.74	8.22	2,067.44
Whitefish Bay	3.40	10.20	2,566.47
East Milwaukee	2.94	8.82	2,220.20
Cudahy	3.55	10.65	2,678.50
West Allis	3.36	10.08	2,535.92
Lake, town	7.15	7.15	1,802.64
Wauwatosa, town	2.72	2.72	682.36
Greenfield, town	.39	.39	101.84
Milwaukee, town	.00	.00	0.00
Total	141.73	404.67	$101,844.11

	Lighting Receipts	Lighting Taxes	Total Taxes
Milwaukee, city	$469,714.02	$18,788.56	$105,977.30
South Milwaukee	......	......	2,067.44
Whitefish Bay	2.00	.08	2,566.55
East Milwaukee	......	......	2,220.20
Cudahy	......	......	2,678.50
West Allis	......	......	2,535.92
Lake, town	65.00	2.60	1,805.24
Wauwatosa, town	......	......	682.36
Greenfield, town	......	......	101.84
Milwaukee, town	542.00	21.68	21.68
Total	$470,323.02	$18,812.92	$120,657.03

The following is a statement, as required by law, of the gross cash receipts derived from the operation of the railways and electric lighting plants of the Milwaukee Light, Heat & Traction Company for the twelve months immediately preceding Dec. 1, 1903, viz:

Gross cash receipts, railway system	$350,347.82	Tax at 2%	$7,006.96
Gross cash receipts, lighting system	70,004.44	Tax at 2%	1,400.09
Total	$430,352.26	Tax at 2%	$8,407.05

Apportioned as follows:

	Railway Actual Mileage	Railway Tax Mileage	Taxes
Racine, city	15.33	45.99	$1,849.84
Caledonia, town	7.10	7.10	285.88
Mt. Pleasant, town	3.89	3.89	156.26
Somers, town	5.25	5.25	210.91
New Berlin, town	9.59	9.59	386.03
Waukeshà, town	2.45	2.45	98.80
Waukesha, city	3.76	11.28	4o4.05
Pewaukee, town	5.68	5.68	228.43
Delafield, town	1.61	1.61	64.46
Milwaukee, city	1.27	3.81	153.45
Oak Creek, town	3.85	3.85	154.85
South Milwaukee, city	2.70	8.10	325.82
Greenfield, town	11.58	11.58	465.96
Wauwatosa, town	9.88	9.88	397.30
Wauwatosa, city	4.06	12.18	489.79
Milwaukee, town	.29	.29	11.91
North Milwaukee, village	2.21	6.63	266.97
West Allis	8.34	25.02	1.006.20
Total	98.84	174.18	$7,006.95

	Lighting Receipts	Lighting Taxes	Total Taxes
Racine, city	$54,710.92	$1,094.22	$2,944.06
Caledonia, town	......	......	285.88
Mt. Pleasant, town	1,049.97	21.00	177.26
Somers, town	......	......	210.91
New Berlin	......	......	386.08
Waukesha, town	775.66	15.51	114.31
Waukesha, city	1,161.06	23.22	477.27
Pewaukee, town	......	......	228.43
Delafield, town	......	......	64.46
Milwaukee, city	......	......	153.45
Oak Creek, town	......	......	154.85
South Milwaukee, city	5,471.91	109.44	435.26
Greenfield, town	......	......	465.96
Wauwatosa, town	20.44	.41	397.71
Wauwatosa, city	6,790.48	135.81	625.60
Wilwaukee, town	......	......	11.91
North Milwaukee, village	24.00	.48	267.45
West Allis, village	......	......	1,006.20
Total	$70,004.44	$1,400.09	$8,407.05

REORGANIZATION OF CAR BUILDING COMPANY

The Niles Car Manufacturing Company, of Niles, Ohio, has reorganized with ample additional capital and is now in the market for business. It has recently added a new blacksmith and machine shop, and as all old orders have been completed and shipped, the company is in excellent position to make prompt deliveries. A. W. Schall has been retained as superintendent, and as it was under his supervision that practically all cars so far turned out by this company were built, it can be taken for granted that all future cars will be of the same high-grade as those now in service on the Aurora, Elgin & Chicago Railway; Western Ohio Railway; Rockford, Beloit & Janesville Railroad; Stark Electric Railway; Trenton & New Brunswick Railway; Louisville & Eastern Railroad, etc.

The company recently showed what it could do in the way of quick shipments, by delivering twenty-five double-truck city cars to the Cleveland Electric Railway within twenty-eight days from date of order.

James B. Ludlow has been appointed general sales agent, having resigned his position as secretary of the Ludlow Supply Company of Cleveland, Ohio.

COL. BRYAN TRAVELS ON THE EVANSVILLE-PRINCETON ELECTRIC LINE

Col. William Jennings Bryan, enroute from Indianapolis to Evansville, made the trip from the city of Princeton to Evansville on the new Evansville-Princeton traction road, which has been in operation just a month. It was on January 14 that Col. Bryan made his visit to Evansville, and as there was a demand among the people that they be given the opportunity to see and hear the distinguished Nebraskan, General Manager Sonntag tendered the use of special cars to the Evansville committee, who went to Princeton to meet Col. Bryan. The result was that the distance of 28 miles from Princeton to the Ohio River city was made at easy stages, stops being made wherever and whenever desired, orders having been issued that the "Bryan special" should have right of way.

At the completion of the journey Col. Bryan complimented the manager for the manner in which he had been treated, saying the road was one of the smoothest he had ever traversed, and that the equipment was of the very best. He said that his ride through such a picturesque country, and being given the opportunity to meet so many people under such favorable conditions, was most gratifying to him.

GOVERNOR OF OHIO DISCUSSED ELECTRIC RAILWAYS IN HIS INAUGURAL ADDRESS

In his inaugural address, Myron T. Herrick, the new Governor of Ohio, touched on the subject of electric railways as follows: "The rapid growth of interurban railroads, street railroads and other quasi-public corporations, and the apparent demand for their enlargement in the next few years, render it desirable that they shall be regulated and governed by wise legislation, that will encourage the investment of capital to the extent that it is necessary to meet the demands and requirements of the public; that will insure it protection when invested; that such corporations shall be so regulated that the public shall secure the most efficient service at reasonable cost."

Governor Herrick is interested in several electric railways in Ohio, and the above views are indicative as to how he will stand in the event of the passage by the State Legislature of a bill providing for the placing of electric railway franchise matters in the hands of a special commission. It seems probable that such a measure will be introduced in the present Legislature.

INDIANAPOLIS INTERURBANS DECLARED COMMON CARRIERS

Henry Warum, City Attorney, has rendered an opinion at the instance of the Indianapolis Board of Public Works, to the effect that interurban cars are common carriers and must carry freight; that the interurbans entering Indianapolis must, under their franchises, build freight depots in a reasonable time; and that they must haul freight for a reasonable compensation. If there is any doubt as to the reasonableness of the time in which to provide freight houses or of the charge for freight haulage, it must be determined by a court of law.

REMARKABLE EARNINGS OF THE CHICAGO & MILWAUKEE RAILROAD COMPANY

Earnings of the Chicago & Milwaukee Electric Railroad Company for the year show gross of $292,246 and net $193,619. The per cent of increase over 1902 was 50.9, though in September, 1903, the Libertyville branch was opened. Comparative figures follow:

	Gross earnings	Oper. exp.	Net earnings	%†
1900	$140,684.55	$59,515.44	$81,169.11	42.3
1901	171,171.99	74,015.09	97,156.90	43.2
1902	190,110.31	79,364.12	110,746.19	41.7
		1903		
January	$12,035.19	$6,570.52	$5,464.67	45.5
February	10,644.73	5,817.41	4,827.32	54.6
March	13,355.12	6,317.37	7,037.75	47.3
April	15,160,56	6,242.20	8,918.36	41.1
May	20,042.31	7,156.61	12,885.70	35.7
June	22,482.59	7,742.66	14,739.93	34.4
July	29,529.43	8,522.87	21,006.56	28.1
August	30,465.17	8,745.91	21,719.26	28.7
*September	40,920.70	9,820.14	31,100.56	21.5
October	43,307.42	10,746.31	32,561.11	24.8
November	30,218.57	10,626.66	19,591.91	31.1
December	24,084.97	10,318.41	13,766.56	42.8
Total	$292,246.76	$98,627.07	$193,619.69	33.7

*Libertyville branch opened Sept. 1, 1903.
†Per cent of special expenses to gross receipts.

STILWELL-BIERCE & SMITH-VAILE COMPANY'S AFFAIRS

The bankruptcy proceedings instituted against the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, one of the largest builders of water turbines, pumps, etc., in this country, will not interfere with the operation of the plant, whose capacity is now taxed to the utmost. The petitioners are Frank J. McCormick, of the Dayton (Ohio) Supply Company, who has claims for $4,379.53, with interest; John W. Johnson, of Dayton, who files a bill of $1,963.82, with interest, and Alexander Gebhart & Company, also of Dayton, who put in an account for $10,994, with part interest. The petition has been lodged in the District Court of the United States, South Division of Ohio, West Division.

Receivers have been appointed in the persons of H. E. Talbot, president of the Stilwell-Bierce & Smith-Vaile Company, and William B. Earnshaw, an attorney of Dayton. The company is incorporated under the laws of the State of New Jersey, with a capital of $1,100,000, practically all of which has been issued. The assets of the company are put at $2,000,000, while the liabilities foot up a total of $1,250,000. The contracts in hand are understood to represent at least $500,000.

It is confidently expected that matters will be adjusted satisfactorily within the next month or so. The company is taking orders right along, and is figuring on some substantial contracts, especially for export to South America and England, in which countries it has been doing quite an extensive business for some years past.

IMPORTANT TRANSFER DECISION IN NEW YORK

A decision which, unless reversed on appeal may result shortly in the issuance of transfers by the Interurban Street Railway Company, at every point in New York where its lines meet or intersect, has been rendered in the Appellate Term of the Supreme Court.

The opinion reverses the ruling of Justice Tierney of the Municipal Court, in the case of Richard Topham, who brought suit to recover the $50 penalty prescribed by statute for the failure of a railroad corporation to grant a transfer when requested.

Justice Tierney, after hearing Topham's story of his ride on the Broadway line, and the refusal of the conductor to give him a transfer at Twenty-Third Street, held that Sec. 104 of the Railroad Law, which provides the $50 penalty, did not apply to the defendant and ruled in the company's favor. The Appellate Term in reversing his decision, grants Topham a new trial, with costs.

Justice Freedman says that the judgment of the lower court was erroneously placed on the ground that the provisions of Sec. 104 did not apply to the corporation. Inasmuch, however, as the question involved is of great public importance, the railway company is given leave to appeal its case to the Appellate Division.

A MODERN ENGINE PLANT

The Hooven-Owen-Rentschler Company, of Hamilton, Ohio, designer and builder of the well-known Hamilton-Corliss engine, has lately completed the reconstruction of its entire plant. All departments of the works have been thoroughly remodeled, equipped with modern tools of special designs, and located so that all material may be quickly handled at minimum expense. These extensive improvements have more than doubled the manufacturing capacity of the plant, and the company is now better equipped than ever for turning out first-class steam engines.

The works enjoy splendid transportation facilities, a siding along the westerly wall of the main shop connecting with the Cincinnati, Hamilton & Dayton Railway, and another on the eastern side running into the main line of the Pittsburg, Cincinnati, Chicago & St. Louis Railway. A loop connecting these lines runs through the southerly end of the main shop. The standard gage tracks are arranged to deliver all raw material directly into the foundry, blacksmith and machine shop yards. Inside the works the handling of engine parts and other material is greatly facilitated by a complete system of industrial railways and cranes, the capacities of the latter ranging from 10 to 50 tons.

The tool room is located in the center of the shop. The northeast corner of the main building is used for the general offices of the company, the upper floors of this section being devoted to the drafting departments. The superintendent's office is situated in the machine shop and is elevated about 5 ft. above the floor level, thus commanding an excellent view of the entire shop. Intercommunication between all departments is afforded by an elaborate interior telephone system.

The power station and main shop are connected by a 5-ft. diameter tunnel, which contains the steam heating mains, electric conduits and other piping systems.

NEW COMMISSIONER OF BRIDGES IN NEW YORK INSPECTS STRUCTURES

Last week Commissioner of Bridges Best, of New York, accompanied by the deputy commissioner, the chief engineer and the engineer of the Brooklyn Bridge, made a partial inspection of the Brooklyn and Williamsburg bridges, in the course of which he looked into the matter of relief from the present overcrowded conditions in both the terminals of the former structure. Commissioner Best would not say what he proposes to do to relieve congestion on the old bridge, but said he thought the terminals could be improved. The inadequate elevated train service on the bridge is what seemed to strike the bridge commissioner most forcibly in the course of the inspection, and he said that he intends to give the matter very careful consideration. As regards the Williamsburg Bridge the Bridge Commissioner says he sees no reason why trains, both elevated and surface, should not be running on the structure within six months. In view of the difficulties existing at the Manhattan terminal, Commissioner Best's statement that there will be cars running on the new bridge in six months is interesting. It is said that the Manhattan terminal of the new bridge will not be ready for use inside of a year and a half, and at present there are absolutely no switching facilities which would permit of the operation of either cars or trains, except from terminal to terminal. Mr. Best would not say what scheme it is proposed to adopt that will provide transportation arrangements on the new bridge inside of six months.

ANNUAL BALL OF THE INTERNATIONAL RAILWAY EMPLOYEES' ASSOCIATION

The third annual ball of the International Railway Employees' Association, of Buffalo, N. Y., was held on Jan. 5, and proved a very enjoyable and successful affair. It is estimated that fully 5000 people were present. The association is a beneficiary organization and the proceeds of its annual balls have always substantially increased its funds.

W. Caryl Ely, president of the International Railway Company, was at the ball and danced as well as the youngest man present. All the other officials of the company were also on hand to see the employees and their friends have a good time. Among them were T. E. Mitten, first vice-president and general manager; Frank Clement, second vice-president; R. F. Rankine, treasurer, and W. J. Sullivan, secretary.

REMARKABLE RECORD OF RAILWAY MOTOR SERVICE

James Anderson, manager of the Sandwich, Windsor & Amherstbury Railway, Windsor, Ontario, has recently reported the remarkable service performed by Westinghouse 12-A railway motors on his lines. The first motor of this type has been in continuous operation since 1895, a period of eight years, during which time it has covered a distance of approximately 450,000 miles. Not a coil has been renewed on either armature or field, nor has any repair been made other than the replacement of brushes, relining of bearing boxes and the turning off of commutator. The commutator has been worn from an original diameter of 8⅜ inches to 8 inches. As a wearing depth of ¾ inch is provided in the manufacture, it would appear that under similar conditions this commutator still has a prospective life of eight years, making a total life without renewal of sixteen years, and a corresponding travel of approximately 900,000 miles.

Three additional 12-A motors of the same size and construction were installed in 1896. During seven and one-half years service each has operated over 400,000 miles. Commutator diameters of two of these motors have been reduced to 8-1/16 inches, while that of the third now measures 8-3/16 inches. Except bearings and brushes, all parts are still intact, and the motors are doing regular duty. In 1901 two additional motors of similar type were put in service. Each now has 135,000 miles to its credit. Commutators have been turned to 8-3/16 inches and 8-5/16 inches diameter respectively. The last 12-A motor was added in 1902, and has operated over 58,000 miles. The commutator now measures 8-¼ inches in diameter.

With the exception of rebabbitting bearings, renewing brushes and turning off the commutators, and the replacement of one broken hand-hole cover, not a cent has been expended on the repair of any of these motors. Not a coil has been replaced on armature or field, nor has a soldering iron been even once brought in service. All parts are apparently in as good condition as when new, and each motor is taking its regular part in the work of the system.

These motors are operated in single equipment, and under 18-ft. closed cars during the winter, and ten-bench open cars during the summer season. The road is practically level and without sharp curves, so that conditions are favorable.

PROPOSED RAILWAY COMMISSION FOR NEW YORK CITY

Comptroller Grout, of New York city, has taken a stand in opposition to the plan of some of the men interested in the Merchants' Association, and in the City Club as well, to have the L gislature pass a bill for the creation of a Municipal Railway Commission to have full charge of all street surface and elevated railroads in New York. The Comptroller declares that instead of vesting these power in a new commission, the powers should be given to the present Board of Estimate and Apportionment.

"The Board of Estimate is daily becoming more and more the board of directors of this city," said the Comptroller. "This is a good thing. The proposition that has been advanced by Merchants' Association and City Club men to have a new committee of three would complicate matters, and I hope that they will either alter their bill before it is presented to the Legislature, or else that the Legislature will amend the measure before passing it."

BROOKLYN RAPID TRANSIT TO HANDLE PACKAGE FREIGHT

The Brooklyn Rapid Transit Company has entered into a contract with the Bush Terminal Company to handle package freight.

The Bush Terminal Company has erected a number of fine piers and warehouses along the water front in South Brooklyn, extending from about Thirty-Ninth Street to Fifty-Second Street. It now handles business for the following lines: Baltimore & Ohio, Jersey Central, Erie, Lehigh Valley, New York Central, Ontario & Western, West Shore, and the Old Dominion Steamship Company. These connections will make a large volume of package business available for collection and distribution by the Brooklyn Rapid Transit lines.

The question of the transit company's right to transact such a business seems to be decided by the fact that a practically similar traffic has been carried on in the removal of ashes at night and the operation of the American Express Company's cars on the trolley roads. The freight business will be handled for the most part at night.

ANNUAL REPORT OF THE LOUISVILLE RAILWAY RELIEF ASSOCIATION

The annual report of the Louisville Railway Relief Association, composed of employees of the Louisville Railway, for the year ending Dec. 31, 1903, has just been issued. The condition of the association has improved wonderfully during the past year. The association has added a considerable amount to the reserve fund, establishing the stability of the association. The good work done during the past year was accomplished by the careful and painstaking work of the entire board of managers. The membership has increased very considerably. The dues collected from members during the year amounted to $2,986. Interest, etc., made the total receipts for the year $3,089.36. Sick benefits amounting to $1,705.50 were paid to one hundred and sixteen members. Death benefits paid were $300, and the general expenses for the year $380.45, making the total disbursements $2,385.95, a net gain for the year of $703.41. This sum, added to the amount on hand at the beginning of the year, $4,395.04, gives a balance Jan. 1, 1904, of $5,098.45. The report contains a resolution adopted at a special meeting of the association, thanking the company for assisting in the success of the annual entertainment of the association, which last year took the form of a Christmas Tree for the children of the members. The company furnished transportation for the families of the employees, and also the services of many employees in the preparation of the entertainment.

NEW YORK SUBWAY STRIKE AVERTED

A general strike on the New York Subway was scheduled for Jan. 14, owing to the employment of non-union men at the power house and at other points along the line. Fifty union tile layers at the Eighteenth Street and Fourth Avenue Station went out on Jan. 13, because the Manhattan Glass Tile Company employed four non-union men. The president of the tile company refused to discharge these men, explaining that they were experts in laying the special tiling used, and that they had no union in their specialty.

Complications were increased by the fact that several of the out-of-town contractors have employed non-union labor, and the unionists demanded that either New York men be employed at union wages, or the men employed be paid New York union wages.

To avert the threatened tie-up a meeting of all the representatives of the trades interested in the completion of the Manhattan subway, and of the contractors vitally concerned, was held on Jan. 15 in the office of John B. McDonald, the general contractor for the subway. The conference lasted two hours, at the expiration of which time it was announced that all existing differences between the trades employed in the subway and John B. McDonald and the sub-contractors had been amicably settled. The result was arrived at after many mutual concessions.

THE ADJUSTMENT OF THE WORCESTER & SOUTHBRIDGE FAILURE

A settlement of the claims against the Worcester & Southbridge Street Railway Company, of Worcester, Mass., whose financial difficulties resulted in the appointment of receivers last summer, is made probable by the report of a committee of the creditors recommending the acceptance of an offer to pay 50 cents on the dollar in cash on all unsecured claims, without discrimination as to whether or not they are endorsed. Payment of the claims is to be made on or before Feb. 15, with interest up to Jan. 1. All claims must be in the hands of the Worcester Safe Deposit & Trust Company for collection Jan. 19.

The committee of the creditors was appointed at a meeting at Boston Dec. 18 to make an investigation to determine whether the offer of a settlement on a basis of 50 per cent, made by the receivers, was the best that could be made. The committee reported that as much is being contributed by the endorsers of the notes as could be obtained from them in bankruptcy proceedings, and that the credit of the road will be used to raise funds equal to the amount that could be realized from a forced sale.

Many of the creditors of the Worcester & Southbridge Street Railway Company have filed with the Worcester Safe Deposit & Trust Company acceptances of the cash offer of 50 cents on the dollar made by the receivers of the road. Jan. 19 was the last date for filing acceptances.

AN AUTOMOBILE'S VALUE IN AN EMERGENCY

John J. Stanley, general manager of the Cleveland Electric Railway Company, is the owner of a handsome touring car built by the Winton Motor Carriage Company, of Cleveland. Mr. Stanley frequently uses his automobile in going over the system, but found it of exceptional value on the occasion of the Holmden Avenue car house fire, mentioned in the Street Railway Journal of Nov. 21. On the morning of Nov. 16 Mr. Stanley, who lives some miles from the Cleveland business section, was awakened by a telephone message that the Holmden Avenue car house was on fire. Instead of having to delay until a horse and buggy could be hitched up, Mr. Stanley ordered out his automobile and quickly reached the fire. As it was 4 a. m., and in an hour it would be time for the morning cars to start on their runs, Mr. Stanley saw that unless strenuous measures were speedily taken, a large portion of the system would be tied up. It would have done no good to telephone to other car houses to have cars sent, because there were no men on hand at that time to run them. Mr. Stanley, therefore, gathered eight employees who were at the fire, and taking them in his automobile, sent them post haste to other car houses, with instructions to return with double headers. In a short time a number of cars were on their way to the tied-up district, and there was but little interference with the schedules on the entire system.

ST. LOUIS COMPANIES IGNORE NEW CAR LICENSE LAW

The St. Louis Transit Company and the St. Louis & Suburban Railroad Company are disregarding the new street car license law which became operative Jan. 1, and which provides a tax of 1 mill for each passenger carried. The city register notified the companies in advance that the new law would go into effect Jan. 1, and ordered the company to make daily reports of passengers carried on each car, beginning Jan. 1. The intention of the companies evidently is to carry the case to the courts.

Under the old law there was a tax of $25 on each car operated. Under this law the city received a revenue from the street car companies of about $22,500 a year, while under the new law it was hoped to get about $160,000 a year. The latest quarterly reports of the two companies show that the Transit Company carried 37,583,198 passengers, and the Suburban 4,407,822. On this basis the quarterly tax would amount to nearly $168,000 a year. The extra traffic of the World's Fair period, it was estimated, would bring this sum well above $200,000.

The register has twice notified the companies in regard to the provisions of the law, and has informed the companies that he will take the necessary steps to compel compliance. The register and the comptroller have held a conference on the matter.

PROPOSED STATE COMMISSION FOR OHIO PUBLIC SERVICE CORPORATIONS

Developments of Senator Hanna's alleged plan for a State commission to grant franchises to street railway companies show that the project is to include public service corporations of all sorts, such as gas, electric light, telephone companies, etc. As now planned, the law will provide for a commission of five, to be appointed by the Governor, to look into questions of fares, etc. Other phases of the quasi-corporation business will also come before this commission and it will have power to grant original franchises and extensions. The work is being entrusted to Squire, Sanders & Dempsey and John W. Warrington, who were Governor Nash's code advisers.

The constitutionality of the proposed law is already being attacked by Columbus attorneys. One of them said that such a law would not stand the test of the courts. He pointed to recent decisions in street franchise cases of several kinds. The rights of owners of property abutting on lines of proposed street railways have been well guarded by the courts. In a Butler County case, the Supreme Court, within the last year, held that the owner of abutting property could even sell his consent for a railway franchise in the street.

It is this right that the bill proposes to take, not only from the property owners, but from their representatives in city councils as well. It seems to run squarely against the constitutional provision that one may not be divested of his property rights, even for the public use, without fair compensation.

PROPOSED REPEAL OF NEW YORK'S "NEAR SIDE" ORDINANCE

As stated in the STREET RAILWAY JOURNAL of Jan. 9, the New York Board of Aldermen passed on Dec. 14, 1903, an ordinance entitled "Rules of the Road," the most important part of which is that requiring surface cars to stop only on the near side of the street when discharging or taking on passengers.

Although the ordinance went into effect on Jan. 1 in Brooklyn Borough, little opposition was shown until it became effective on Jan. 17 in Manhattan Borough. Chief among the objections has been that it compels passengers to get on and off cars about 40 ft. from street crossings and wade through snow or mud to the sidewalks.

An ordinance was introduced recently at a meeting of the Board of Aldermen, calling on the street railway companies to clean the streets 40 ft. back from the crosswalks. It was discovered afterward that it could not be made effective, and that the only remedy would be to ask the Street Cleaning Commissioner to do this work. Commissioner Woodbury, however, said that to clear a space in each block where rear ends of the cars stopped under the new ordinance made it necessary to take men from other work and crippled his force. Then the Aldermen who had advocated the stopping of cars on the near side of the street decided to repeal the measure.

On Jan. 19, Alderman Doull introduced a resolution calling for the repeal of the "near side" section of the "Rules of the Road." The resolution was referred to the railroad committee, and it will probably be two weeks before any change can be effected. Sentiment appears to be divided with regard to this matter, as many people believe that the new rule has not been given a fair trial. In any event, the Aldermen could not have chosen a worse time for dabbling in traction matters. It is needless to say that although the railway companies had nothing to do with making the ordinance they are receiving the usual abuse from the public.

STREET RAILWAY CARS FOR SNOW REMOVAL

Commissioner Woodbury, of the Department of Street Cleaning of New York, has outlined plans which he has been going over to effect an improvement in the methods of removing snow from the city streets. These plans include the use of modern railroad machinery to sweep up the snow, load it into cars on every street and avenue where there are surface railways, and then have the loaded cars run to the dumping points by the street railway companies. The Commissioner says he has the support of the officials of the companies to carry out the plan.

President Fish, of the Illinois Central Railroad, is one of the railroad builders who first called Commissioner Woodbury's attention to the plan, which is now in operation on the Illinois Central and many other roads, especially further West. Working along the lines laid down, Commissioner Woodbury declares that with the last storm he could have cleaned Broadway to Fifty-ninth Street in four hours, and before the city was ready for business on the following day could have cleaned Forty-second, Thirty-Fourth, Twenty-Third and Fourteenth Streets, which are the principal streets of New York City. The Commissioner declares the plan will not diminish the number of men employed, will cost no more than the present system, and ought to cost considerably less. It comprises a plan by which the snow will be collected and loaded into a train of thirty or more trolley cars.

NEW OFFICERS OF THE PECKHAM MANUFACTURING COMPANY

At a recent meeting of the board of directors of the Peckham Manufacturing Company, E. Burton Hart, Jr., Bird S. Coler and Henry G. Lewis were elected to the board, in place of J. J. Riley, Virgil B. Van Wagonen and W. H. Wilkinson, resigned. The board now consists of the following: E. Peckham, president; Hon. Bird S. Coler, ex-comptroller of the city of New York and member of the New York Stock Exchange; E. Burton Hart, Jr., president of the Portsmouth, Kittery & York Street Railway Company, director of the Consolidated National Bank, etc.; J. R. Beetem, vice-president and general manager, formerly general manager of the Union Traction Company, of Philadelphia, and vice-president of the New York & Queens County Railway Company; Henry G. Lewis, treasurer, assistant cashier of the Consolidated National Bank, etc.; Hon. C. H. Duell, ex-commissioner of patents, U. S. A., and member of the firm of Duell, Megrath & Warfield; Geo. H. Bowers, secretary and assistant treasurer.

INCREASE IN WAGES AT SEATTLE

Several months ago, when loyal employees of the Seattle Electric Company refused to join a strike, the company assured them that they would be rewarded by an increase in wages soon, and accordingly a new wage scale was recently posted. It became operative on Jan. 1. Both the old and new wage scales for motormen and conductors, which are shown in the following table, indicate the high prices which prevail on the Pacific Coast generally, and especially in such a rapidly growing place as Seattle:

Time of service—	Rate per hour in cents old scale		Rate per hour in cents new scale
Six months	22		22
Next twelve months	23	next 6 months	23
Eighteen months to five years	24	1 to 4 years	24
Five years	25	4 to 6 years	25
Ten years	26	6 to 10 years	26
Ten to twelve years			27
Twelve to fifteen years			28
Fifteen to eighteen years			29
Eighteen years and thereafter			30

CHICAGO TRACTION DEVELOPMENTS

Minority stockholders of the North and West Chicago Street Railroad Companies are attempting to break the amended lease to the Chicago Union Traction Company adopted last August, and in the United States Court of Appeals have questioned the power of Judge Grosscup to pass upon the validity of such lease. A movement has been started to secure the removal of R. R. Govin and James H. Eckels as receivers of North and West Chicago Companies. It is claimed that they could not consistently be receivers of both the Union Traction Company and the underlying lines.

CHICAGO STRIKE RIOTER CONVICTED

The first of the list of Chicago strike rioters, indicted in December, to be convicted is John Kelly, who has been found guilty of violence during the Chicago City Railway strike. The evidence showed that Kelly was in a crowd of strike sympathizers at Nineteenth and Clark Streets and was caught stoning a car.

POLICE STOP CAR SERVICE IN LA CROSSE, WIS.

The police of La Crosse, Wis., stopped all street cars on Jan. 12, and arrested the motormen operating them. An ordinance was passed several weeks ago providing that all street cars in the city must have conductors. The company has not complied with the terms of the ordinance, and the case will probably be carried to the Supreme Court.

PROPOSED HIGH-SPEED EXPERIMENTS NEAR SCHENECTADY

It is reported that the General Electric Company and the New York Central & Hudson River Railroad Company are arranging for a series of high-speed tests by electric power over a stretch of track, 9 miles in length, belonging to the New York Central & Hudson River Railroad between Schenectady and Amsterdam, and which is not now used for regular passenger traffic. The roadbed is said to be well-suited for these high-speed experiments and a rate of 125 m. p. h. is reported to be that which will be aimed at by the officials in charge.

AN EDISON MEDAL TO BE FOUNDED FOR ELECTRICAL STUDENTS

The friends and associates of Thomas A. Edison have taken steps to found an Edison medal, which will be entrusted to the American Institute of Electrical Engineers for annual award to graduating students in electrical engineering. It is proposed to present the medal fund for this purpose at the Institute's annual dinner on Feb. 11, to be held at the Waldorf-Astoria, at which Mr. Edison will be a guest of honor.

NEW PUBLICATIONS

Electric Traction. By John Hall Rider; 453 pages; illustrated. Price, 10s. 6d. Published by Whittaker & Co., London.

Mr. Rider is chief electrical engineer of the London County Council Tramways, and his treatise on the subject of electric railway construction and operation is an interesting review of the subject, chiefly from an English standpoint. The book forms one of the Specialists' Series, and is consequently not written exclusively for engineers; nevertheless, it contains a great deal of interesting and valuable reading for the operating engineer and manager, as might be expected from a gentleman of the standing and with the experience of the author. Mr. Rider's opinion of surface contact systems is especially interesting, and is shown by the following two sentences, taken from different parts of the chapters which he devotes to a discussion of this subject: "While surface contact systems are almost perfect in theory, they are most difficult to design and work satisfactorily in practice. * * * No engineer, who values his peace of mind, would willingly put down a system which means the use of, probably, 1000 switches per mile of roadway, the failure of any one of which may have fatal results." We do not agree with the writer that the "passenger-capacity mile" or the passenger mile is the best unit in comparing "running costs," although some of the arguments in its favor are perfectly correct. The "car mile" in combination with the "car hour" will be found, we believe, more satisfactory on the whole than the "passenger mile," in spite of differences in the size and weight of cars.

Traité Pratique de Traction Électrique. By L. Barbillion and G. J. Griffisch. Vol. II.; 778 pages; illus., paper. Price for complete work, 40 fr. Published by E. Bernard & Co., Paris.

The first volume of this elaborate treatise was reviewed in these columns three or four months ago. The second volume contains chapters VI. to X., devoted, respectively, to rolling stock, general characteristics of city and interurban railways, heavy electric traction, special types of roads, and legal. The book is the most extensive and complete of any which has been published since the notable volume by Blondel and DuBois, and the second volume shows the same attention to practical details to which reference was made in the review of the first volume. The book devotes considerable attention to American practice, and a great deal of discrimination has been used in eliminating antiquated examples and cuts, and employing in their places illustrations of late installations. In the chapter devoted to heavy electric railroading, an extended description is given of all the latest elevated, underground and heavy traction roads.

Das Eisenbahn und Verkehrswesen auf der Industrie und Gewerbeausstellung zu Düsseldorf, 1902. By M. Buhle; 44 pages, 220 illustrations, paper. Price, 6 Marks. Published by Julius Springer, Berlin.

This is an extended illustrated review of the exhibits of steam and electric railway track construction and rolling stock at the recent Düsseldorf Exhibition. Views are given in the first part of the pamphlet of the different types of wheels and brake-shoes exhibited, among both of which we notice several American appliances. Following this comes the section on track construction and rail bonds, after which views are given of the different types of cars exhibited. Some of the parlor electric cars shown at Düsseldorf were among the most handsomely finished which have ever been built, and included in their construction a number of novel features, such as special arrangements for raising and lowering the sash, and in the seating arrangements.

Report of the twenty-first annual meeting of the New York State Street Railway Association; 230 pages. Published by the Association.

The report of the Syracuse convention is at hand, and contains the papers and discussions presented at that meeting as well as the banquet speeches and proceedings, the standard rules adopted by the Association for the government of employees, constitution and by-laws of the Association, list of members, etc.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED JAN. 12, 1904.

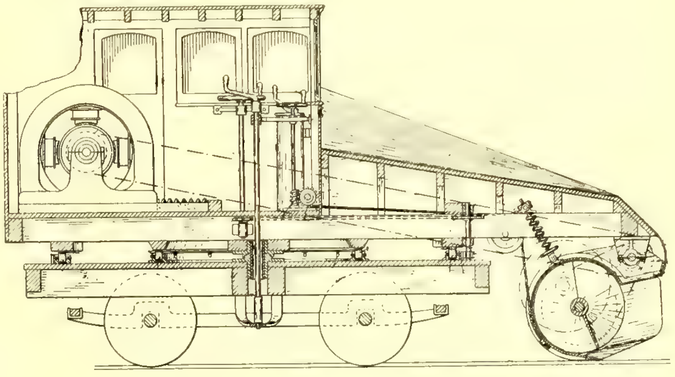
749,100. Electrically Operated Railway Switch; Claude W. Breedlove and Rudolph R. Grant, Berkley, Va. App. filed March 25, 1903. Details.

749,172. Reversible Rotary Snow-Plow; Otis Cutting, Seattle, Wash. App. filed Aug. 4, 1903. Details of construction.

749,261. Switch; Troy Cope, New Waterford, Ohio. App. filed Aug. 20, 1903. Details.

749,401. Electric Railway; Leon W. Pullen, Philadelphia, Pa. App. filed April 18, 1903. A system wherein circuit controllers in the roadbed are actuated by magnets carried by the car to energize contact studs fixed at intervals along the way.

749,509. Trolley; Willis D. Williams, Kirkland, Arizona Ter. App. filed Aug. 19, 1903. Star wheels mounted on both sides of the harp to maintain the wheel in contact with the wire and adapted to turn upon their bearings when they contact with the hangers of the trolley wire.



NO. 749,172.—REVERSIBLE ROTARY SNOW PLOW

749,579. Convertible Car; Michael Power, Toronto, Canada. App. filed Aug. 17, 1903. The seats are arranged in sections longitudinally of the car when used as a "closed" car, and are adapted to be swung across the car when it is used as an "open" car. Other features.

749,597. Electric Railway Switch; Johann G. Weniger, New York, N. Y. App. filed June 9, 1903. Details.

749,601. Trolley Harp Device; Frederick H. Allen, Dunkirk, N. Y. App. filed Nov. 2, 1903. A construction whereby the wheel may be quickly removed and replaced.

749,609. Thomas M. Galbreath, Memphis, Tenn. App. file Sept. 29, 1903. A novel construction of rail adapted to be laid in pavement.

749,626. Switch Mechanism; John W. Osborne, Exeter, Ill. App. filed March 17, 1903. Details.

PERSONAL MENTION

MR. HORACE F. PARSHALL AND MR. R. W. BLACKWELL, of London, are making a short visit in this country.

MR. J. N. ELEY, formerly the chief electrician of the Georgia Railway & Electric Company, of Atlanta, has taken a similar position with the Mobile Light & Railway Company.

MR. CHARLES GOODWILL has been appointed superintendent of transportation of the Saginaw Street Railway, of Saginaw, Mich., to succeed Mr. Thomas B. Redmond, who resigned recently.

MR. J. MAC WOLFF, of Waynesboro, has been chosen to succeed Mr. W. L. Minick as general manager of the Chambersburg, Greencastle & Waynesboro Electric Railway Company. He entered upon his new duties Jan. 11.

MR. E. G. LONG, for the past five years the vice-president and general sales agent of the Peckham Manufacturing Company, has resigned that position and has opened offices in the White Building, 95 Liberty Street, New York, where he intends to devote his attention to the handling of electric railway material, making a specialty of export trade.

MR. GEORGE LAIRD, of New York city, has been appointed division superintendent of the Battle Creek division of the Michigan Traction Company with headquarters in Battle Creek, Mich. Mr. Laird was formerly connected with the Metropolitan Street Railway Company, of New York, holding the position of general foreman of the Eighth Avenue division.

MR. ALBERT GALLATIN, long connected with the Sacramento Electric, Gas & Railway Company, in the position of general manager, has resigned his position to take effect April 1, when it is his intention to go with his family for an extended visit to Europe. Mr. Gallatin will not retire from a close connection with the property, since he retains his large holdings in the Sacramento Electric, Gas & Railway Company. For a long

time Mr. Gallatin has wished to retire from the work of administration, but he has continued in active duty to carry into effect certain of his projects which he desired to perfect under his own hand. Mr. Gallatin's successor has not yet been determined.

MR. HENRY G. FOREMAN has resigned as president of the board of directors of the Chicago Union Traction Company, giving as a reason his many other public duties in Chicago including the fact that he is president of the county board, which is now in a controversy involving Union Traction tax matters.

MR. W. J. TUBBS, former secretary of the Railway Department, Y. M. C. A., Texarkana, Tex.-Ark., has entered upon his new work as secretary of the Street Railway Department, Y. M. C. A., of Richmond, Va. Quite a handsome clubhouse is being fitted up and the association is expected to formally open in a few weeks under the most auspicious circumstances.

MR. HARRY DESTEESE, of the Stuart-Howland Company, has been transferred to the headquarters of the company at 261-287 Devonshire Street, Boston, and promoted to the position of assistant manager of the railway department. He will, however, continue catering to his many customers in the same territory as when in charge of the New York city branch.

MR. GEORGE BACON, electrician of the Cleveland Electric Railway Company, of Cleveland, Ohio, has resigned to accept a position with the Willard Storage Battery Company. The vacancy has been filled by the appointment of Mr. Frank Wisner, who formerly was electrician for the Cleveland City Railway Company. Mr. Wisner has charge of all electrical equipment in power houses and battery stations.

MR. W. J. JOHNSTON, formerly proprietor of the "Electrical World," of New York, has sold to Mr. H. M. Swetland his stock interest in the Johnston Publishing Company, the corporation which owns the "Engineering and Mining Journal," and has severed his connection with that publication. Mr. Johnston will now devote his entire time and energies to the development of the "Pacific Coast Miner," which he has owned personally for the past year, but to which heretofore he has only been able to give "absent treatment."

MR. CHARLES H. MEYER, a young man who for years has been identified with the development of the street railway enterprises in York, Pa., and vicinity, died at his home in York a few days ago, as the result of an illness of several weeks. The deceased was educated in the public schools of York and at Princeton. Until two years ago he was the treasurer of the York Street Railway Company. When the York Street Railway system was extended to reach suburban and rural villages, Mr. Meyer was placed in charge of the construction of two of the most important lines the York & Dover Electric Railway and the York & Dallastown Electric Railway. He performed these duties most successfully. At the time of his death Mr. Meyer was treasurer of the York County Agricultural Society, a director in the York National Bank and the York Gas Company, and was identified with other public enterprises. He is survived by two children and two sisters, Mrs. Grier Hersh, wife of the vice-president of the York County Traction Company, and Miss Helen Meyer.

MR. W. G. ROSS, the newly appointed managing director of the Montreal Street Railway and the Montreal Park & Island Railway Cos., was born in Montreal, Aug. 6, 1863. For more than twenty years he has been an accountant and auditor, having been associated with his father in that capacity as early as 1880. Between 1880 and 1890 he was successively secretary, treasurer and assistant manager of the Windsor Hotel Company. In 1892 he became associated with Mr. James Ross, who was active in developing Canadian street railways, and organized the financial department of these companies. Mr. W. G. Ross has been successively comptroller and secretary-treasurer of the Montreal Street Railway Company. He also occupies the position of second vice-president of the Montreal Light, Heat & Power Company, is treasurer of the Mexican Light & Power Company, and is a director in various other companies. He was one of the organizers of the Street Railway Accountants' Association of America.

W. G. ROSS

GENERAL ASA S. BUSHNELL, of Springfield, Ohio, former Governor of Ohio, died at Columbus, Ohio, three days after being stricken with paralysis while attending the inauguration of Governor Herrick. For many years General Bushnell was at the head of large manufacturing interests at Springfield. Two years ago he sold out these interests, and it was announced that he would invest a considerable portion of his immense fortune in the building up of an electric railway system centering at Springfield. He acquired control of the Springfield & Xenia Traction Company, and organized and became president of the Springfield, Troy & Piqua Traction Company, whose line is now nearing completion. General Bushnell was much interested in the work of giving his home city better transportation facilities, and had several other lines in view. He served with great distinction in the civil war, was a thirty-second degree Mason, and greatly beloved as a public spirited and benevolent gentleman, whose chief interest seemed to be the building up of his home city.

MR. JOHN B. ALLAN, recently appointed general manager of the Allis-Chalmers Company, is an example of what steady, efficient service in the employ of one company, together with ability, can accomplish. Mr. Allan's career is notable, not for the great number and variety of positions which he has filled, but for the opposite, and for the fact that it is practically identical with the growth of one of the great engine building concerns of the country. Mr. Allan was born at Davenport, Iowa, in 1860, in which place he spent his boyhood and received his common and high school education, together with some practical education in a general machine shop. At the age of seventeen he went to Worcester Polytechnic Institute, from which he graduated as a mechanical engineer in 1880, and in May of the following year he entered the employ of Edward P. Allis & Company as a draftsman, and also working on engine indicating and testing. During the four years of his service in the Milwaukee shops promotions were frequent. In 1885 the company decided to open a Chicago office, and Mr. Allan was placed in charge. The business of the company in Chicago had previously been taken care of by agents who had other interests, which had resulted in their financial embarrassment. As a consequence, the Chicago business was in a demoralized condition, and it fell to Mr. Allan to put matters again on a satisfactory basis. Mr. Allan relates how, in his capacity as engineer as well as salesman, he spent many evenings and holidays in the engine rooms of Chicago plants, making necessary repairs on neglected engines in order that the company's reputation might not suffer and that sales could be made on the strength of satisfactory performance of engines already running. The territory of the Chicago sales office was gradually increased, less and less being handled direct from the Milwaukee office, until in time it included all the territory between Duluth and New Orleans, Eastern Ohio and the Rocky Mountains. As manager of the most important office of the largest Corliss engine builder in the country, Mr. Allan, naturally, for many years had much to do with the steam engineering of many of the largest power plants erected in the Middle West. When the Allis-Chalmers Company was formed Mr. Allan was placed in general charge of the engine sales department, with headquarters still at Chicago, a position similar to that which he had before the consolidation, but with enlarged power. This position he held until the recent action of the board of directors, which made him a vice-president and the general manager of the company, in charge of all departments, including selling and manufacturing. This appointment was very popular with those in the service of the Allis-Chalmers Company, because Mr. Allan is personally acquainted both with the men and the needs of the company, and so has the confidence and co-operation of the heads of all departments, as no one who had not been long identified with the business could have. Mr. Allan, although connected with the selling department for a number of years past, is fully as much engineer as salesman, as is eminently fitting in one who has had charge of the placing of the Allis product. Nearly every man has his hobby outside of business, and Mr. Allan's is the collection of fine paintings. Paintings of his home collection are to be seen frequently in the loan exhibits in the Art Institute at Chicago, and at least one will be seen at the St. Louis Exposition as the best work in America of a noted French painter.

J. B. ALLAN

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, JANUARY 30, 1904. No. 5.

Published Every Saturday by the

McGRAW PUBLISHING COMPANY

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: 929 Chestnut Street.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York,"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Canada and Mexico......................$4.00 per annum

Single copies, first issue of each month, 25 cents; other issues, 10 cents.

To all Countries outside of the United States, Canada and Mexico.... $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

The Position of the Track Engineers

Two letters from subscribers in this issue call attention to a subject to which we have referred in our editorial columns, and which is of considerable importance to those companies who wish to maintain a high standard of track construction. We refer to the somewhat anomalous position of track engineers who have no association of their own, and hence, theoretically at least, no opportunity for debating the subject of track construction. This is undoubtedly a misfortune, because, in the opinion of many, there is no department of street railway work to which greater attention could often be profitably paid than to that relating to the permanent way. It is true that at nearly every meeting of the American Street Railway Association at least one paper has been presented on some subject connected with this department, but the discussion has not been particularly full, and no great effort has been made to secure the attendance at the meeting and participation in the discussion of the track engineers of the different roads. Would it not be possible for either the American or the Mechanical Association to devote one day, which would be announced beforehand, to topics connected with track construction and maintenance? If necessary, the sessions could be made one day longer, so as not to interfere with the rest of the programme, or else one afternoon could be devoted to this subject. The different companies should then arrange, so far as possible, to secure the attendance at this meeting of their track engineers, even if the latter did not remain for all the days during which the convention was in session. This may not solve the problem, but is offered as a suggestion to accompany, possibly, that proposed by Mr. Lewis, of assigning a large part of this work to a committee, where a few interested and active workers could accomplish a great deal of preliminary work and report their conclusions to the main body for adoption.

Manhattan "L" Passes Million Mark

During the discussion of the transportation problems of New York a year ago it became evident that the public generally possessed very little accurate information regarding the facilities for handling the enormous traffic of the Borough of Manhattan, and that those who criticised the management of the elevated and surface lines were either incapable of appreciating the herculean task involved and the conditions under which the work was done or lacked knowledge of the growth of these systems and the demands that were constantly being made upon them. The same criticism is heard to-day, and officers of the Merchants' Association only recently charged the Manhattan management with failing to comply with the orders of the State Railroad Commissioners. No doubt these superficial critics will be surprised to learn that the Manhattan elevated lines are now carrying more than a million passengers every day, and that on Monday, Jan. 18, the number reached 1,025,000, the highest figure thus far attained. It should be mentioned in this connection that this was an ordinary day's business, there being no special attraction or public function to call out an unusually large throng. This performance is noteworthy of itself, and it is especially interesting as illustrating the possibilities of electric operation as compared with steam. Before the transformation of the elevated lines was effected, the Manhattan was seriously handicapped by the limitations imposed by steam operation. The old management found it impossible, on the West Side, to stop more than forty trains per hour at any one station while locomotives were in use, and then the trains were limited to five cars. Now it is found practicable to increase this number to sixty trains per hour and to add at least one car to each train. The company is now operating daily 1380 cars, which comprises every bit of rolling stock fit for service, including all of the new cars thus far received for the subway. This is just 300 cars more than the old Manhattan management estimated as the ultimate capacity of the system when it was decided to make the change from steam to electricity. Last winter, it will be remembered, sleet storms interfered with the schedule, owing largely to the fact that both steam and electricity were employed on the same lines. Now, however, that the transformation is complete and all the motor cars are provided with sleet cutters, the movement of trains has not been interrupted at any time, and not a single trip has been missed on account of snow or sleet.

Still the demand for more accommodations continues, the station platforms are thronged throughout the rush hours, the cars are necessarily crowded to their limit, and, consequently, representatives of the Merchants' Association contend that the

company is not attempting to afford relief. Bosh and buncombe! The Manhattan system has increased its capacity from an average of 749,172 passengers per day, the number carried in the holiday season a year ago, to more than a million a day at the present time. Of course, it is just as hard for the passenger to stand up when a million patrons are carried as it was when there were only 750,000 fellow sufferers, and the average man hanging on a strap can hardly be expected to view the situation with the same composure as the philosopher ensconced in a comfortable cross-seat, but with a better understanding of the situation and the earnest efforts of the men operating the road to meet the requirements there would, doubtless, be less resentment manifested, and the traveling public should await the opening of the subway with more patience.

Stopping at the Near Corner

The ordinance which requires the street cars in New York City to stop at the near instead of the far corner has now been in force for two weeks in the Borough of Manhattan and four weeks in the Borough of Brooklyn, and opinions differ as to whether it can be considered a success. There are, as our readers know, several good reasons for stopping at the near corner, the principal one being that the motorman has an opportunity, while the car has stopped, to look up and down the cross street and see whether any vehicle is coming. He can then chose his own time to cross the street. On the other hand, when the stop is made at the far corner, the car passes the cross street at considerable speed, and there is greater possibility of collision. Where a line crosses a street near a fire engine house, the Interurban Street Railway Company always has stopped its cars on the near corner for this very reason, and where a line crosses a double-track street railway, the cars are still stopped at the far corner as well as at the near corner.

Unfortunately for those who have been hoping that the solution of this long-debated question in street railway practice would be definitely settled upon its merits by the present experiment, the exceptionally inclement weather which New York City has experienced during January has been unfavorable to a fair trial of the plan. Owing to heavy snow-storms the streets have been blocked to some extent by piles of snow, and the city authorities first attempted to compel the railway companies to clear a path opposite the rear platform, or about 30 ft. from the crossing, to the sidewalk. It was found, however, that the city had no power to compel the companies to do this, and the Street Commissioner protested that his force was inadequate for this work if he was expected properly to attend to his other street cleaning duties.

Another difficulty which has been caused by the cold weather is that it has prevented the passengers from using the front platform for ingress and egress. It is the policy of the Interurban Street Railway Company to allow passengers to enter and leave the car by the front platform in warm and moderate weather, but when the temperature falls below 40 degs. instructions are given to close the front platform gates, although the motormen are allowed a certain amount of discretion and are permitted to open them and let passengers in and out by the front platform in cases of congestion. Still, the general rule has compelled most of the passengers to leave by the rear platform, and, consequently, at an uncleared point. Another difficulty has been that persons have not yet got used to the ordinance; and still another, that many people do not recognize the street at which they wish to leave the car until after the car has crossed it. With the old plan they could dismount on the farther corner, but with the new plan if they do not get out before they cross the street at which they wish to alight, they must be carried to the next near corner.

The experiment is one for which the city authorities only are responsible, and the Police Commissioner, who has charge of the traffic on the streets, still advocates it, although the Aldermen are showing a disposition to repeal the ordinance. The railway companies in the case are occupying the position of interested spectators, as their policy when the plan was first proposed was that while they did not advocate the change they would not oppose it. The result of the test, as so far conducted, is that the ordinance, as a whole, is a desirable one, although a very unfavorable time was selected for putting it in force. If it had been instituted in the late spring or summer it is our opinion that the public would have become so used to it that they would have been willing to have put up with the undeniable discomfort which accompanies its enforcement in very cold and snowy weather.

Pilots on Interurban Cars

As fenders are coming to be the usual adjunct of city cars, so cow-catchers, or pilots, are becoming popular with the managements of many interurban roads, especially in Indiana. Several experiences on high-speed interurban roads have tended to confirm the conclusions reached by steam railroads many years ago, that pilots were a good thing to have at the head of a fast train. In one accident, especially, which occurred on a road running out of Indianapolis recently, the value of the pilot was very conclusively demonstrated. A horse attached to a buggy wandered away from a blacksmith shop, got over the cattle-guard onto the private right of way of the railway company, and finally got caught in a bridge on the interurban road. This happened at night, and a car coming down-grade onto the bridge at high speed could not be stopped for many feet after it had passed the horse and buggy. Fortunately, the car had a pilot and the only result was the killing of the horse and wrecking of the buggy. Had the pilot been absent the chances for a derailment on the bridge, at high speed, and a very disastrous wreck would have been very great. In some cities the municipal ordinances require that some kind of a fender be used on all cars operating within the city limits. If such an ordinance is made applicable to interurban cars fitted with pilots it will cause great embarrassment unless some ingenious scheme can be evolved for changing from pilot to fender at the city limits.

Warning Against Municipal Ownership

Carter H. Harrison, the foremost champion of municipal ownership in the West, has been so busily engaged in hampering the street railway companies of Chicago and inciting the turbulent element of that section to noisy demonstrations against the present transportation companies, that he has not been able to find time, as Mayor of the city, to enforce the laws enacted for his guidance and investing him with authority and responsibility for the protection of life and property. It required a catastrophe to divert his attention from his hobby, and bring him to a realization of his accountability for the enforcement of the laws. One of the lessons of the Iroquois Theater fire, involving a loss of 572 lives, is contained in the exposure of the incapacity of the Harrison administration during the inquest conducted by the coroner's jury, and should be a warning to those who favor entrusting further service to political management. Not only Mayor Harrison but the chief of the fire department and commissioner of buildings were found to be culpably ignorant and criminally negligent in this

matter, and their failure to enforce the laws was held to be largely responsible for the great loss of life. They have been formally held for the grand jury, and no matter what the outcome may be the investigation has put them in a sorry plight. And yet, considered in its entirety, Chicago will probably rank high in point of efficiency of municipal government when compared with other large cities of the country. How, then, can intelligent people advocate turning over such important departments of public service as the transportation system of a city to the mercy of corrupt and incompetent politicians? What assurance have we in the experience of Chicago that its transportation service would not meet the same fate as everything else entrusted to municipal management and control? None whatever. On the contrary, there is every indication that such a step would result in a carnival of corruption. In this connection, our municipal ownership friends will be interested in the announcement that the municipal street railway in Grand Junction, Col., consisting of 1¾ milles of track, two horses and two cars, the only municipally operated street railway in this country, has suspended operations, and an investigation of the financial possibilities of the system, on the part of capitalists, is solicited by the city authorities.

The Sleeping Car Proposition

We are heartily glad that on at least one long interurban system the sleeping car is to be given a fair trial. When the extent of an electric road reaches dimensions that give a chance for an all-night journey the sleeper is certainly worth a trial, and within limits the chance for success seems fairly good. Certainly the absence of smoke and dust is an important advantage during a considerable part of the year, and to the occupant the car would doubtless prove attractive as a relief from the usual kind, dusty and stuffy, with blankets surfaced like emery cloth with the ineradicable grime of years. But from the standpoint of the manager the final test of the fitness of things is the result. Is there good reason to believe that the sleeping car business will, in itself, pay, or that it will attract enough extra travel to the regular cars to cover any possible deficit? Now, in all such matters as this the proof of the pudding is in the eating, and a few months of experience will be of more value than months of theorizing about it. But, offhand, from the broader aspects of the case we are inclined to think that the experiment will be a success. As to the mere question of fare we are dubious. It may reasonably be assumed that the charge for berths will be, as it is on ordinary railroads, at least enough to cover reasonable expenses, but putting a sleeper on a long regular train is one thing and running it as an independent car is quite another. Yet, although the actual cost of long hauls with relatively few passengers is a subject on which little experience has been had on electric roads, it looks as if electric roads could stand it quite as well as steam roads. Interurban electric roads charge relatively low fares, but with a well-filled car an all-night run at even 1½ cents per passenger mile ought to cover expenses.

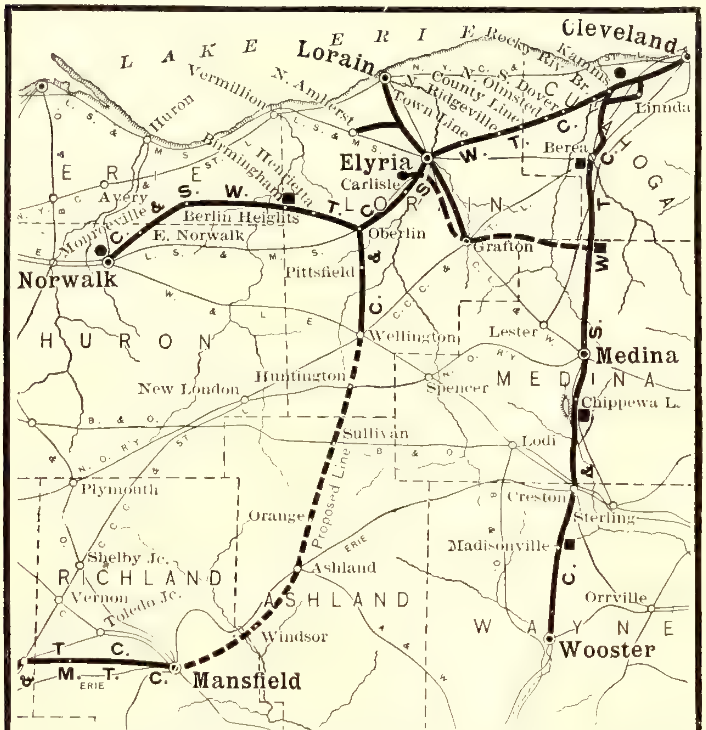
Nor is quick running time always an advantage in this class of service. As we pointed out editorially in our issue of Aug. 1, an electric sleeping car service, between cities 100 miles to 150 miles apart, with a schedule arranged to suit the convenience of the public, would often be more attractive to passengers than a competitive faster steam service with more inconvenient times for arrival and departure. And this is the condition which exists to-day in the Central States where the proposed electric sleeping car service will be instituted, and where the present steam road schedule is based largely upon the convenience of through passengers between the large terminal cities rather than between the cities of moderate size en route.

We can assume, therefore, that the sleeper service, if well patronized, ought at least to clear expenses, and its indirect effect on the traffic of a road ought to be well worth while. Somehow it is difficult to get the general, as aside from the local, public to take the long interurban lines seriously enough. We have many times called attention to the lack of adequate provisions for building up traffic, and the publicity given by a sleeper service is a thing which may possibly prove to be important. Once get the public used to the idea that long trips may be cheaply and conveniently made on electric roads and you will have a valuable increase of traffic. On exactly the same line, parlor cars can be, and to a very small extent are, advantageously used on long runs. We could name a number of long lines on which, during the summer at least, parlor cars, routed through from terminus to terminus of the system, would attract much travel which now goes to the steam roads on account of the inconvenience of transfers and waiting upon the electric roads as now run. All this is right along the line of steam railway evolution that ought to be taken as a text book by every manager of an interurban line. On steam roads parlor cars and sleeping cars came as part of a general demand for more comfortable service on long routes, and as a result of the competition that once existed between railroads running through the same territory. Like causes should naturally produce like results in interurban practice. The parlor car and sleeping car are not yet fiercely demanded by the patrons of electric lines, but they are powerful instruments of competition, and a little experience with them will awaken the public demand, that means extensive patronage.

But in order to make parlor car and sleeping car service valuable, the managers of interurban lines must take still another leaf from their rival's book. Few of the fraternity now in active service can run back in memory to the days when each little railroad ran independently, quite irrespective of the convenience of its passengers; when connecting roads made it a point to annoy one another, and the passenger had to change cars half a dozen times in a day's run. It is difficult to-day even to find out how bad the case really was, but some of our fathers and grandfathers still remember it to their sorrow. And the electric roads are passing through just this stage of their economic evolution at the present time. Consolidations, the advantages of which we have often pointed out, may, and in time will, remedy much of the existing trouble in long runs over electric lines, but the work of consolidation is slow, and as at present carried on seems to be influenced by about every consideration save that of long-distance travel. And for some reason not easily discovered the simple fundamental idea of through routing of cars does not seem to have worked its way into the generally acute consciousness of the electric railway manager. To such a suggestion we doubt not that a dozen exceptions can be taken, but the steam railway men of the generation before our own raised and overcame every objection that can be conjured up to-day. It is high time that we of the twentieth century should take their experience to heart. The advent of electric sleepers and parlor cars is a step in the right direction, but its full advantage cannot be realized until those sleepers and parlor cars can, by a general modus vivendi between connecting lines, be routed to the very end of the track that can be made physically continuous. Let us, in this instance at all events, stop adhering to the steam railroading of 1850 as our accepted pattern, and try the virtues of the practice of a later era in the art.

IMPROVEMENTS IN THE POWER EQUIPMENT OF THE CLEVELAND & SOUTHWESTERN SYSTEM

In providing for large extensions to its system, the Cleveland & Southwestern Traction Company is just completing important additions to its main power station, making it one of the largest interurban stations in the country. This plant is particularly interesting because of the fact that the new units, one of which is now in successful operation, represent one of the first steam turbine installations for electric railway work in this country, if, indeed, it is not entitled to the distinction of being the pioneer. The high-tension alternating-current



Map of Cleveland and Southwestern System and Connections, showing location of Power Stations and transmission lines.
Generating Plants indicated by heavy black dots ●
Sub-stations indicated by square blocks ■
Transmission line across country shown by broken line ▬ ▬ ▬ ▬

DISTRIBUTION SYSTEM

transmission system is used to provide for a considerable portion of the system at the present time, and eventually the old equipment will be entirely superseded.

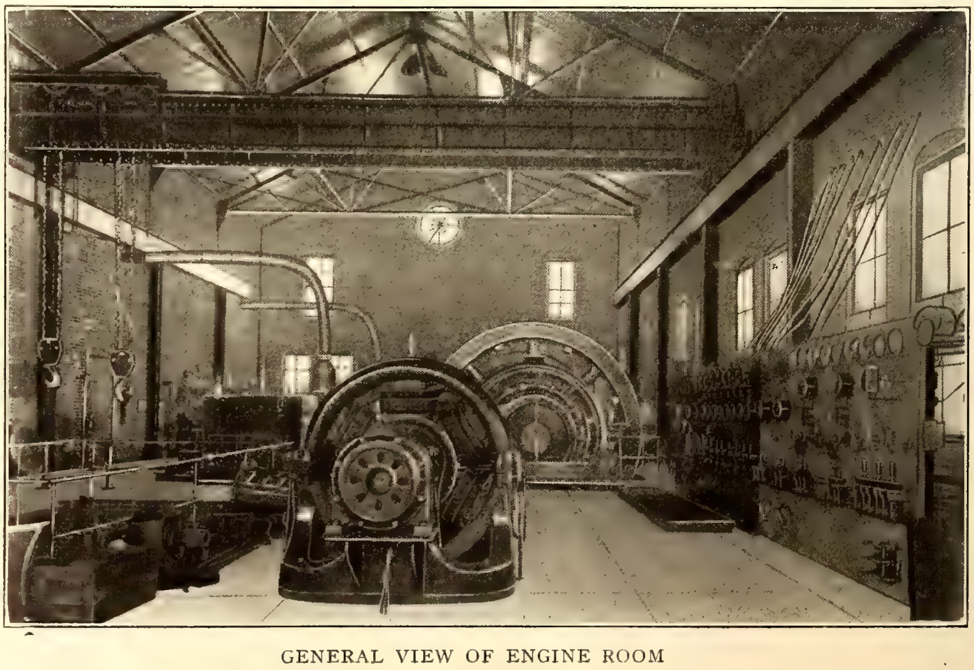
The system was described in the STREET RAILWAY JOURNAL of June 27, 1903, and a map was presented showing the lines in operation and under construction. A modification of this map is here presented, showing the location of the generating stations, sub-stations and transmission lines. The generating plants are indicated by square black blocks, the sub-stations by round black blocks, and there is a transmission line from Elyria almost directly east to the north and south line, midway between Cleveland and Medina, which is represented by a broken line in the cut.

The original road, extending to Berea and Elyria, was operated from a direct-current station located at Rockport, at the junction of the two lines. This station is still in operation, and supplies 750 kw, feeding to Berea and half-way to Elyria. The equipment includes two 325-hp simple non-condensing horizontal Allis engines, belted to 250-kw Westinghouse generators, and one 325-hp simple non-condensing Slater engine, belted to a 250-kw Walker generator. Current is generated at 600 volts. Eventually this station will be abandoned and a rotary installed. At Norwalk the company owns the local lighting plant, which also assists the railway load at that end of the line. This equipment includes two 225-hp tandem compound condensing engines, belted to Westinghouse generators, and a 250-kw rotary converter. Steam is supplied by two 150-hp tubular boilers and one 275-hp water-tube boilers.

TEMPORARY INSTALLATION

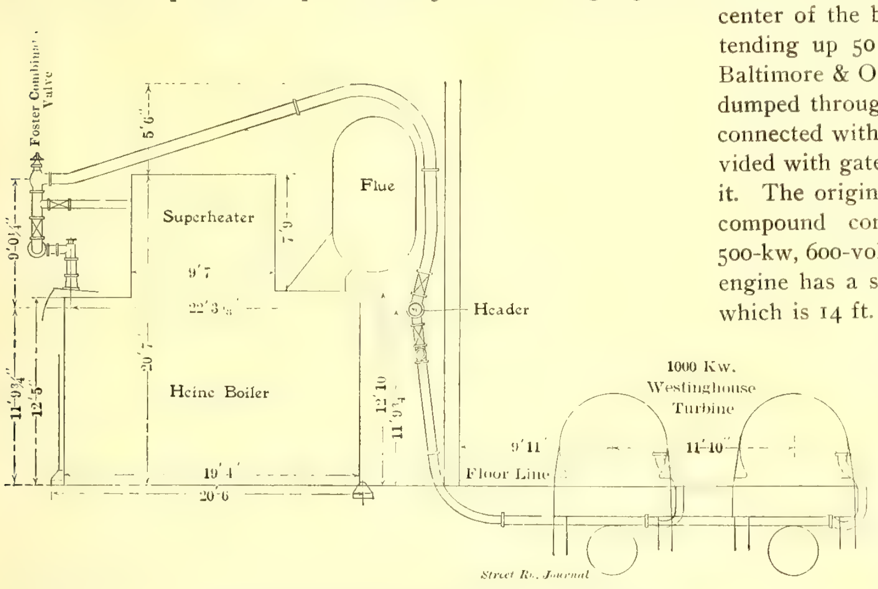
For nearly two years, while the turbines were being built and installed, the consulting engineer, W. H. Abbott, was obliged to resort to unusual means to keep the distant portions of the new extensions in operation. A heterogeneous lot of equipment for supplying alternating current to the sub-stations already completed was installed, and the changes made from time to time to take care of unusual conditions and breakdowns, caused by overloaded engines and generators, demonstrated to a remarkable degree the extreme flexibility of the modern alternating-current transmission in connection with rotary converters and transformers.

Two 300-kw rotary converters were installed in the main station, and were operated inverted with direct current supplied from the bus-bar of the old Westinghouse equipment, and the low-voltage alternating current produced was stepped up to 20,000 volts for the transmission lines, by means of oil-cooled transformers. As new extensions were completed a belted Walker generator was temporarily installed in a lean-to at one end of the station, and this supplied direct current in parallel with the other generators. Later a Westinghouse vertical engine, belted to a 300-kw rotary, was placed in another lean-to, and this supplied alternating current for the transmission lines. The equipment at the Norwalk generating station gave and received considerable assistance. At times the rotary converter in this station was belted to the line shaft, and supplied alternating current for the sub-station at Birmingham. At other times it took alternating current through the Birmingham sub-station and supplied direct current for that end of the road. On other occasions it took direct current from the trolley line and operated as a direct-current motor, driving the lighting generators. Again it performed the same service, taking alternating current from the transmission lines and operating as an alternating-current motor and turning the line shafting. Much of the time it was used as a belted direct-current generator,



GENERAL VIEW OF ENGINE ROOM

supplying that end of the road direct. At one time before the turbines were placed in operation 115 miles of high-speed

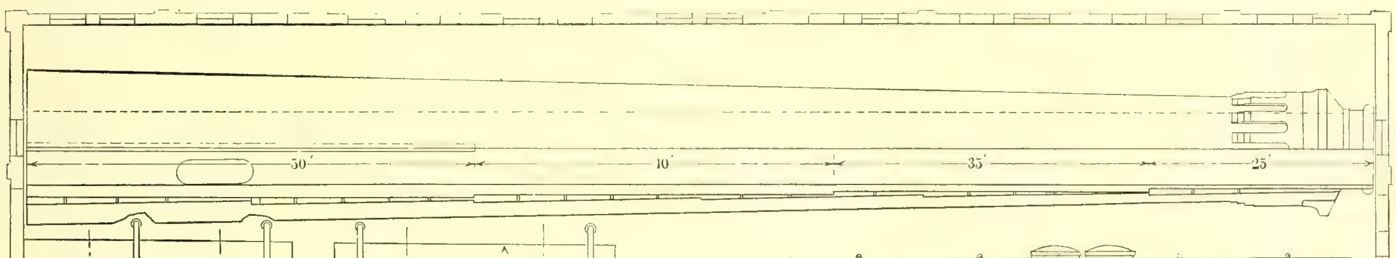


SECTIONAL VIEW SHOWING STEAM PIPING

suburban lines, with half-hourly service, were supplied by about 1100 kw of generating equipment.

MAIN POWER HOUSE

The main power station, erected three years ago to take care of the Oberlin-Wellington and the Lorain extensions, is located at Carlisle, a short distance from Elyria, on the Black River, which affords ample water supply. The building is a modern steel structure with heavy brick walls, and is divided into two sections. The boiler room is 154 ft. 4 ins. x 49 ft. 6 ins., and the engine room 103 ft. 6 ins. x 49 ft. 10 ins.; both rooms are on the same level. A brick stack, 150 ft. 6 ins. tall and 17 ft. 4 ins. wide at the base, projects upward from the center of the boiler room. The stack has a dividing wall extending up 50 ft. Coal is run onto a high trestle from the Baltimore & Ohio Railway tracks, which pass the house, and is dumped through chutes into the boiler room. A large cistern, connected with the river by tunnel, properly screened and provided with gates, adjoins the house, and all water is taken from it. The original power equipment included two 750-hp cross-compound condensing Slater engines, direct-connected to 500-kw, 600-volt Westinghouse direct-current generators. Each engine has a separate jet condenser, located in the basement, which is 14 ft. 7 ins. deep, and extends under the whole of the engine room. Two 325-hp and two 345-hp Sterling water-tube boilers supply steam at 150 lbs. Hoppes water purifiers are located overhead in the boiler room. The direct-current switchboard occupies a position near the engines, and at present the direct-current machines supply the portion of the system in the vicinity of Elyria, the longest line being 17 miles. The building was designed for double its original equipment, and only half the space, in both boiler and engine room, was occupied. The new equipment, now in operation and being installed, consists of sufficient turbine equipment to permit shutting down for the present, at least, all the direct-current machinery in Elyria and Rockport. As a matter of fact, the turbine equipment, when ordered, was designed to take care of the proposed extension from Wellington to Mansfield, a distance of 40 miles, in addition to the present system, but as the matter of building this extension has been held up owing to existing conditions, the new equipment will be more than ample to take care of the present system.



PLAN OF POWER HOUSE

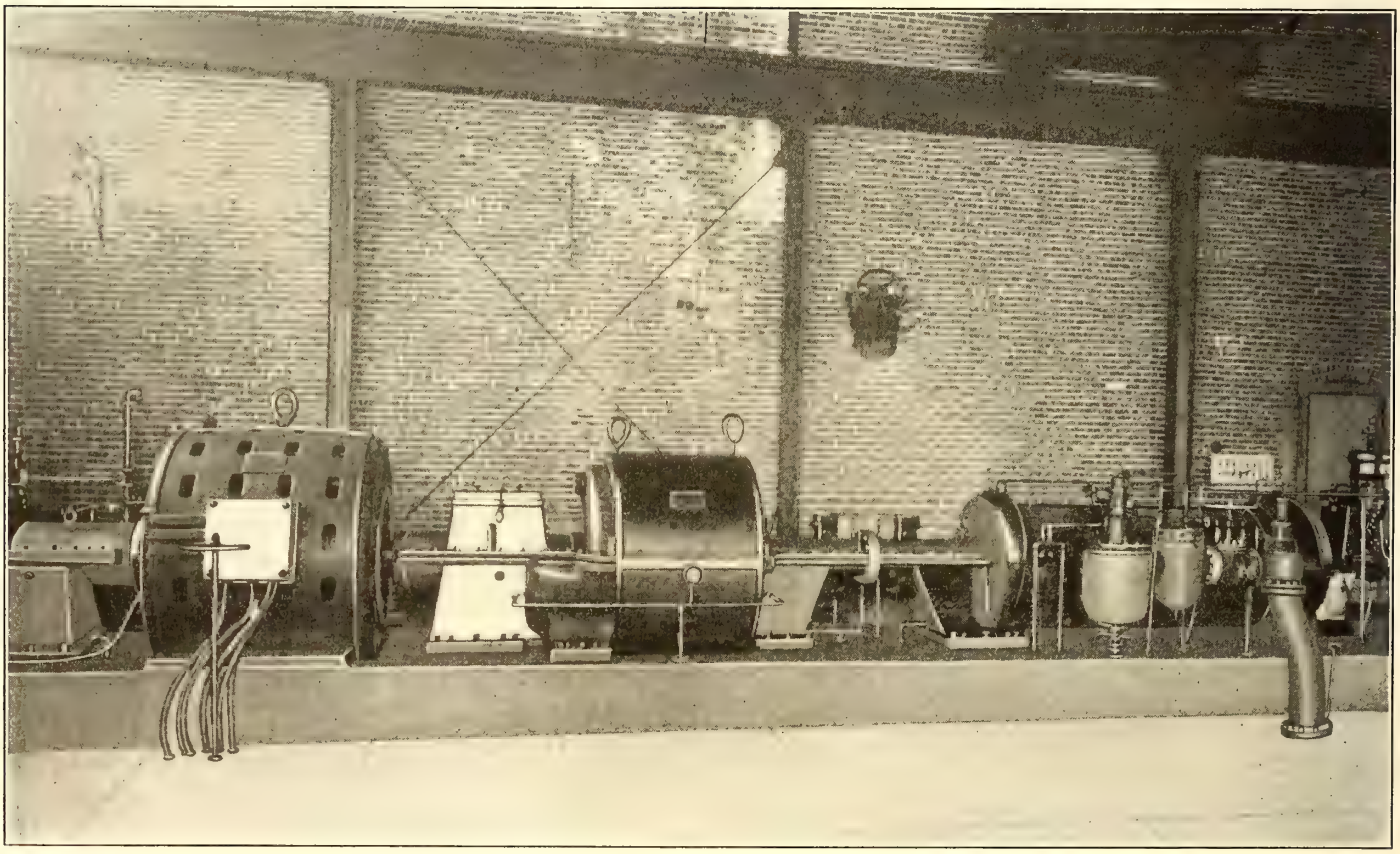
In looking at the plant the first thing that appeals to the observer is the small space occupied by the alternating-current equipment as compared with the direct-current equipment, kilowatt for kilowatt. With the turbine machinery the capacity of the station has already been tripled, and there is still room for a third 1500-kw unit in addition to the high-tension switchboards and transformer banks, which are located in concrete-lined compartments in the basement. It is further estimated that a saving of one-third in boiler-plant capacity will be effected through improved economy of the turbines, in addition to a saving of $2,900 upon each 1500-kw foundation.

The main direct-current units, aggregating 1000 kw, occupy 3200 sq. ft. of floor space, or 2.13 sq. ft. per electrical horse-power. The present turbine equipment of 2000-kw capacity occupies 1780 sq. ft., allowing for liberal passage ways, or .445 sq. ft. per electrical horse-power, a little less than one-fourth of the space required for the reciprocating engine units. Furthermore, space still remains for a future 1500-kw unit.

TURBINE EQUIPMENT

The turbines are of the Westinghouse-Parsons multiple-expansion, parallel-flow type, each unit consisting of three independent sections, namely, high-pressure cylinder, low-pressure cylinder and generator. Flexible mechanical couplings connect the several sections of the rotating shaft, and permit the removal of any section without disturbing the adjustment of the remaining parts of the unit. Steam distribution in the turbines corresponds somewhat to that of the tandem-compound engine. Steam enters through an automatic quick-closing throttle valve which operates only in case of emergencies, unless by hand, and passes through an ordinary throttle valve, thence to a removable steam strainer, which prevents all foreign matter, such as shreds of packing, boiler scale, etc., from entering and clogging the turbine, and, finally, steam reaches the admission valve at the side of the turbine cylinder. This valve is of the poppet type, and is operated by a small auxiliary cylinder, using high-pressure steam, in turn being controlled by a relay valve actuated by the governor. After admission, steam expands through successive alternate-moving and stationary blades, forming the expansion stages of the high-pressure as well as the low-pressure cylinders. Emerging from the high-pressure cylinder at considerably reduced pressure, steam passes through a separator, which removes all condensed steam, thence passing into the low pressure and through a steam cycle corresponding to that of the high-pressure cylinder. The exhaust steam passes vertically downward to the condenser.

The general construction of the turbine conforms closely to that of the single-cylinder type of Westinghouse-Parsons turbine. Both cylinders are neatly lagged with sheet steel, held in with polished steel retaining bands, the interior being filled with non-conducting material to reduce radiation. The turbine unit is mounted upon a cast-iron bed-plate of the box pattern, strongly ribbed inside to furnish sufficient rigidity to preserve alignment. Holding-down bolts are not used, as they are unnecessary. At the end of the high-pressure turbine shaft is an automatic speed limit. This is a centrifugal device, and may be set to release at any predetermined speed. It controls, with high-pressure steam, a quick-closing throttle valve in the main steam line, and serves to shut off completely the steam supply should the speed rise above the safety limit, due to the disabling of the governor. The speed limit may be operated by hand, by means of a small trigger, through which it may also be reset, and the quick-closing throttle opened to full port. The lubrication of the turbine is accomplished, as usual in this type, by flushing the bearing shells with oil under about $1\frac{1}{2}$-ft. head. This oil is circulated by a small pump positively driven from a worm gear which operates both pump and governor. For facilitating the starting of the turbine a by-pass around the throttle valve is provided, which permits the introduction of a small amount of live steam for warming up the cylinder walls and rotating parts. A by-pass is also provided between the first and second stages of the high-pressure cylinder, which may be opened in case of loss of vacuum. Full load may then be carried upon the turbine, running non-condensing. This feature also permits an



1000-KW STEAM TURBINE IN MAIN POWER PLANT AT ELYRIA

overload of 50 per cent to be carried while the turbine unit is operating with the usual vacuum.

The generator is of the revolving field type, and delivers three-phase, 25-cycle current at 400 volts. The speed of the unit is 1500 r. p. m., necessitating a two-pole field, which is constructed of annealed steel of the highest tensile strength, and has strap copper winding embedded in deep slots and retained by wedges. There are numerous air ducts, providing adequate ventilation. The armature stationary element is of the usual Westinghouse construction, but its diameter is much less than that of the ordinary slow-speed engine type machine. The generators may be easily synchronized by means of a single adjustment of the turbine governor, through which the speed may be raised or lowered as desired while the machines are running. This adjustment also enables a proportional load to be secured between two or more generators that are in parallel.

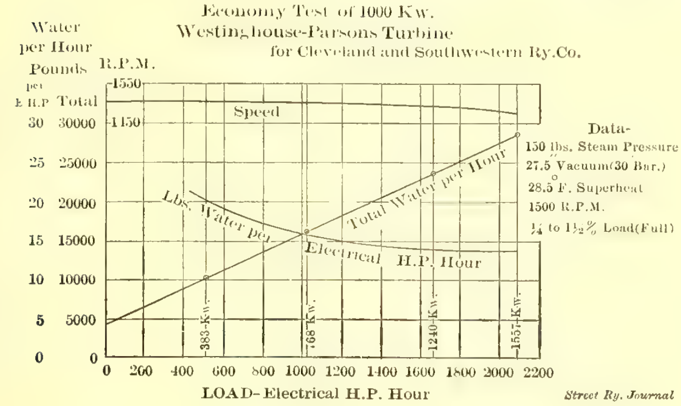


DIAGRAM OF TURBINE TESTS

A 30-kw, 125-volt direct-current exciter on the same bedplate is driven by a flexible shaft connection from the main shaft, which necessitates its running at the same speed. It is connected with the general oiling system. To overcome the variation in voltage of the main generator, due to cumulative effect of speed variation of the exciter, Tirrell regulators will be used in the exciter field. By means of series turns on the regulator these compensate for the drop in the generator and line voltage, so as to give a rising voltage characteristic. The use of a direct-connected exciter is somewhat of a departure from the ordinary practice.

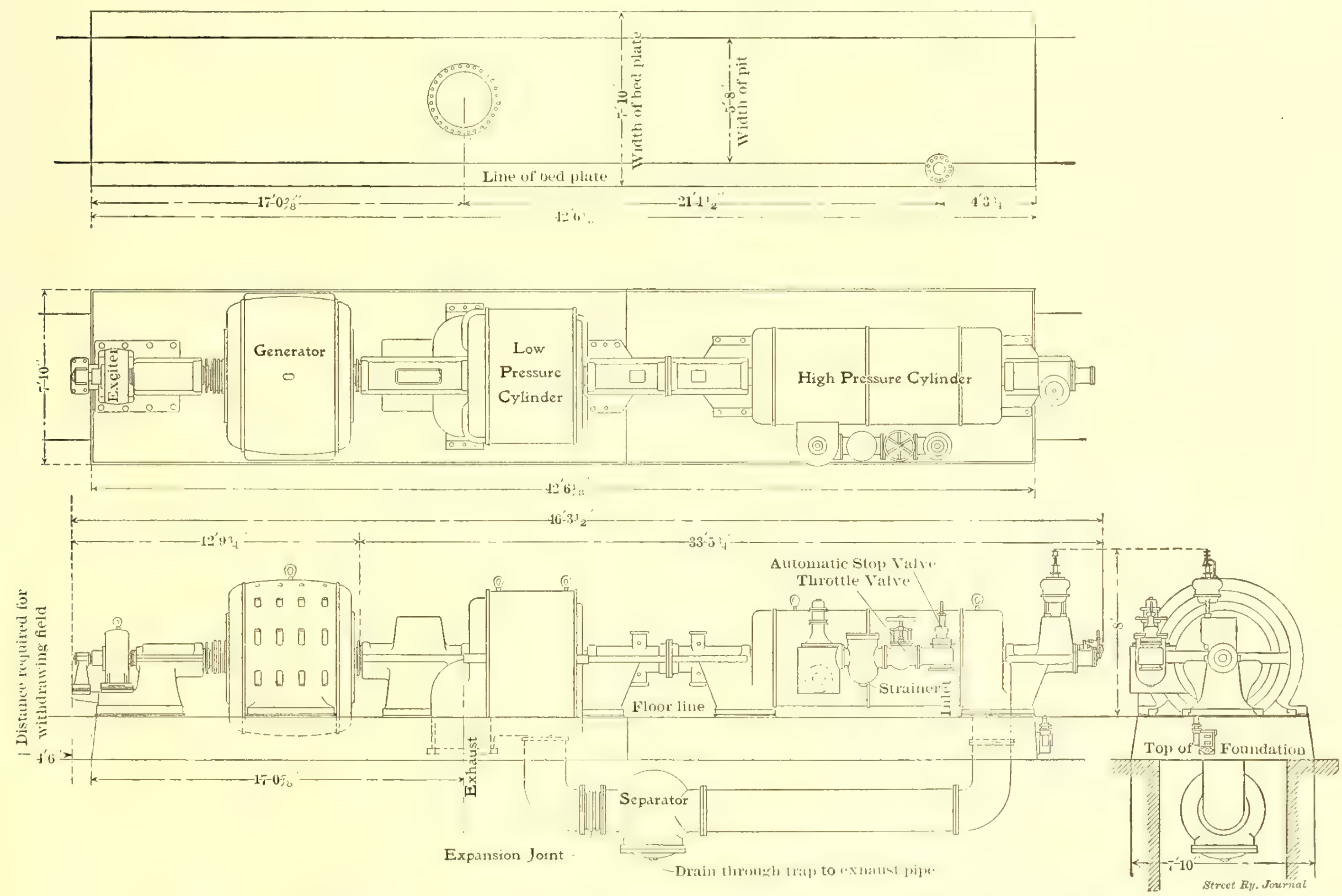
TURBINE TESTS.

The results of official economy tests conducted in the Westinghouse Machine Company's shops, at East Pittsburg, are given in the table herewith, and are shown graphically in the curve sheet, reprinted from the STREET RAILWAY JOURNAL of Dec. 19, 1903.

The conditions of the test were maintained approximately uniform throughout each run. The best economy was realized at a load of 1557 kw, namely, 13.668 lbs. of water per electrical horse-power-hour, this being equivalent to about 11.6 lbs. per indicated horse-power in a reciprocating engine:

TEST OF 1000-KW TURBINE FOR CLEVELAND & SOUTHWESTERN RAILWAY COMPANY

	NO. 31			
Number of tests..........	8	9	10	11
Load kilowatt............	1557.64	1239.83	767.94	383.36
Electrical horse-power....	2087.8	1661.96	1028.07	513.88
Throttle pressure per gage	145.95	144.25	147.55	155.05
Vacuum, actual, inches...	27.6	26.64	26.58	26.67
Vacuum, referred to 30-in. bar	27.48	27.52	27.46	27.55
Superheat at throttle, degrees, F..............	28.0	28.4	27.6	29.95
Revolutions per minute...	1475.6	1490.5	1502.6	1507.3
Total water, pounds......	28536.8	23180.7	16506.6	10302.0
Water, per electrical horse-power-hour, pounds..	13.668	13.94	16.05	20.04

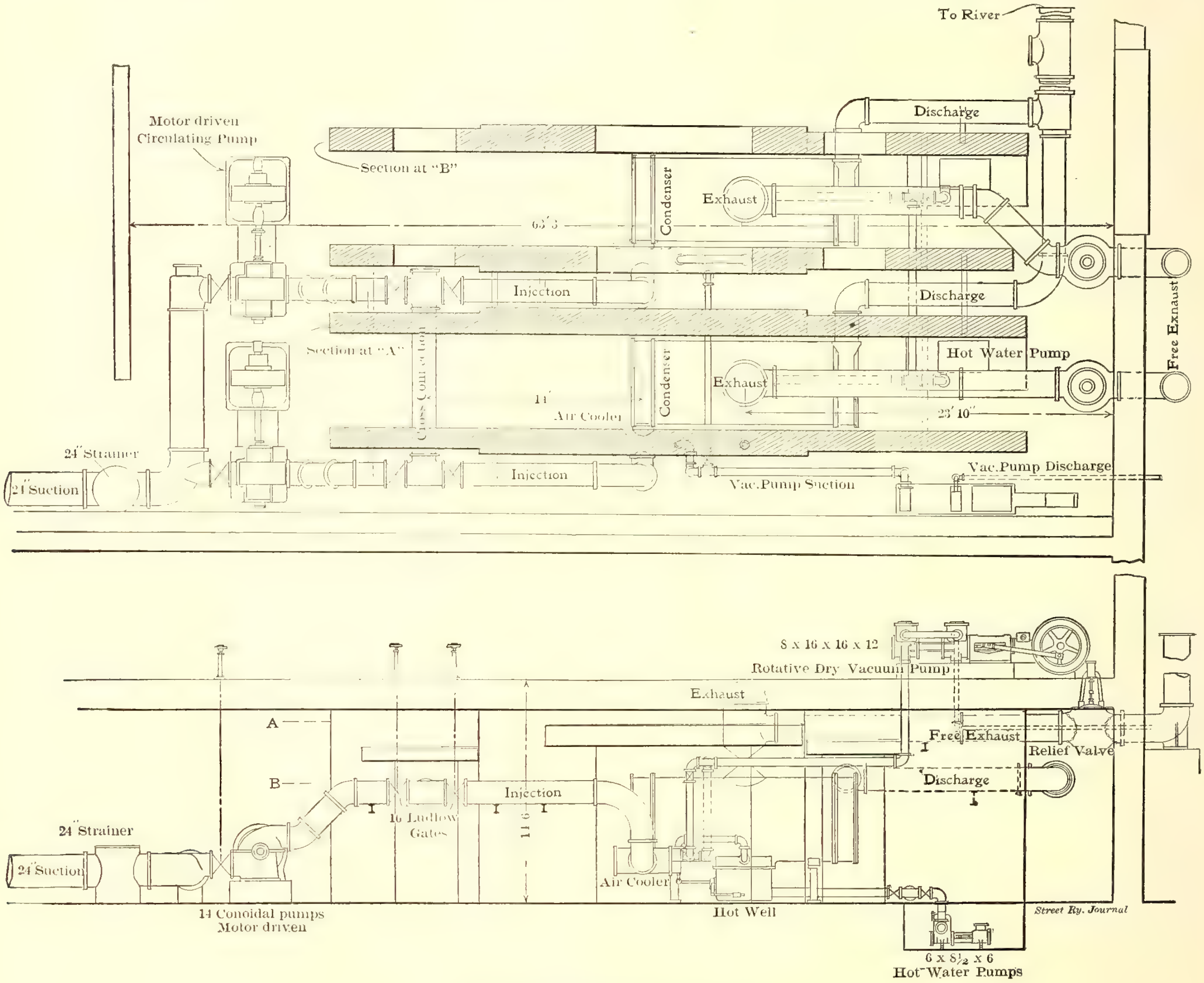


1000-KW STEAM TURBINE AND ALTERNATING-CURRENT GENERATOR, 1500 R. P. M., 3000 ALTERNATIONS, 400 VOLTS

The arrangement of the foundations and condensing system

is clearly shown in the plan reproduced herewith. As in the case of the engine plant each unit is equipped with an independent condenser, but the circulating water and other pumps are used in common by both units. A striking feature of the installation is the foundations. In the plan the two turbine foundations have been sectioned at different levels to show the area required for supporting the dead weight of the turbines. The foundations consist of concrete walls, slightly battered and varying in thickness from 17 ins. to 21 ins., and approximately 12 ft. 9 ins. in height. A heavy concrete plate, resting upon a bed of hard-pan, constitutes the foundation footing. The openings in the foundation walls accommodating side, which will keep the tube in place, and, at the same time, permit it to expand and contract freely. It also makes it possible to remove any tube readily or replace any stuffing box in case of leakage. At the point where the steam enters the condenser there is a baffle-plate to distribute it and relieve the tubes of its impact. Both condensers have suitable hot wells, with floats controlling the steam throttle to the pump, which removes the condensed steam and delivers it to the main hot well, from which it is returned directly to the boilers.

In connection with each condenser there is an air cooler to precipitate all moisture from the air before it reaches the air or vacuum pumps. This cooler is of the surface type, and is



TURBINE CONDENSING APPARATUS

piping, and the air cooler are spanned by steel beams. Each foundation wall is one solid piece of monolithic construction.

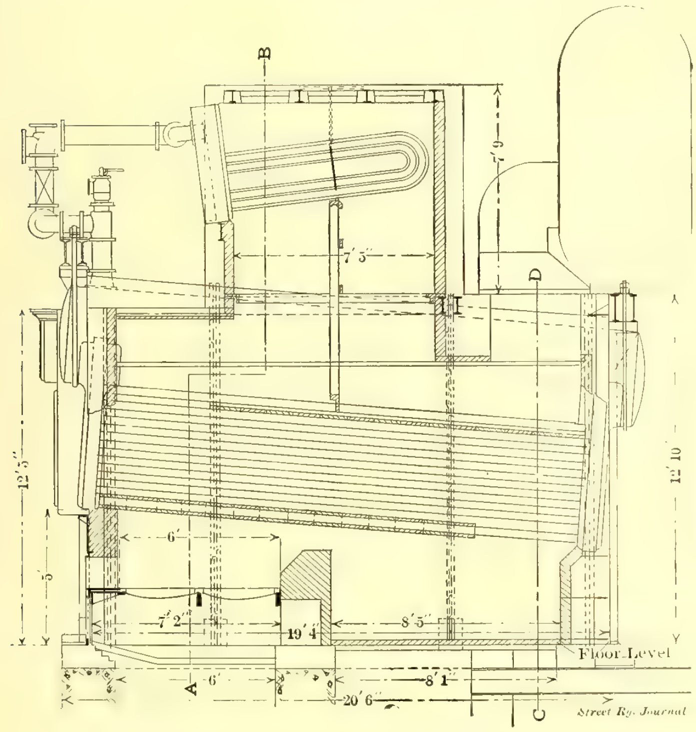
CONDENSERS AND PUMPS

The condensers, which are of the Worthington surface type, cylindrical in form, and measuring 8 ft. x 15 ft. over all, are located directly under the turbines, between the foundation walls, resting on the same floor bed, and with their intakes directly under the turbine discharges. This makes an extremely short passage for the exhaust steam, and reduces friction losses to practically zero, which in condenser connections of the usual length is quite considerable. It also utilizes space which would otherwise be wasted. Each condenser contains 3400 sq. ft. of cooling surface, consisting of 1110 1-in. brass tubes, made of seamless tubing. The ends of these tubes are straight, and pass through stuffing boxes in the tube heads, each stuffing box being provided with a gland having a lip on the in-

placed in the path of the circulating water just before it enters the condensers, so that the air is thoroughly cooled on its way to the pump, and all water is condensed and removed. This operation places less work on the pump, and it gives a greater efficiency, at the same time securing a temperature nearer that corresponding to the vacuum carried. These results cannot be obtained by extra surface within the condenser where the vapors are still in contact with the water, or by passing vapors through sheets of water, which only guarantees saturation.

The vacuum pump is located on the engine room floor, and is driven by steam. It is of the two-stage type, 22 ins. to 25 ins. of vacuum being taken care of in the first cylinder and the remainder in the second cylinder. It is hoped in this way to reduce the leakage past the valves to a very small amount, even after the pumps have been in operation a long time and the parts have become worn. The pump has two heavy fly-wheels.

The circulating pumps are located in the basement with the condensers, and are of the centrifugal type direct-connected to 40-hp, direct-current 500-volt motors, the latter being operated from a switchboard located above on the engine room floor. The pumps are cross-connected so that each will supply either condenser. The circulating water is pumped from the cistern adjacent to the power house, through the condensers and back again to the river, discharging water so that there is a syphon effect, the only work required being that in overcoming the friction in the pipes. These centrifugal pumps are of a special form known as the conoidal type, with double-suction and diaphragm impellors, which may be removed without dismantling the pump. The impellors differ from those in ordinary use, in that they are of comparatively greater length and small diameter. The construction is that of two inverted cones, their bases meeting in a diaphragm in the center of the pump casings.



SECTION OF BOILER SETTING, SHOWING SUPERHEATER

On these cones are cast radial vanes of such shape as to maintain direct water ways and secure the highest efficiency.

The hot-well pumps are steam driven; the water of condensation runs to them by gravity and is pumped into a closed hot well, particular attention being paid to excluding the air from this water so that the pipes may not be attacked by chemically pure water impregnated with air. The relief valve is operated by a water piston, which is automatic, or may be operated by hand. Each condensing equipment will condense 22,500 lbs. of steam per hour, and maintain a vacuum of 27½ ins. with circulating water at 70 degs. F. At lower temperature, 28 ins. vacuum or more will be carried. All water piping is of cast-iron of large size. Particular care has been taken to leave all passages free. The floor underneath the condensers is made with 4-in. conduit tile, covered with 2 ins. of cement, frequent drain holes being opened down to the tile. The floor above the basement is composed of iron plates of special design, to admit a large amount of air and ensure good ventilation.

BOILERS

Steam for the additional equipment is furnished by three 500-hp Heine water-tube boilers, the rating being based on 10 sq. ft. per horse-power. In order to reduce the height of the boilers and also the size of the plates in the legs, the requisite surface was obtained by using two 250-hp boilers set up close together as one boiler. C-shaped tile, which completely encircle the tubes, are used on the lower row, while ordinary tile baffling plate is used below the upper row. At present the boilers are hand fired, but arrangements have been made for putting in stokers. Grates are of the herring-bone type. The boilers are suspended from iron work, no weight resting on the walls. There is space in the room for another 500-hp boiler, and ample space for getting at tubes conveniently in the rear and also between each battery.

Above the boilers and supported by them are superheaters, which are composed of a number of bent tubes fitted into a boiler-plate head. They are known as the Schmidt type, and were built by the Heine Company. The gases, after going through the boilers, pass through the superheaters and then to the smoke flue. There are dampers by which the amount of gases may be regulated, also vertical openings in the side walls of the boilers leading from near the bridge wall directly to the superheater, so that the hot gases may be taken directly. Openings are left in the side walls of the superheaters so that soot and ashes may be blown out. The superheaters are easily accessible for the removal of tubes and other repairs, and each is built to give 75 degs. superheat when the boiler is running full load.

The plans for the piping were laid out so that the boilers may be run with or without superheaters. The boilers have safety valves so piped as to discharge steam into the open air outside the house. Automatic Foster valves are located at the points where steam starts for the header, and these are so arranged that they will automatically shut off the boiler if the pressure in the boiler goes down, if a tube breaks, or in case of breakage in the header or steam piping at any place in the house which would produce a sudden rush of steam. At several points in the engine and boiler rooms are valves operated by hand, which will shut off all boilers. All fittings on the piping and the header are extra long Crane type. No sharp bends that were avoidable were used, and care was taken to get long radius curves. The header and pipes to the turbines were made quite small, since it is expected always to run with superheated steam and with a continuous high velocity of flow. This latter is rendered possible by the nature of the turbine, which takes steam practically continuously, and not only a quarter of the time, as with reciprocating engines. The different character of the two systems is vividly shown by comparing the new header, 12 ins. in diameter, and the old one, which is 24 ins. in diameter. The two headers are connected by a U-bend, with valves for cutting apart. Another valve is located in the header so as to cut it at a point between the first two 500-hp boilers and the third boiler. There is a cross-connection provided with valves, however, between the pipes feeding the two turbines, so that they may feed from either end of the header.

The boiler feed pumps are located in a large open pit on the basement floor. There are two low-pressure suction Laidlaw-Dunn-Gordon pumps, which take hot-water from the hot well to the heater. From the heater the water flows by gravity to two outside-packed plunger-type outside-valve Worthington pressure pumps. All pumps are cross-connected so that any of the four can be used on the boilers or for suction purposes. The water for the old boilers goes to a Hoppes purifier, from which it runs by gravity to the boilers. On the new portion, and on all the plant when only the turbines are running, it is arranged to use condensed water practically as fast as it can be supplied, a small hot well under the foundations taking the water when there is a surplus. The heater is of Hoppes open type, of sufficient size practically to condense all the steam from the auxiliaries.

TRANSFORMER ROOM

Six 350-kw oil-cooled Westinghouse static transformers are located in a separate room along the basement wall, nearly under the high-tension board and near the turbines. The floor above the transformers is made of iron floor plates which are

designed so that excellent light and ventilation are always to be had. These plates can be taken up readily and the transformers handled by crane. The transformers are provided with a number of taps by which the voltage may be varied in steps up to 10 per cent. They are designed for 25-cycle current, and increase the voltage from 390 to 20,000.

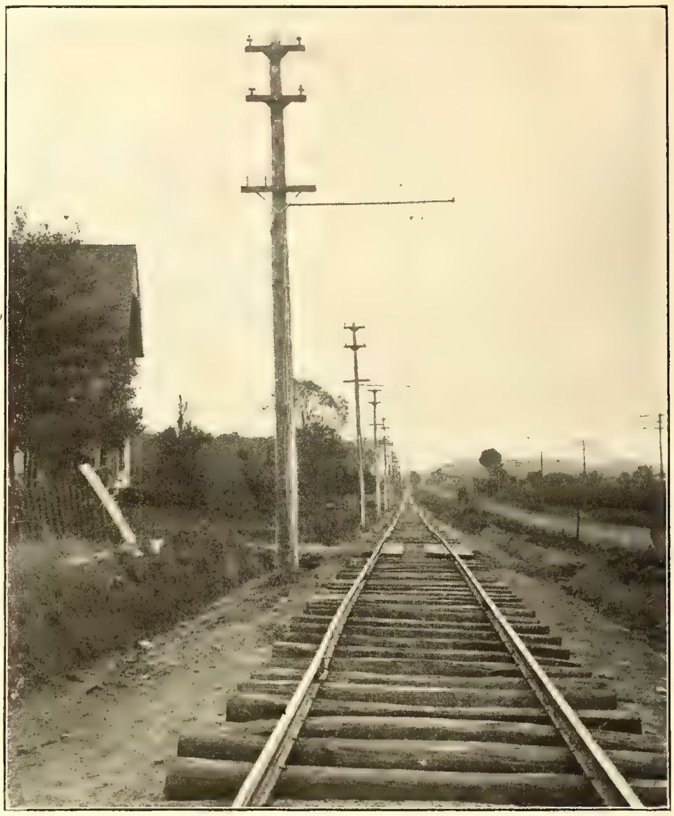
WIRING PLANS

All the low-tension wiring is copper cable, rubber insulated and encased in lead. It is suspended from the ceiling in iron racks, the lead itself resting on light wood strips to prevent abrasion. The current goes from the generators to the low-tension board, where it may be thrown to either one of two sets of three-phase bus-bars. From either of these sets of bus-bars it can be lead to any of the transformers.

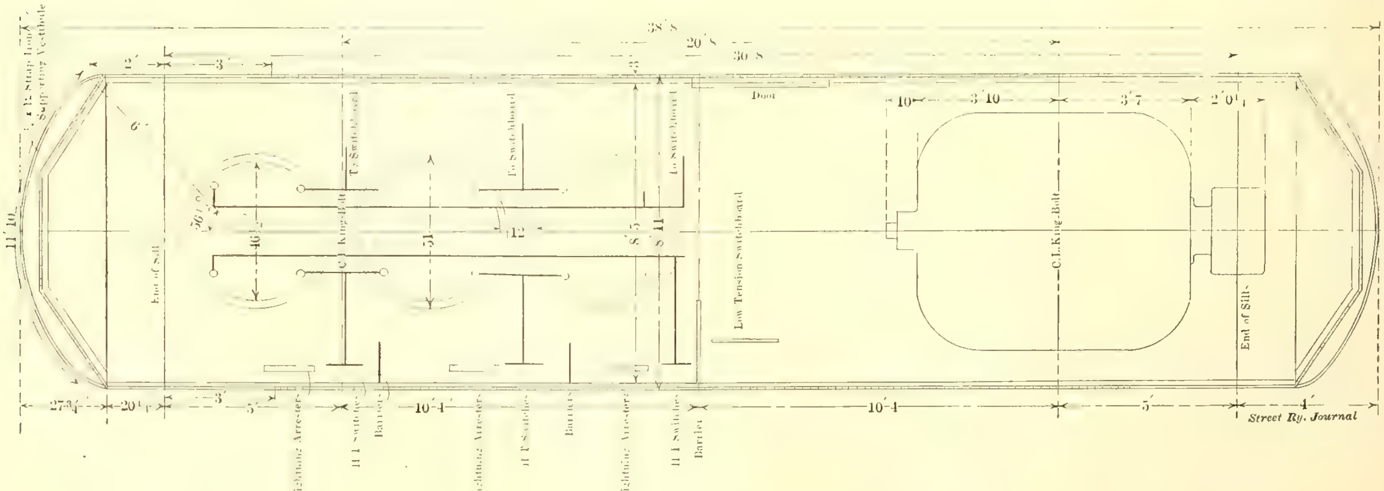
SWITCHBOARDS

The low-tension board consists of one double-exciter panel, two 1500-kw generator panels, one load panel, two 1500-kw transformer panels, two delta panels, to be located in the basement near the transformers. By pulling any one of the double pole switches on the delta panel one of the transformers can be cut out and the other two left connected. The two exciter panels control the direct-current exciters on the generators. These are arranged so that either exciter may feed either or both generators. Wattmeters on the front of the board measure the energy produced by each exciter. The two large generator panels are arranged to indicate the number of amperes produced, take care of circuit breakers which are non-automatic, and support the wiring for synchronizing. They also have power factor meters and double-throw switches for throwing to either set of bus-bars. The load panel has totalizing ammeter, integrating wattmeter, voltmeter, Bristol recording ammeter and fuses for station lighting. The transformer panels are arranged to show the amperes going to the transformers, and are equipped with automatic circuit breakers and time-limit relays. There are double-throw switches to take current from either set of bus-bars. Only the upper set is connected with the load panel, the lower set being intended only for use when the generators are run separate, as in lighting work, or when an accident has happened to the upper set. Synchronizing meters are used instead of lamps to throw the two machines in step. The board has a connection with the old board controlling the rotary converters in the station, so that the two rotaries may be run from either the alternating-current generators as rotaries or from the direct-current machines as inverted rotaries.

The high-tension board consists of three complete sets of Westinghouse fuse-type pole switches, mounted on an iron frame with large marble barriers between them, which are also supported from the iron framework. The wiring is carried on porcelain insulators, the pins being set in blocks of wood, which are attached to the iron framework. The advantage of this construction, it is said, is that any of the woodwork might burn without destroying the efficiency of the balance of the board or doing more damage than the dropping of the one pin attached to the block that burned. The wiring is copper cable covered with 11-32 of rubber, and the cable covered with four layers of special non-combustible fibre. In all the wiring plans provision was made for carrying conductors on insulators as though it were bare. There is a regular system of high-tension bus-bars, which can be cut in two when the current is off by very long-break knife switches, mounted on porcelain insulators. The high-tension current is measured by instruments placed in grounded secondaries running from series transformers in the main circuit. Stanley static ground detectors are used. Below the floor, and near the high-tension side of the transformers, are located the delta high-tension switches. These are of the long-break knife type, arranged to be operated only with the current off. They are mounted on heavy insulators with marble



LINE CONSTRUCTION



PLAN OF PORTABLE SUB-STATION

barriers around them. The lightning arresters are of the Westinghouse low-equivalent type with large condensers. They are placed above and back of the high-tension switches, just low enough to give ample space between them and the overhead crane. The condensers are set on the engine room floor back of the high-tension board. To permit the engine-driven generators, which are over-compounded, to work in parallel with the rotaries when it is desired to deliver direct current from the latter, kicking coils are put in series with the alternating-current leads of the rotaries. By this provision current is lagged sufficiently so that with an over-excited field on the rotaries the alternating-current voltage will be boosted by the series turns on the rotary fields so that the resulting direct-current voltage on them will be the same as that of the direct-current engine-driven generators. The kicking coils stand on the engine room floor back of the high-tension board.

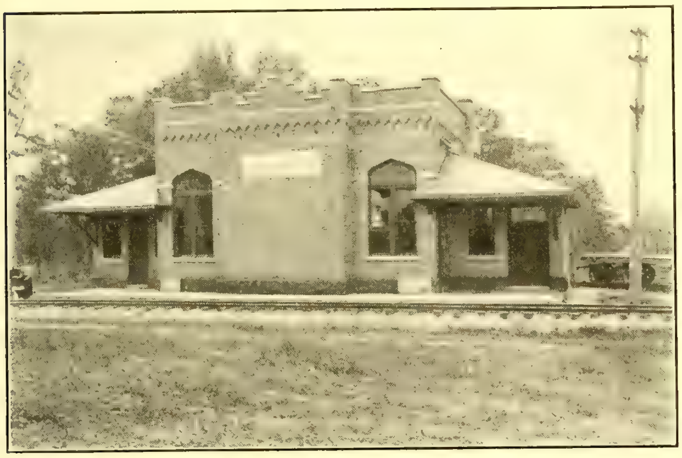
A 20-ton hand-power crane, built by the Brown Hoisting Machine Company, of Cleveland, and provided with two cars, covers the entire engine room. Care has been taken in designing the machinery to arrange the basement so that all heavy pieces can be handled by taking up the floor.

TRANSMISSION

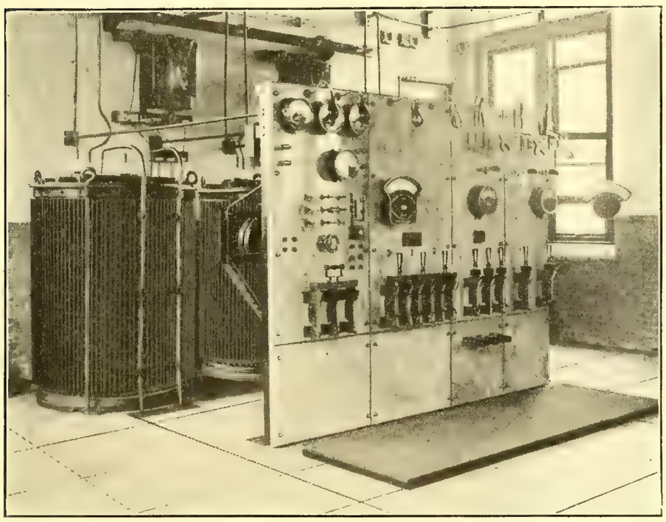
The high-tension lines are built uniformly with 35-ft. poles set 6 ft. in the ground. The three-phase lines are No. 3 and No. 4 wire, according to requirements, a portion of it copper and a portion aluminum. Four wires are used on each circuit, all boards being arranged so that the fourth wire can be used when there is trouble on any of the other three. Locke No. 3 brown porcelain insulators, mounted on iron pins with wood tips boiled in paraffine, are used. Cross-arms are standard, 3¼ ins. x 4 ins. x 42 ins. Frequent troubles with iron cross-arm braces has lead to the use of a triangular-shaped wood brace soaked in carbolineum to prevent cracking. Poles are spaced 100 ft. apart, and in ordinary cases the lines are used on the poles carrying the trolley brackets, telephone wires, feeders, etc. The high-tension line supplying the southern division of the system runs across country from Elyria to Brunswick, a distance of about 18 miles.

PORTABLE SUB-STATION

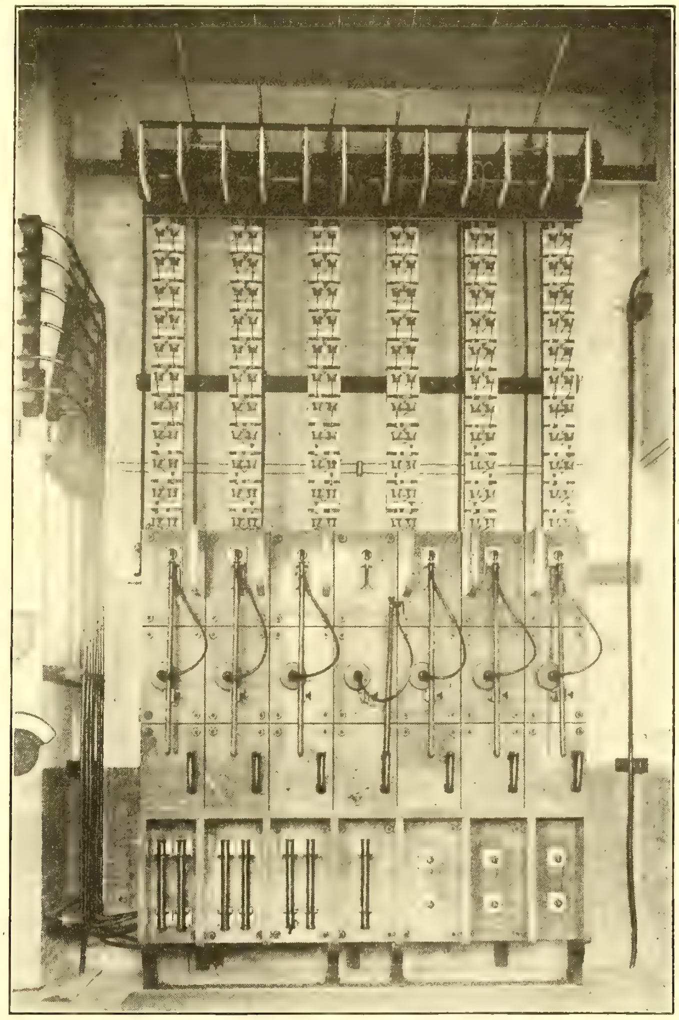
During the recent unsettled condition of the power equipment the company maintained, to great advantage, a floating sub-station. This consisted of a sub-station equipment installed in a plain and heavy car body, which was built in the company's repair shops. It was fitted with M. C. B. freight trucks without motors, and it was pushed to any portion where extra power was needed. For some weeks prior to the writing of this article it was located at the car house in Berea, where it was helping out the Rockport power station in supplying the northern portion of the southern division of the system. Unfortunately, a few nights ago, the car house, with all its contents, including the floater, was destroyed by fire. As the car was found to be of immense value in maintaining the voltage at points where there were excessive loads, it is probable that it will be replaced as soon as possible. The arrangement of the equipment and the wiring of the car are shown in the accompanying plan. The high-tension lines enter through holes on the outside near the top and pass to long knife switches, and from there to three 110-kw round-type oil-cooled Stanley transformers. Westinghouse low-equivalent lightning arresters were mounted back of the transformers. The low-tension wires



EXTERIOR



SWITCHBOARD AND TRANSFORMERS



HIGH-TENSION CIRCUIT BREAKERS AND LIGHTNING ARRESTERS

CHIPPEWA SUB-STATION

were rubber insulated lead-covered cables, and were carried along the side of the car to a 300-kw Westinghouse rotary converter at the other end. Numerous marble barriers and a liberal amount of asbestos board were used to prevent fire.

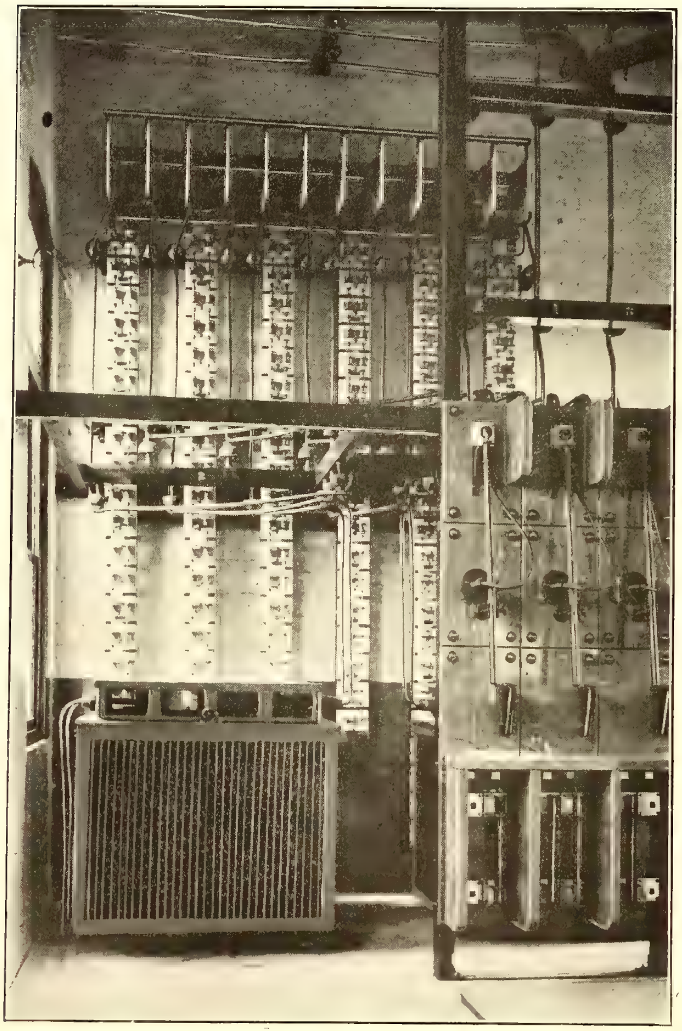
OPERATION

The ultimate plan of operation provides for the abandonment of the direct-current power stations at Norwalk and Rockport, and the installation of sub-station equipments in these houses. The alterations at Norwalk will probably be made in the near future, and 450 kw of converters and transformers will be installed at this point to take care of the local lighting load as well as the western end of the Norwalk division of the road. The Birmingham sub-station has a 300-kw rotary, while the 600-kw rotaries in the main power station will take care of the balance of the Norwalk division and the spur lines radiating from Elyria. On the southern division there are 300-kw outfits at Berea (the floater), 600 kw at Brunswick, 300 kw at Chippewa and Madisonburg, a total of 1500 kw on this division, making a total of 3150 kw of sub-station apparatus. It is hoped that one of the 1500-kw turbines will be able to supply the average load for these sub-stations, leaving the direct-current apparatus in the main station in reserve for accidents to other turbines.

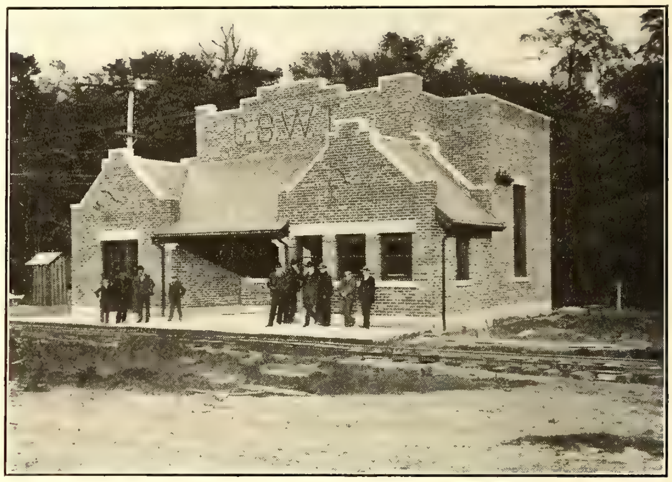
SUB-STATIONS

The Birmingham and Brunswick sub-stations are equipped with standard Westinghouse apparatus. They were described and illustrated in the STREET RAILWAY JOURNAL of June 27, 1903. In providing for the extension of the southern division to Wooster, recently placed in operation, two very fine sub-stations were erected, one at Chippewa Lake and the other at Madisonburg. The buildings are designed for passenger and freight stations, and architecturally as well as structurally they are above the average of stations of this kind. Practically no wood enters into their construction. The walls are of brick with Bedford sandstone trimmings. The roof is supported on I-beams, and is constructed of expanded metal laid with cement. The foundations are brick and concrete, and the floors are concrete and tile on shale surface. The foundations for the rotaries are built into the floor. There is a covered gutter extending around the edge of the floor for placing large lead-covered leads which cannot be bent at sharp angles.

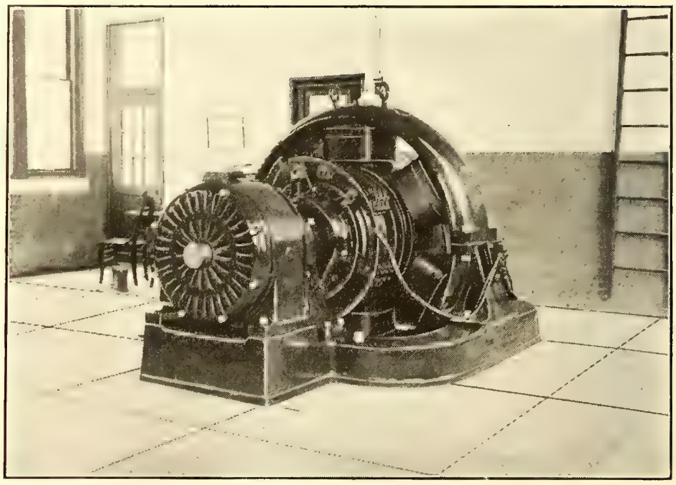
The entire electrical equipment for these sub-stations was installed by the Stanley Electric Manufacturing Company, and it shows a number of features out of the ordinary. Each station has installed one 300-kw, 25-cycle, six-pole compound-wound rotary converter, which takes current from the transformers at 397 volts alternating current, and delivers it at 650 volts direct current. The machine is over-compounded 10 per cent and is designed to withstand a 50 per cent overload for 4 hours, and a 100 per cent overload for 3 minutes. The machine is set very low, and the floor below is cut out, affording good ventilation. The armature and commutator are unusually large for a machine of this rating, the former being 40 ins. and the latter 35 ins. in diameter. The bearings are very long, and have ring oiling devices. The brush holders are of the radial type. The pole tips have not the massive copper bands common with other makes. The iron of the pole faces embrace nearly the whole of the armature surface. The makers claim this prevents the enormous rush of current when the machines are thrown in somewhat out of step, and also prevents the flashing of the machine. These converters may be readily synchronized, and it was not necessary to install synchroscopes. The



TRANSFORMER AND HIGH-TENSION ROOM



EXTERIOR VIEW



ROTARY CONVERTER

MADISONBURG SUB-STATION

armature and field insulation is designed to withstand a pressure of 3500 volts for 5 minutes. On the extended shaft of the direct-current end there is a 30-hp induction starting motor, also space for a pulley, as the machines were previously used as belted generators. The static transformers are in the rear of the high-tension switchboard. In the Chippewa station, they are of the Stanley make, but in the Madisonburg station two Westinghouse transformers have been installed, and the Stanley transformers designed for this station were placed in the floater, as their shape was more suitable for this service. The Stanley transformers are of 110-kw capacity, and the cases are round. Vertical flanges are added for radiation. Thermometers indicate the temperature of the oil used in cooling. Taps are brought out to vary the voltage from 5 per cent to 10 per cent. Six heavy leads run from the low-tension sides to three pairs of alternating-current switches on the low-tension switchboard, to give delta connection on the low-tension side. The low-tension cables are lead-covered, rubber insulated, and each passes through a separate conduit. The high-tension cables are heavy rubber-insulated, and are mounted on Locke No. 3 chocolate insulators. In all wiring behind the switches the lead is cut off 6 ins. above the floor line, and the cables are grounded at the end of the lead, in all cases, with the tin tissue method.

The low-tension board has four panels of blue Vermont marble, 2 ins. thick. The description of the board in the Madisonburg sub-station may be accepted as fairly representing the practice on all parts of the system. The alternating-current machine panel has one main three-pole machine switch of the quick-break pattern, rheostat, synchronizing plugs, three sets of voltmeter plugs, by which it is possible to get the machine voltage with the machine switches open and also any two bus-bar voltages; motor-starting switch for the alternating-current motor, throwing to the right on low voltage and to the left on high voltage, or directly across the bus-bar; voltmeter of the Stanley hot-wire type, phase indicator, synchronizing lamps, and three ammeters, the two outside being of 800-amp. capacity and the center the field ammeter. The next panel has three 1000-amp. quick-break switches, designed to cut in or out the secondaries of either of three transformers, the wiring being so designed that it is possible to run the station temporarily on any two transformers, or use the bank of three; a standard Weston station ammeter of 1200-amp. capacity, a Thompson recording wattmeter of 1200-amp. capacity, and a 24-hour chart Bristol recording ammeter. The third panel is the direct-current machine panel, and contains three cable plugs for temporary connection to the floating sub-station, which may be used in case of accident to the converter; three single-pole 800-amp. quick-break switches, the negative on the left, equalizer in the center and the positive on the right; voltmeter plug. Weston round-pattern station ammeter, I. T. E. overload and reverse current breaker of the single-pole pattern and 900-amp. capacity. In case of interruption of the high-tension current the breaker will throw, and will also throw on reversal of polarity to the converter. The feeder panel has two feeders installed. It contains one 1000-amp. quick-break switch, a 1000-amp. Weston round-pattern ammeter and a 1200-amp. I. T. E. breaker for each feeder. At the extreme right and top of the board is a swinging voltmeter on a bracket, registering a pressure of 750 volts. On the back of the board is mounted a Ward Leonard rheostat, a small transformer for board lights, resistances for voltmeters, ammeter shunts and lightning arresters. The bus-bar work is of the laminated type, and is extra heavy for mechanical strength as well as conductivity. The Weston ammeter leads are cylindrical pieces of fibre. All small wiring is fastened with small porcelain cleats, the board being drilled and plugged with lead or expansion bolts with lead sleeves. The potential voltmeter and pilot lamp leads are mounted on the extreme top of the board to eliminate all danger of fire or short circuit. Instruments are all copper finish.

The high-tension switchboard has seven panels. It is mounted on a paraffine-impregnated white ash frame. All marble on the board was boiled in paraffine. The board is made up of panels 16 ins. wide x 2 ft. high. It is insulated from the wood frame by hard rubber pads. The four left-hand panels have the incoming high-tension leads, and the four right-hand panels have the outgoing lines. The current on entering the station passes through pole-type switches at the top of the board, then through fuses, of which there are three for each leg of each of the three phases, in order to allow for delta connection. Four wires are used on all high-tension lines, and the fourth wire also has a fuse for possible short circuits. The six wires leaving the board go then to the lightning arresters, each branch passing through two kicking coils with path to earth in front of each coil. Wires go then to the static transformers, thus completing the high-tension circuit. The Stanley pole-type switches occupy each three panels in height, the upper having a plug finger mounted on a porcelain base with a hard rubber guide below it. The center panel has a flexible cable connection secured to the end of a pole with a clamp to hold it in place. The lower panel has a pocket for the pole when not carrying current. The principle of the switch is simply a flexible lead and flexible cable. The cable end is pushed up into a socket fitted to receive it. Each switch is separated by marble barriers. The fuses, which are mounted on the lower section of the board, consist of hard rubber tubes, in which the fuse wire is held. On each end of the tube is an enlarged chamber containing a carbon ball which is held at one side by means of the fuse. When the fuse volatilizes the ball drops down, covering the hole where the fuse previously passed, and thus ruptures the arc. The rapid expansion of gases, due to the volatilization of the fuse, throws up a tell-tale aluminum lid at the upper outlet of the tube, showing which fuse has blown. The fuses are in pairs, each pair having two legs of the delta connection. Each pair is separated from the others by barriers and from the pole switches by a shelf. The upper right-hand half of the board is devoted to four-pole switches controlling the outgoing lines, thus enabling this set to cut out lines beyond. The lower part of the right-hand side of the board has a switching device for using the fourth wire. These consist of three hook-type selective switches, arranged to be operated by means of a hook on the end of a pole. Each of the three switches is connected to one of the main incoming lines, and when thrown that line is connected to the fourth wire. Each of the switches is separated by marble barriers with a marble shelf above. The lightning arresters consist of six rows of standard cellular-type Stanley arresters, surmounted by twelve impedance coils, with a path to earth at the head of each coil, making four impedance coils on each line, and four paths to earth from the point of highest potential. About half-way down the arrester the circuits join, making two paths for each circuit; two-thirds of the way down they join again, making one path to each circuit, or three for the three-phase line. This plan provides thirty-two single arresters in series from each point of connection with the full voltage to ground. The ground is formed by one heavy wire running to the track and another to a large copper plate buried in wet ground and surrounded with charcoal.

To obviate the expense of installing a crane in each sub-station the engineer of the road designed a special portable crane, which can be taken to any point on a car and set up in a comparatively short time. Roughly speaking, it consists of a large saw-horse, standing, when set up, about 16 ft. tall, so as to clear any equipment in a sub-station. The top member forms a track upon which runs a carriage for a chain hoist. The legs and cross-pieces of the saw-horse are made of angle-iron, while the top rails are channels. The several pieces are fastened together with large bolts. The crane will lift about 4 tons, and

it has been found of great value in handling heavy equipment. All sub-stations have a track entering the building, so that large pieces of equipment may be handled directly from the car.

ENGINEERING

The entire design, purchase and application of all steam and electric equipment used on this system was carried out by W. H. Abbott, who for the last three years has been consulting engineer for the Cleveland & Southwestern Traction Company, as well as the other properties controlled by the Pomeroy-Mandelbaum group of interests. The present plans were made and the contracts placed when the steam turbine in America was at its very beginning, only one large machine being in operation, and that was installed in a lighting station. To commit a large railway proposition to turbines at that time might be considered rash, but is now looked upon as evidence of a far-sighted judgment, which the present generally admitted success of turbines proves. The long delay in completing the Cleveland & Southwestern turbines has robbed this plant of its true position, namely, that of being the first large plant in which turbines were definitely in operation in America, but there is little doubt that this was the first electric railway in this country to place contracts for large turbines.

TOURISTS AND CALIFORNIA ELECTRIC ROADS

The management of electric railway properties in California are alive to the possibilities of the trolley in connection with visitors on sightseeing excursions. In Los Angeles, for instance, one of the many tourists' bureaus has established a branch office at the Pacific Electric Company's ticket office, where tickets will be placed on sale which will allow stop-over privileges at the ostrich farm, and tally-ho rides at Pasadena. Another form of tickets will be good for the round trip to Pasadena, including tally-ho rides, and still another ticket will entitle the purchaser to a round trip to Pasadena, including admission to the ostrich farm. An observation car will be put in service running from Los Angeles to the ostrich farm and allowing 30 minutes at the latter place.

ELECTRICAL EQUIPMENT OF THE LIVERPOOL, SOUTHPORT & CROSSENS SECTION OF THE LANCASHIRE & YORKSHIRE RAILWAY

It will be remembered that little more than twelve months ago it was stated in this paper that the Lancashire & Yorkshire Railway Company, one of the important steam railroads of England, intended to electrify the portion of its line between Liverpool and Southport, and although at that time much of the detail of the work had to be decided, a start was made early last year upon the work, which has steadily and quietly progressed. The original scheme has since been extended, and a service at certain times of day will be given to the stations as far as Crossens on the north side of Southport on the old West Lancashire Line, so that the residents in these districts will eventually be able to go to and return from Liverpool and district without change of cars.

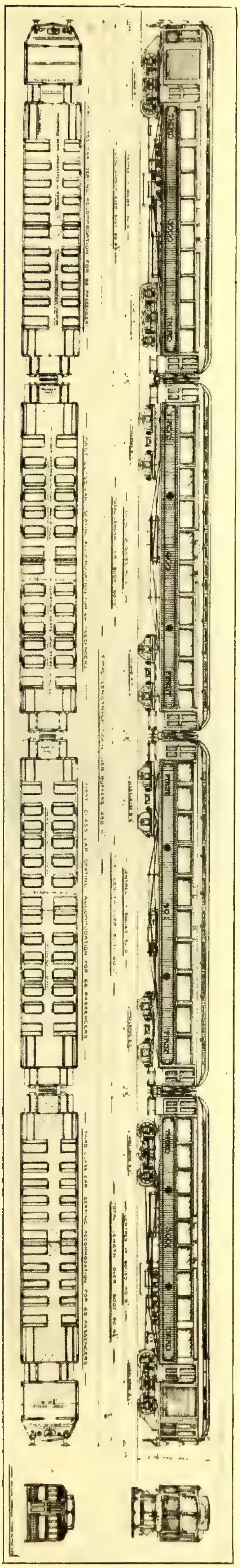
EXTERIOR OF FIRST-CLASS CAR

The track to be electrified amounts in all to about 23 miles of double line, nearly all of which has been completed, and all high-tension alternating cables have been laid. The sub-station buildings are all completed, and progress is being made with the erection of machinery which will be contained in them. The rolling stock is also in an advanced state, and is being fitted up with electrical equipment. The power house building is complete, and every effort is being made to get the machinery ready for operation early this year.

THIRD-CLASS CAR

Although some particulars have already been given of the scheme of electrification, a general description is appropriate at this time. Briefly, the usual train will be composed of two first and two third-class cars, the third-class cars of which are equipped with four motors of 150 hp each, making a total of 1200 hp per train. To operate these motors current is obtained from a third rail, which is fed with direct current at about 600 volts from four sub-stations, three of which are situated at Birkdale, Seaforth and Sandhills, respectively, and another in the main power house building at Formby.

The power station adjoins the railway, on the banks of the River Alt, at Formby, is a building 290 ft. long by 130 ft. wide, and consists of an independent steel structure, the steel



FOUR-CAR TRAIN ON LANCASHIRE & YORKSHIRE ELECTRIC DIVISION

stanchions of which, in addition to carrying the roof, support traveling cranes over the engine room, the spaces between the stanchions being filled with brickwork. It has two spans, one containing sixteen Lancashire boilers, 8 ft. 6 ins. in diameter by 32 ft. long, for a working pressure of 160 lbs. per square inch, together with superheaters, feed pumps, induced draught plant, etc.; the other and larger span contains four horizontal cross - compound condensing engines of 1500-kw capacity, also one subsidiary vertical compound condensing engine of 750-kw capacity, capable of taking large overload for short periods.

The generators in connection with these engines are of the three-phase type, with a periodicity of 25 and a voltage of 7500. The engine room also contains steam-driven exciters, sub-station plant and a main switchboard.

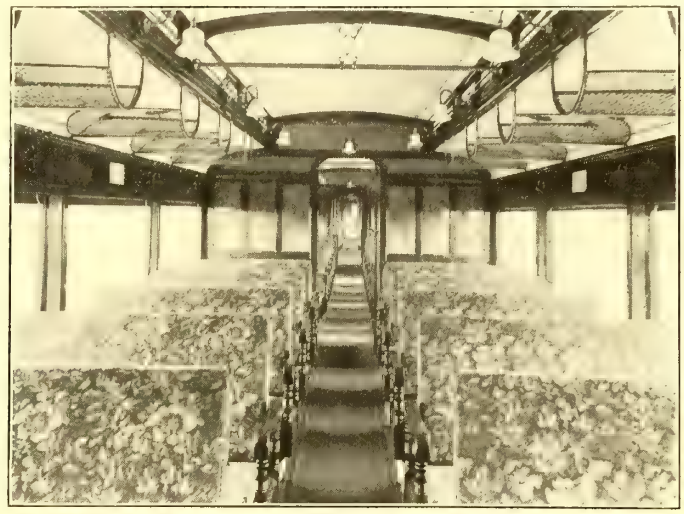
Three-core paper-insulated metallic-sheathed cables convey the high-tension current to the sub-stations, and are laid on the "solid system," at a suitable depth along the company's right of way.

Four rotary converters of 600-kw nominal capacity and 600 d. c. voltage, are provided in each sub-station, with three air blast transformers in connection with each rotary. The connections from these sub-stations to the third rail are made by insulated copper cables, run under ground in troughing.

The third rail is carried outside the track rails, and is supported at intervals of 10 ft. on insulators. The center of the rail is 3 ft. 11½ ins. from the center line of the track, and the top of the rail 3 ins. above the surface of the track rails, these being dimensions agreed upon between all the British railway companies.

The third rail is of special composition to secure conductivity, weighs 70 lbs. per yard, and is protected by a timber guard rail at points where there might be danger of accidental contact. To ensure a good return circuit a fourth rail, supported on wooden blocks, has been placed in the 4-ft. way, and bonded to each running rail; this method of return, it was thought, would interfere least with the running tracks, and would permit the easy removal of any running rail at any time

The cars differ from those used on the steam lines of the company, and were built especially for the service. They are 60 ft. long and 10 ft. wide, being the widest cars in Great Britain.



INTERIOR OF FIRST-CLASS CAR

This width was adopted because it was found before any operations were begun that it was possible on the Southport line, as distinguished from other parts of the main line, to have wider stock, some slight alterations to the track and some trifling ones to the platforms along this length alone being necessary. The cars have center aisles throughout, with vestibules to allow passage from one car to the next, according to the American practice.

The motor cars are run at the ends of the train, and are the third-class cars, and, as previously described, are equipped with

INTERIOR OF THIRD-CLASS CAR

two 150-hp motors on each truck, and with multiple-unit control. The front end has a small compartment for the motorman, containing all the apparatus for controlling the train; and near this is a baggage compartment, the remainder of the car being devoted to passengers. Most of the seats are cross-seats, and seat three on one side of the passage and two on the other, but at the ends longitudinal, to allow more room for passengers entering or leaving the cars. The seats are all covered with rattan, and are of the Hale & Kilburn walk-over type, supplied by G. D. Peters & Company. The interior of the cars is fitted with oak, giving a very light appearance.

The trailers or first-class cars have seats arranged after the same design, but only two on each side of the passage; they are upholstered in "epingle," the interior decoration being mahogany, with light wood panelling, and the roof covered with millboard. A four-car train will carry 270 passengers, the third class seating sixty-nine and the first class sixty-six people.

Perhaps it is well to mention that in order to run a satisfac-

TRAIN OF ELECTRIC CARS ON LANCASHIRE & YORKSHIRE RAILWAY

tory suburban service it is necessary that the delay at stations should be reduced to the smallest possible amount, and this will entail alterations in the method of dealing with baggage, as it is not to be expected that the electric trains can carry heavy luggage. Notice boards will be hung on the platforms showing passengers where to stand to await their class, and in order to ensure quick loading and unloading of passengers, strict regulations will be made that every passenger is to enter the carriages at the end door and leave by the front door, thus ensuring a continuous circulation.

In view of the alarm caused within recent months by fires on electric trains, it will be interesting to note that the company have taken all possible precaution against any such occurrence. The motor compartments have, with the exception of the roof, which is covered with sheet-steel plates, been lined with uralite, a well-known fireproof material, the floor also being fireproof. In addition, the cable conduits are lined with uralite, and the whole of the floor over the motors is covered with the same material and thin steel plates. All the trains also carry fire appliances.

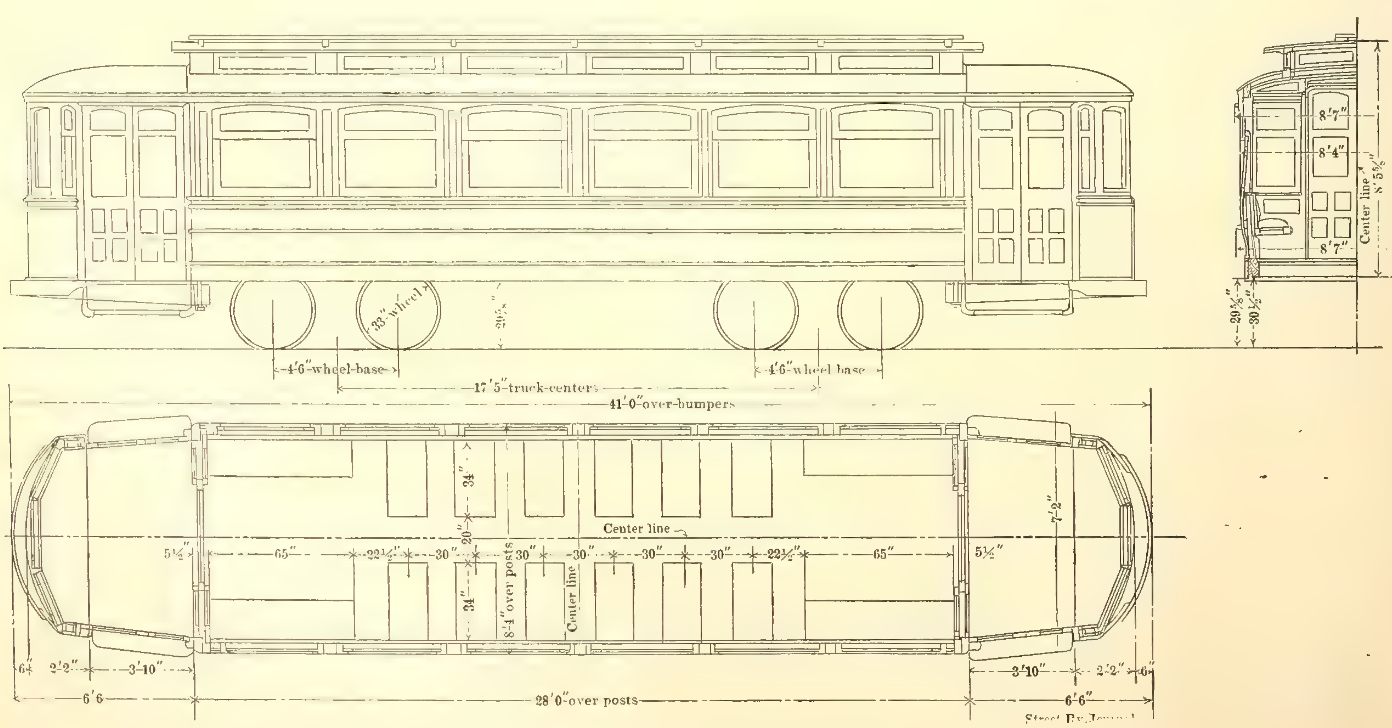
The vacuum brake used on the trains is, with some slight differences, the same as that used all over the Lancashire & Yorkshire Railway. It is fitted with quick-acting valves, but is provided with an electrical exhauster in place of the steam ejector on the locomotive. This is probably the first instance in Great Britain of the use of the vacuum brake upon electrically-operated trains.

The service will start with a 10 minutes headway in both directions between Liverpool and Hall Road, and every second train will run through to Southport. In addition an hourly express will run in each direction between Liverpool and Southport and at certain times the trains arriving at Southport from Liverpool will go on to Crossens. The accommodation trains between Liverpool and Hall Road and those between Liverpool and Southport will be run in less time than at present, but it is not intended that the expresses to Southport shall do the journey in less time than the fastest steam trains now running.

The whole of the work with the exception of the rolling stock, which is being made at the Horwich and Newton Heath Works of the railway company, is being carried out by Dick, Kerr & Company, Ltd., of London and Preston, who are now completing at their Preston works the main and auxiliary generators, the sub-station equipment, the control equipments of the trains and the rest of the electrical plant.

NEW CHICAGO UNION TRACTION CARS

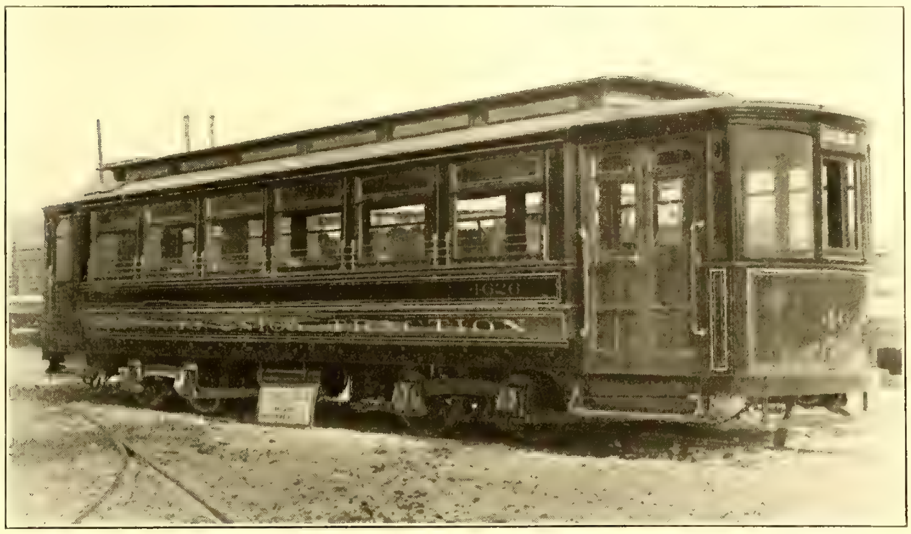
The 100 new cars ordered by the Chicago Union Traction Company from the St. Louis Car Company last fall, are now being received in Chicago. These cars are the semi-convertible type, and are the first of that type to be ordered by the Chicago



PLAN AND SECTIONS OF NEW CAR FOR UNION TRACTION COMPANY, CHICAGO

Union Traction Company, which has heretofore adhered to open and box cars. The seating arrangement is a compromise between cross and longitudinal seats, similar to that found in the standard cars of several other cities. There are cross seats for twenty-four persons in the middle of the car, and longitudinal seats at the ends for sixteen more, making a seating capacity of forty. The car has a 28-ft. body with a platform 6 ft. long on each end. The car is designed to carry a large standing load, both on the platforms and inside.

All the principal dimensions are shown on the accompanying plans. The side sills, which form the main support of the body, are 8-in. x 5-in. timbers, bolted to a 7½-in. x ½-in. steel plate. These side sills are strengthened with a truss rod of bar-iron, placed just below the window sills. The windows are very wide, and the posts are 54 ins. center to center. The cars are finished in cherry, with great simplicity and freedom from dust catching carvings or elaborate mouldings. The trucks are the St. Louis No. 47 short-wheel base city truck.



SIDE VIEW OF NEW UNION TRACTION CAR

The cars are being equipped with four G. E. 70 motors, of 40-hp each. This is a new design of motor, designed first for Milwaukee city service and specially adapted to inspection and repair from above without the use of pits. It is built on the same tlines as the G. E.

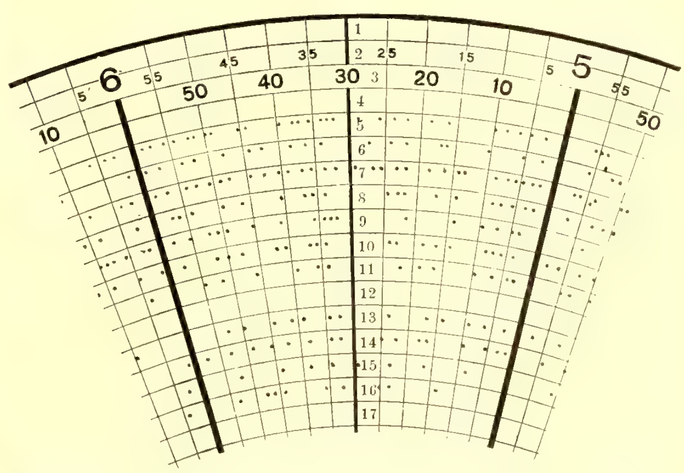
INTERIOR OF CAR

74 motor, which was described in connection with the new Milwaukee interurban cars in the issue of Sept. 5, 1903. The National Electric Company's Christensen air brakes are used on all these cars.

Stockholm's electric tramways, now in construction, are to be ready for use early this year.

NEW CAR-CHECKING SYSTEM OF THE BROOKLYN RAPID TRANSIT COMPANY

The Brooklyn Rapid Transit Company has adopted an ingenious method for recording the time when the company's surface cars pass a given point. It is an adaptation of a scheme originally devised by some of its officers for automatically checking elevated trains, and described in the STREET RAILWAY JOURNAL for Nov. 2, 1901. Its use on the elevated system has been discontinued, and the same machines are now employed for surface car registration. For this service the device consists of an electric clock with a revolving dial, over which is placed a circular sheet of paper, having especially arranged lines and figures on it. Each sheet may be used for 12 hours, after which it is replaced by another. As the motion of the dial is clockwise, the markings must, of course, be read from



PORTION OF BROOKLYN RECORD, SHOWING HEADWAY OF SURFACE CARS PAST A GIVEN POINT

right to left. One of the complete 12-hour charts is shown in the cut on the next page, while a sector, just one-half size, is reproduced above to show the method of marking.

The distance between each radius represents 5 minutes. The heavy black figures indicate the hours and the lighter figures around the edge of the sheet the minutes, the 5-minute intervals being represented by somewhat smaller figures than the 10-minute intervals. The figures from one to twenty-four, placed within the concentric circles, indicate the different divisions, the operations of which are to be recorded.

On the sector reproduced the car service on ten divisions are recorded. The inspector has before him ten push buttons, numbered to correspond to the route numbers used. These

buttons, which are operated like typewriter keys, actuate a needle which perforates the sheet, and so records not only the route but the time when a car passes the checking point. The rings nearest the center, which have small recording areas, are used for the lines traveling on long headways, leaving the large areas for those on short headways.

Two of these clocks are now in service—one in the starter's box at the foot of Broadway, Brooklyn, and the other in a special booth suspended from the elevated structure at Fulton and Court Streets. The men in charge of these clocks are in no danger of being kept idle, as many cars pass the points mentioned. Ten lines intersect at Court and Fulton Streets, over 400 cars an hour passing that point during the time of heaviest traffic. The check at both points will be made on cars going in one direction in the morning and in the opposite direction at night.

The check system enables the company to determine how closely the time-tables are kept, for by simply referring to the relative distance between the holes in each ring, the chart reader finds a graphic history of the traffic conditions on each line. Another benefit is that this system will furnish the company with a record of all delays. The same result could be

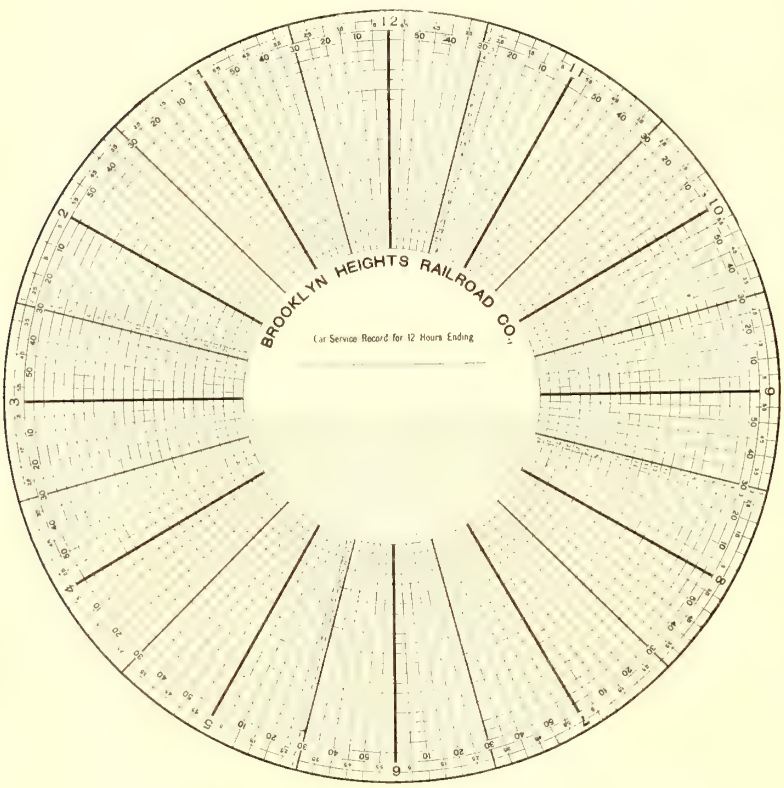


CHART USED IN CHECKING CARS IN BROOKLYN (ACTUAL SIZE OF CHART 22½ INS. IN DIAMETER)

obtained, of course, by pencil memoranda, but no one man could record the same number of cars in a given time by a much less rapid system.

If the present experiment prove successful the new system will be introduced at other important points.

Again have the impulsive Koreans sought vengeance on the trolley cars that are operated within the limits of Seoul, their capital city. This time, as on the previous occasion, the attack was incited because of the killing of one of the native residents. The prompt intervention of the authorities, however, prevented the mob from doing more than destroying one car. In the previous outrage two cars were burned and several demolished. The system is owned and operated by Americans.

THE POSITION OF THE TRACK ENGINEERS

SCHENECTADY RAILWAY COMPANY
Schenectady, N. Y., Jan. 19, 1904.

Editors Street Railway Journal:

The perusal of the editorial in the Jan. 16 issue of your journal, in which you touch upon the stand taken by the American Railway Mechanical and Electrical Association in reference to a possible extension of the scope of that Association to include all subjects relating to the construction and maintenance of the permanent way, has moved me to address you on the subject, in the hope that some way may be devised of arriving at the opinions of electrical railway men upon the subject.

I am a member of the Association in question, and at the Saratoga Convention raised the question which you discuss in your editorial. It was not difficult to see that the suggestion that the scope of the Association be enlarged met with very little response.

I took pains, however, to broach the subject to several railway managers who were at Saratoga, and each one gave it as his opinion that an extension of the work of the Association to include all subjects pertaining to track would be a distinct gain for the railways. At the New York State Convention, held at Syracuse a month later, I made some remarks to this effect when discussing a paper on "Track Construction," read by Mr. Wilson, of Buffalo.

I think it is not difficult to understand and appreciate the position taken by the mechanical and electrical engineers. The men who originated the Association, and who are now directing its affairs, are the heads of the mechanical and electrical departments of our larger street railway systems. It is very natural that this should be so. But it so happens that practically all these men are concerned with mechanical and electrical details only, and it is, therefore, fair to presume that the very interest which they manifest in their particular work prevents, to a considerable extent, their giving proper weight to the subject of "permanent way." I believe that I can speak with some understanding on this point, since I remember very distinctly the comparative indifference with which I viewed the mechanical and electrical side of street railway work when I was in charge of the roadbed only, and the quite different light in which the two subjects presented themselves to me when I assumed charge of the mechanical equipment as well as of the roadbed.

If our electric railway systems were as large as are the steam railway systems of to-day, and could their organization in all cases permit of division along lines similar to those followed on steam roads, it would then be possible to form within the electrical railway companies an association comprising the track engineers only. As the matter actually stands, however, there are few electric roads outside of those in the larger cities where the various departments do not overlap, and the functions of track, mechanical and electrical engineers are not infrequently exercised by one and the same person. In my estimation it would not be possible to create another self-supporting association comprising the track engineers only, and if they cannot affiliate with the association already formed, their organization will be indefinitely postponed. For a business growing so rapidly as is that of the electric railway this would be a distinct loss. Immense sums have been spent in the past ten years on poor roadbed, and will continue to be, undoubtedly, but a proper discussion of details can do much to effect economies in this direction. It requires no involved calculations to demonstrate that a very large per cent of the capitalization of an electric railway lies in its roadbed. Plenty

of roads are paying from $20,000 to $25,000 per mile of single track for track in city streets. There cannot be any question that the expenditure of such sums for permanent way demands the employment of the best possible methods if the railway company hopes to provide for renewals out of its income. Then again, high-speed interurban roads are giving rise to a number of questions that must be solved intelligently if the companies are to be spared the expense of making large future expenditures to correct what are soon proven to be false economies and poor engineering.

It would be altogether for the best interest of the companies if all their engineers were associated together to discuss all problems of construction and maintenance of plant. The great body of electric railway engineers in this country is vitally concerned in all the questions so embraced. They are entitled to a chance to discuss among themselves those questions which they cannot hope to discuss in the meetings of the American Street Railway Association. It was remarked at Saratoga that the members of the American Railway Mechanical and Electrical Association were much more concerned as to how a motorman uses his controller handle than they were in any question affecting the permanent way. This should be so only in the narrowest sense. The use and abuse of the controller is not without importance, but not many managers, I imagine, would place that question in the same category with the one of roadbed construction.

It doubtless seems to the mechanical and electrical engineers, as they are starting their organization, that they have more work before their Association than it can do justice to. I do not think this is necessarily so. At the start there will be much to do, but many of the questions now pressing will not be long in solving, and I believe that time can be found for the subjects that the track engineers will want to discuss. Moreover, it has been found in other similar organizations that work of the sort our Association has to do can best be handled by committees, and it may be found desirable to expedite the work we have to do in that manner.

The name of the Association is one of the things which, I presume, many of the present members would be loath to change, and it would not be essential provided that its scope could be. That is all I would care to contend for. As a suggestion, however, I think the name, "American Society of Electric Railway Engineers," would apply to an association embracing all the engineering features of electric railways, and would be uniform with the names "American Society of Mechanical Engineers," "American Society of Civil Engineers," etc.

As the engineers connected with electric railways have, I take it for granted, the interest of their respective companies primarily at heart, the opinions of the managers of those companies would have, I suppose, considerable value in determining the scope of our organization. It is to the companies we look for support, and I believe that should the managers be persuaded to pass their opinion, and should it be found favorable to the including of the track engineers in our Association, there would certainly be an added reason for so doing, for it is the managers who are best able to judge of the relative importance of the different features of their organization.

It is the hope that the STREET RAILWAY JOURNAL may find some way of obtaining an expression of opinion upon this subject that has led me to address this communication to you. The electric railways can, undoubtedly, continue to exist even though their track engineers are left to reach their conclusions unaided by the experience of others of their profession, but in my humble opinion the matter of their being included in the newly-formed association is one of some considerable importance to the railway companies, and I am led to believe by editorial above referred to that the STREET RAILWAY JOURNAL is similarly minded. C. C. LEWIS, Chief Engineer.

NORTHERN ILLINOIS ELECTRIC RAILWAY COMPANY

Dixon, Ill., Jan. 20, 1904.

EDITORS STREET RAILWAY JOURNAL:

I notice your editorial on "Track Work and the Master Mechanics," on page 87 of your issue of Jan. 16, and would like to suggest that if the men having charge of roadway design, construction and maintenance, do not find a ready welcome in the organization of the master mechanics (and it would be hard to discover a reason why they should) they might find an organization among steam road men that would fill their wants. I have in mind, particularly, the American Railway Engineering and Maintenance of Way Association.

This organization is only four or five years old, and was formed largely of steam road men, but a careful perusal of its bulletins, since my work has changed from steam to electric road work, convinces me that I cannot do better than retain my membership and carefully follow the discussions of the various subjects brought up in the association. I do not recall the exact requirement for membership, but am sure that any experienced engineer in charge of roadway work is eligible. Full particulars may be obtained by addressing L. C. Fritch, secretary, 1562 Monadnock Block, Chicago.

I mention this particular association because I am personally acquainted with its work, and know that it would be of incalculable advantage to electric railway men, though there are, doubtless, other organizations that would do as well for those who wish to follow out some specific part of roadway construction or maintenance, such as is covered by the Association of Bridge Superintendents, Road Masters' Associations, etc. When the electric roadway construction has become so specialized as to demand it, and men engaged in this work become strong enough numerically to warrant it, a separate organization might be formed. But until that time comes it would seem that a more suitable connection could be formed with men occupied in similar lines outside of the electric field than with those engaged in dissimilar work with electric railway companies. A. M. SHAW, Chief Engineer.

DOUBLE REGISTER RODS AND UNIVERSAL NAME STAMPS

Jersey City, Jan. 21, 1903.

EDITORS STREET RAILWAY JOURNAL:

The use of a register rod on both sides of a car would be of great convenience to the conductor, and would often save considerable time in a crowded car. It should be remembered that half of the fares are collected from each side of the car, and if there is only one register rod the conductor has to force his way back and forth to register his fares as he collects them. This always entails great annoyance to passengers and takes time, a serious matter in collecting fares, particularly in a crowded car.

Another way in which time could be saved, principally for the receiver's clerks, but also incidentally for the conductors, is by the conductors using a rubber stamp instead of writing their names on their day cards, trip envelopes, etc. It would not be necessary to have individual stamps, but one similar to that used for stamping dates would answer, if letters were substituted for the dates. The time required for setting the stamp and stamping the day cards and envelopes would be considerably less than that of signing one's name the same number of times, and the printed record would be very much easier to read in the office.

WILLIAM J. KELLY.

The New Orleans Railways Company publishes and distributes gratis an excellent tourists' guide to New Orleans. The folder contains illustrations and descriptions of the most prominent and quaint features of the Crescent City and vicinity and how to get there via trolley, a complete map, car routes and schedules, list of hotels, theaters, railroad depots, etc.

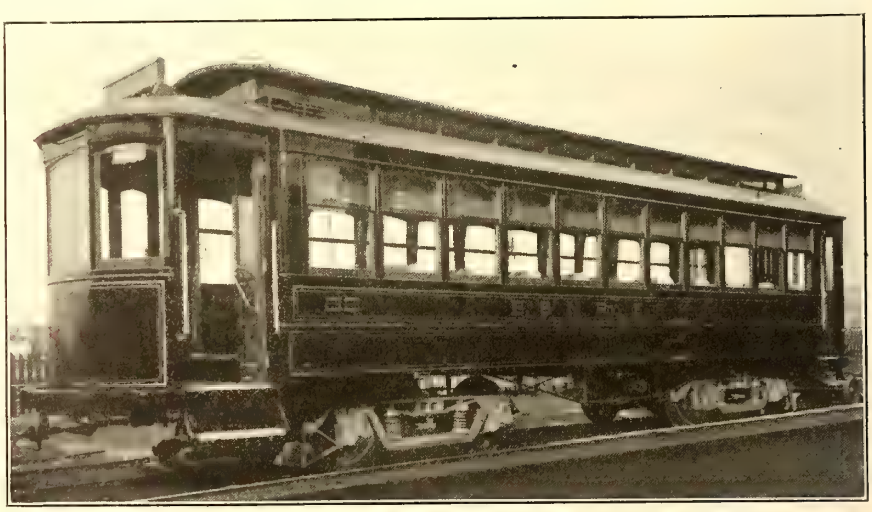
SEMI-CONVERTIBLE CAR FOR BLOOMINGTON & NORMAL RAILWAY

The accompanying illustration shows a new semi-convertible car of Brill type, built by the American Car Company, of St. Louis, for the Bloomington & Normal Railway, Electric & Heating Company, Bloomington, Ill. Normal and Bloomington are connected indirectly by two steam lines, while the electric railway shortens the distance considerably. The cities are about 5 miles apart, and there is much travel between them.

INTERIOR OF CAR FOR BLOOMINGTON & NORMAL RAILWAY

Bloomington is in the center of the State, at the junction of several main railroad lines, and its street railway system includes about 15 miles of lines owned and operated by the above company.

The car is 30 ft. 8 ins. over end panels and 39 ft. 8 ins. over crown pieces; from end panels over crown pieces, 4 ft. 6 ins.; width over side sills, including panels, 8 ft. 1 in., and over posts, at belt, 8 ft. 3½ ins.; from center to center of posts, 2 ft. 8 ins.; the sweep of posts, 1¾ ins. The side sills are 4 ins. x 7¾ ins., with 12-in. x ⅜-in. blades on the inside; size of end sills, 4¾ ins. x 6¾ ins.; thickness of corner posts, 3¾ ins., and of side posts, 3¼ ins. The interiors are finished in cherry and the ceilings are of bird's-eye maple neatly decorated. The illustration of the interior shows the extra wide aisle, which is a feature of this car, as having no wall window pockets, the ends of the seats are brought within the posts and against the side lining. The seats are 35 ins. in length, and the aisle is 25 ins. wide. This illustration also shows the excellent arrangement of lights. The platform steps are 15⅝ ins. over the rails, and the distance from step to platform is 14 ins., from platform to car floor 8 ins. The car is equipped with a number of Brill specialties, including angle-iron bumpers, radial drawbars, "Dedenda" gongs and conductors' gongs.



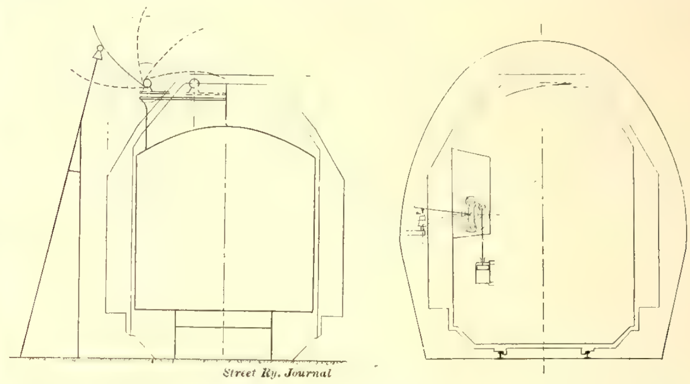
PASSENGER CAR FOR THE BLOOMINGTON & NORMAL RAILWAY

For the convenience of its passengers the St. Louis Transit Company in future will sell $1 ticket books, as it has the $5 books in the past. The books may be obtained at the company's offices or at the car houses. There will be no reduction as an inducement to buyers. As a reason for making up the tickets into $1 books, A. B. Du Pont, second vice-president of the company, said that it was in compliance with a demand in the past for tickets in book form to be sold for $1.

SINGLE-PHASE RAILWAY TRANSMISSION SYSTEM

The Oerlikon Company (Maschinenfabrik Oerlikon), of Oerlikon, near Zurich, Switzerland, has announced the details of its new high-tension transmission system for single-phase electric railways. The company states that it has made no attempt to solve the single-phase traction problem as a whole, but has endeavored to produce an efficient and reliable system covering the transmission, collection and return of current on any type of single-phase railway.

The principal feature of this system is the current collector, which is a curved rod of conducting material, having its convex face in contact with the power wire. This bow may be moved



FIGS. 1 AND 2.—OVERHEAD AND SIDE CURRENT COLLECTION BY FLEXIBLE ROD

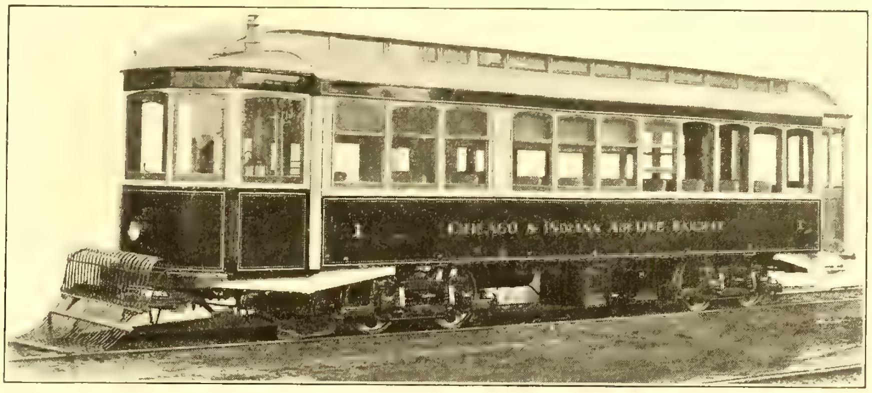
through an arc of about 180 degs., and is easily adjustable wherever there is a change in the character of the overhead structure. This adjustment may be obtained through regulation by the motorman or automatically by projections placed at the proper points along the line.

The several positions which may be assumed by this current collector are shown by the broken lines in the accompanying Fig. 1. The inner end of the collector is attached to a revolving axis, which rests on an insulated base. By means of a spring connected to this axis the collecting rod may be revolved and kept in any desirable position throughout its range. To provide for the possible shifting of the power wire, the rods are somewhat longer than usually required. This excess length is shown in Fig. 1, by the projection of the rod beyond the broken arc. The portion of the rod within the smaller arc is not used for contact, as the pressure along this part is considered too great. This system is adapted to meet all possible conditions, an example of which is shown in Fig. 2, where side contact is made in going through a tunnel lacking sufficient headroom for overhead contact.

SEMI-CONVERTIBLE CARS FOR CHICAGO & INDIANA AIR LINE RAILWAY

The Chicago & Indiana Air Line Railway has received two fine semi-convertible cars from the J. G. Brill Company for use on a new extension of the system to Indiana Harbor. Indiana Harbor is one of Chicago's rapidly developing suburban towns, and is becoming an important manufacturing and shipping point. A ship canal has been constructed extending 5 miles from the lake. Large foundries, rolling mills and other important industries are increasing. The town is about 18 miles from South Chicago, and the company's lines extend through a number of other busy and populous centers.

The cars are mounted on Brill 27-E trucks with outside-hung brakes. The wheel base is 4 ft.; diameter of wheels, 33 ins., and of axle 4½ ins. Each car is equipped with two 55-hp motors. The cars are intended to be run in one direction. The front platform has entrance on one side only, the heating apparatus being placed on the platform opposite the entrance. The rear platform has entrance at both sides. The cars are divided into two compartments, the forward compartment for smokers, seating twelve, and the regular passenger compartment seating thirty-two. The seats are of spring cane with walk-over backs, and the corner seats are placed longitudinally to the car.



CAR FOR CHICAGO & INDIANA AIR LINE RAILWAY

The accompanying illustration shows the car partly open, with the windows at the rear end raised into the roof pockets. The interiors are handsomely finished in cherry, with ceiling of birch, painted light green. The upper part of the hardwood partition dividing the two compartments is of glass. The length of the cars over end panels is 31 ft. 8 ins., and over vestibules, 41 ft. 1 in.; from end panels over vestibules, 4 ft. 8½ ins.; width over sheathing, 8 ft. 4 ins.; interior width available for seats and aisle, 8 ft; from center to center of side posts, 2 ft. 8 ins.; the side sills are 4 ins. x 7¾ ins., with 12-in. x ⅜-in. plates on the inside. The end sills are 5¼ ins. x 6⅞ ins. The body framing is in accordance with the standard practice of the builders of this type of car, as described and illustrated in the STREET RAILWAY JOURNAL of Nov. 28, 1903. The corner posts are 3¾ ins. thick, and the side posts 3¼ ins. The cars are equipped with a number of Brill specialties, including channel-iron radial draw-bars, track scrapers, sand-boxes, angle-iron bumpers, gongs and ratchet brake handles.

NEW PROJECTS IN IOWA

Activity in the construction of electric railway lines in Iowa seems to be centered at Iowa City. Three lines into the city are now practically assured, and two more are under consideration. If all of these lines are built the city will be connected with Council Bluffs on the west and Chicago on the east, and a number of systems, now practically isolated, will be linked together to mutual advantage.

The three assured lines are the Cedar Rapids, Iowa City & Southern, the Iowa City, Davenport & Muscatine, and the Iowa City, Washington & Kalona Electric Railways. The first mentioned line is projected from Cedar Rapids via Iowa City to the southern portion of the State. This line is under construction, and the grading has been completed from Cedar Rapids to within 2 miles of Iowa City. Track crews have been working south from Cedar Rapids for a month. Two bridge crews are at work, one on a bridge at Curtis and the other near Cedar Rapids. In fact, the greater portion of the work between Cedar Rapids and Iowa City is already completed. The entrance to Iowa City cannot be made until a bridge is constructed over the Iowa River near the city. The material for the construction of this bridge is on hand, and the work will commence in a short time. Between Cedar Rapids and Iowa City the line will pass through Curtis, Swisher, North Liberty and Coralville. The line will be about 25 miles in length.

The Iowa City, Washington & Kalona Interurban Railway Company was incorporated recently to construct a line from Washington, via Kalona, to Iowa City, about 28 miles. The surveys have been made and the engineers are now drawing plans. The construction of the line is being pushed by several business men of Iowa City and Washington. It is not the intention of the company to operate the line. It will be leased to other parties. The line will bring Iowa City in touch with a portion of the country south of the city not heretofore connected with it by rail.

The Iowa City, Davenport & Muscatine Company was incorporated last fall, with a capital stock of $2,000,000, for the purpose of constructing a line between Davenport and Iowa City, with a spur to Muscatine. The majority of the capital stock is owned by St. Louis capitalists. The proposed line of the road between Iowa City and Davenport will be several miles shorter than the Rock Island line. The line has been surveyed between Davenport and West Liberty, and the engineers are now at work between West Liberty and Iowa City. The spur will run from a point on the main line near the town of Summit, due south to Muscatine, and will be about 7 miles in length. The plan is to begin construction work in the spring.

The business men of Iowa City are talking of constructing two other lines from Iowa City to neighboring towns; one to Williamsburg and another to Tiffin. The residents of the territory to be served by both of these lines have entered enthusiastically into the projects, and promise to aid in their promotion.

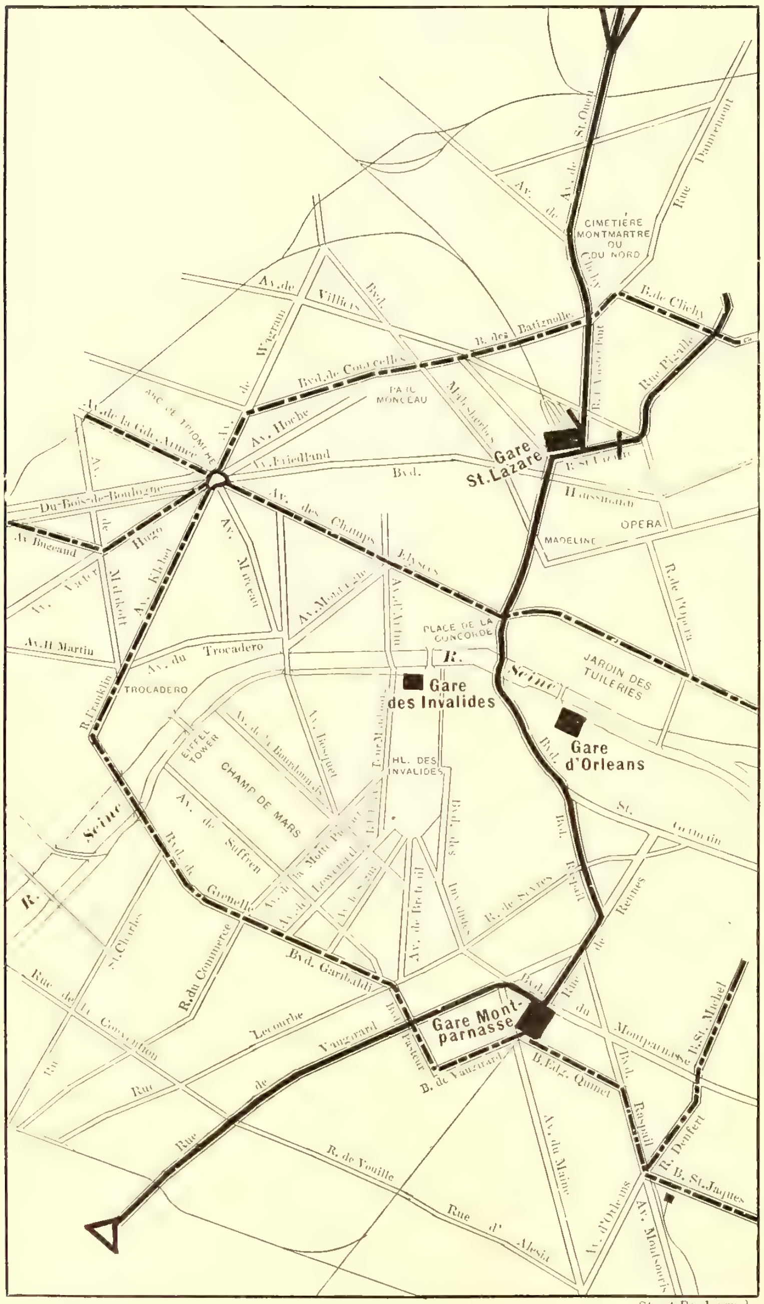
THE ELECTRIC CLUB OF CLEVELAND

At the regular meeting of the Cleveland Electric Club, held a few evenings ago, President Charles Wason, of the Cleveland, Painesville & Eastern Railway, delivered a talk on Japan, illustrating his remarks by lantern slides made from photographs taken on his recent trip to the Orient. Mr. Wason touched on the improvements that are developing Japan, and presented a number of views of telephone, lighting and electric railway plants that have recently been installed. The lecture was a popular one, non-technical, but interesting and timely, in view of the present happenings in that part of the world. After the lecture there was an informal reception for Mr. and Mrs. Wason, followed by dancing. About fifty members and their friends spent a most pleasant evening.

UNDERGROUND ELECTRIC RAILWAY IN PARIS

Several references have been published in this paper to a pıoposed north and south underground electric railway in Paris. This proposal has now taken concrete form, and the route selected is shown on the accompanying map by a solid line. Connecting lines of the Metropolitan are shown by a dot and dash line, and the steam railroads in the usual way. As will be seen, the new line will directly connect four railroad stations, viz., those of Montparnasse, the Orleans Railway on the Quai d'Orsay, Les Invalides and Saint Lazare, also four large government office buildings and three large department stores.

Special difficulties will be encountered in the construction of the new line, as a number of streets through which it will run are narrow and the river will have to be tunneled. The road will be considerably deeper than the present Metropolitan line, and a number of the stations will be more than 10 m below the surface, and will be provided with elevators. It is also proposed to give up the use of the third rail and to use an overhead conductor. The principal reasons for adopting the overhead conductor are said to be to reduce the danger of short circuit and make it safer for passengers to walk along the track in case of necessity.



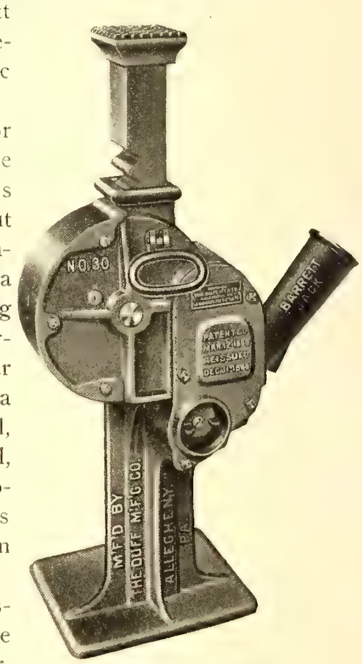
MAP SHOWING NEW NORTH AND SOUTH UNDERGROUND ELECTRIC RAILWAY IN PARIS

The cars will all be mounted on double trucks, and will be of the American intercommunicating pattern. It will be remembered that the Metropolitan cars are divided into compartments, and that most of them are mounted on single trucks.

GEARED RATCHET LEVER JACK

The demand for a quick, positive and durable jack for handling heavy passenger and freight cars, etc., has been met by the Duff Manufacturing Company, of Pittsburg, Pa., in its new Barrett geared ratchet lever jack of 30 tons lifting capacity.

This jack is designated as the No. 30 Barrett jack, and is said to have many features which will commend it to those having heavy loads to be raised quickly and easily. It is made of refined malleable iron and steel throughout in a substantial manner, and is operated like the well-known No. 19 Barrett jack. The jack is single-setting and automatic lowering.



GEARED RATCHET LEVER JACK

The lifting bar or rack is of high-grade open hearth steel, and is raised by a machine-cut steel pinion. This pinion is integral with a large steel gear having ratchet teeth on its circumference. The gear is rotated by means of a socket lever and pawl, and the retaining pawl, together with the automatic lowering device, is the same as is used in the No. 19 jack.

All parts are accessible by removing the shield and gear cover, the removal of which does not in any way impair the working of the jack. The direction is controlled by an eccentric at the side of the frame.

The method of rotating the gear by a socket lever and pawl requires no special care on the part of the operator, as it is not necessary to pull the socket lever out a short distance to engage the next tooth of the gear. The method of operation is simply raising and lowering the socket lever, as in the other sizes of Barrett jacks.

The device described is an improved quick-acting jack, with the simplicity of an ordinary lever jack, the leverage being especially compounded to permit ease of operation and quick action. It is stated that the jack has no complicated features and cannot get out of order. The manufacturer will make several designs of this geared ratchet lever jack in sizes to meet all heavy lifting purposes.

The street railway companies of Cleveland and Akron have been considerably annoyed of late through a form of swindle which is new in that district at least. The modus operandi of the swindlers is to purchase tickets and then carefully split them in two pieces, pasting the split sections onto thin pieces of paste board, with the lithographed side out. In a crowded car the swindle is not likely to be discovered.

FINANCIAL INTELLIGENCE

Wall Street, Jan. 27, 1904.

The Money Market

All discussion of the money outlook naturally takes its cue from the extraordinary enlargement of bank loans, which reached its climax in the increase of over $30,000,000 reported last Saturday. Loans have now increased $85,000,000 during the last four weeks, a movement which quite parallels the extraordinary ones in the early part of 1901 and 1902. The account stands $15,000,000 above the highest previous record in the history of the Clearing-House, which was made in March, a year ago. With the caus s and general nature of this credit expansion, previous articles in this column have already dealt pretty fully. The question raised above all others is whether the capital thus loaned out to financial syndicates is or is not likely to be readily returned as available bank resources. If the new securities against which these credits have been issued for the most part, can be sold to the investing public, then we may expect later on a gradual liquidation of loans. If they cannot be sold, then we shall be confronted again with the unpleasant dilemma of past seasons when forced liquidation of the more readily marketable securities has become necessary, in order to sustain surplus reserve. It is a problem, therefore, which concerns the general stock market fully as much as the money market, the outcome of both situations resting entirely upon the attitude of outside investment capital. So long as money continues to flow in from the country—$14,000,000 more was added to cash holdings last week—interest rates may be expected to continue at their present minimum level. But according to all precedent, increase of cash holdings slackens toward the end of January, ceases entirely after the middle of February, and is followed in March and the early part of April by more or less rapid decline. It is easy to see, if the movement this season follows the parallel of the past, and if loans do not contract, that surplus reserve will have fallen comparatively low by the end of another two months. In banking circles, therefore, doubt is freely expressed as to the maintenance of the present low rates of money for very much longer. The most gratifying feature of the whole money outlook is our rapidly increasing credits in the foreign trade. Europe, having greatly overestimated the size of our cotton and grain crops, has been practically caught short at the top of a wild advance, and from all appearances must continue to pay fancy prices for our cotton, wheat and corn in order to meet its necessary requirements. That this has already resulted in entirely extinguishing American indebtedness on the other side of the water is universally admitted. That Europe will owe this country very largely before it gets through, there is also little reason to doubt. Consequently, our money market will be much better able than it was in previous years, to obtain assistance from abroad in case its own resources are unduly diminished. Call money on the Stock Exchange is quoted at the nominal figure of 2 per cent; time money is obtainable for sixty days at 3½; for ninety days to four months at 4, and from five to six months at 4½ per cent.

The Stock Market

In sharp contrast to the dullness of the previous weeks, the Stock Exchange has witnessed during the last week a considerable increase of activity, and a general improvement in prices. Disappearance of the Russia-Japanese crisis, as an immediate source of alarm, belief that a decision in the Northern Securities case is still som distance off, the extremely easy money condititons, and fairly favorable reports of trade and railroad earnings—these are the visible influences on the side of rising prices. Besides this there are at least three causes favoring a better market. The first is the desire of the large fi ncial interests who bought at the low levels last summer and autumn to secure some of their accumulated profits; the second is the efforts of the banking community to make the market more attractive for the sale of the recent issues of railroad securities, and lastly, there is the activity of a powerful contingent composed of Western speculators, and leading operators in cotton and grain, who see in the present situation an opportunity for a profitable turn on the long side. Necessarily, the buying from these various sources is chiefly in the nature of manipulation, and confidence in the stability of the advance cannot wholly be felt until there is better proof that the movement is meeting with co-operation from investment capital. The public response has so far unquestionably been disappointing. Sentiment among the great body of outsiders is still extremely cautious, not only because of the remembrance of past disasters, but also because of a well-defined doubt as to what the future has in store for business and finance. The traditional uncertainty of a presidential year is complicated in this instance by the serious problems, the solution of which largely depends upon the outcome of next November's election. Financial circles justly feel that there is more than ordinarily at stake in the choice of candidates, and in the outcome at the polls. As a restraining factor this is probably the most important that the present situation holds. But in addition the grave question of the credit position suggested by the recent loan expansion is also a matter of much misgiving.

The movement of the last week has centered almost entirely in the railroad and industrial stocks. The local traction shares, which previously were active leaders, have been relegated to the rear, and trading in this quarter has not been particularly active, nor have prices shown much change. The pools in Brooklyn Rapid Transit, Manhattan, and Metropolitan, have apparently had too much work on hand in other quarters to attend to their traction favorites. These stocks have simply been supported whenever occasion has required, but no further attempts have been made to advance prices. Speculative opinion continues bullish toward the group, on the theory that they will be taken in hand later on, when the rise elsewhere has spent some of its energy.

Philadelphia

Entirely in consequence of the general market improvement, the Philadelphia street railway securities have enjoyed a further advance on the week. The three leaders of the movement have been the Philadelphia Company stocks, Philadelphia Rapid Transit and Union Traction. Dealings in all these issues have been more active than at any time since last summer, but the buying has plainly enough come from speculative sources, and is not inspired by any new developments in the individual properties. Philadelphia Company common rose from 41 to 43, the talk being that a large block of the stock, which for a long while has hung over the market, had at length been absorbed. The preferred rose from 45 to 46½, but subsequently receded to 45½. Rapid Transit has been taken in hand on the assumption that with the $5 assessment paid in, the "bad news" is all out. Quoted at its full value of $15 paid in, the stock advanced from 13¾ to 15¼. Union Traction rose in sympathy, from 47 to 48, which is the highest figure of the season. Philadelphia Electric showed considerable activity, but without any corresponding improvement in price. It advanced from 6⅜ to 6½, and then dropped back to 6⅛. Other sales for the week comprise American Railways at a rise from 43¼ to 45, Citizens' Passenger at 345, Philadelphia Traction at 97⅝, Reading Traction (100 shares) at 30¼, Pittsburg Traction preferred (300 shares) from 48½ to 49½, and Railways General at 2.

Chicago

Rumors that a dissolution of the existing relations between the Union Traction and its subsidiary companies—the North Chicago and the West Chicago—might be sought by the stockholders of the latter, were discredited by the leading officials. The leases are such it is argued, that however disappointed the holders of the sub-company shares may be over the reduction of their dividends, they cannot be nullified without process of litigation. North Chicago stock made a new low record of 70 during the week, on sales of 100 shares; recovering later to 72. West Chicago dropped from 47 to 46. The Union Traction shares were adversely affected by this weakness, the common declining to 5¼, and the preferred to 30. Metropolitan Elevated common was strong at an advance from 16⅞ to 18, Metropolitan preferred sold up to 53, then back to 52⅛. Two thousand shares of Union Elevated changed hands between 2⅜ and 2¾. South Side sold up from 92 to 93, Lake Street receipts went at 2¼ and 2⅛, a hundred shares of Northwestern common sold at 15 and 16, and the preferred sold at 48. All matters growing out of the controversy between the Union Traction and its underlying companies have been referred to a master in chancery, and Judge Grosscup will render no decision until the master's report is in his hands.

Other Traction Securities

Massachusetts Electric issues were the feature of the week's traction dealings in Boston, the common gaining another point to 24, and the preferred a point and a half to 80½. The move appears to be wholly speculative. Boston Elevated was idle on its old

range between 140 and 140½, West End common rose a point from 90 to 91, and the preferred sold at 108. Exceptional activity distinguished the week in the outside street railway bonds dealt in on the Baltimore Exchange, with numerous advances in prices. City & Suburban of Washington 5s sold up from 93½ to 94, Atlanta Street Railway 5s from 103¼ to 103¾, Anacostia & Potomac 5s from 93 to 94⅝, Norfolk Street Railway 5s sold at 105¼, City & Suburban of Baltimore 5s at 112½, Central Street Railway 5s at 114, Baltimore Traction convertible 5s at 101¼, Toledo Traction 5s at 100⅛, Charleston Railway 5s at 102½, Knoxville Traction 5s at 101, Lexington Street Railway 5s at 97, Richmond Street Railway 5s at 104¼, and Augusta Street Railway 5s at 100¾. The United Railways securities rose fractionally, the general 4s, after selling at 90¾, rallying to 91½, the incomes advancing from 56 to 56¾, and the stock from 8⅛ to 8⅜. The upward movement in Interborough Rapid Transit on the New York curb has apparently been suspended for the moment. The stock reached its high point, 109⅞, a week ago, declined to 107¼, and later rallied to 108. Sales of 400 New Orleans Railway common were reported between 9 and 10. St. Louis Transit sold up from 11 to 11½, Washington Traction preferred sold at 47½, the bonds from 75⅝ to 76⅞; Brooklyn Rapid Transit 4s at 76½, and Nassau Electric 4s at 77½. On the New York Exchange, North American shares advanced briskly, anticipating the increase in the annual dividends from 4 to 5 per cent, announcement of which was made yesterday. Twin City Rapid Transit was also bid up apparently by the old speculative pool in the Canadian specialties.

Tractions were comparatively inactive at Cincinnati last week. Five hundred shares of Cincinnati, Newport & Covington preferred sold at 82½ to 82¾, and 210 shares of the common at 28½ to 29, all in small lots. Detroit United advanced from 65 to 69, on small sales, aggregating 112 shares. Cincinnati Street was inactive, twenty-five shares selling at the old price, 133. A small block of Cincinnati Street 5s brought 107, and a small lot of Cincinnati, Dayton & Toledo 5s 81½.

At Columbus there was considerable demand for Springfield (Ohio) Railway & Light, which is making fine gains in earnings; holders are asking 37, and several sales were made around this point. East St. Louis & Suburban sold at 62. Columbus Railway & Light was firm at 35. Columbus Railway common sold at 85¾ to 86. The preferred is now held at 109.

Northern Ohio Traction & Light again featured in Cleveland. The dealings were about 500 shares on an advance from 14½ to 17¾. A few weeks ago there was considerable of this stock for sale at lower figures, but holders now appear to feel that it is due for further increases, and are holding off for higher prices. Northern Texas Traction is again attracting attention, because of its fine showing, and about 350 shares sold at 31¾. Cleveland Electric sagged from 75½ to 72½. This stock has always been inclined to anticipate good news, but now, when it developed that the twenty-year franchise extension could not be negotiated at once, the stock sold off.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid Jan. 19	Closing Bid Jan. 26
American Railways	43	44¼
Aurora, Elgin & Chicago (preferred)	a55	a55
Boston Elevated	140	140
Brooklyn Rapid Transit	50	49⅞
Chicago City	160	160
Chicago Union Traction (common)	5½	5¼
Chicago Union Traction (preferred)	31¾	30
Cleveland Electric	74	70½
Consolidated Traction of New Jersey	63	64
Consolidated Traction of New Jersey 5s	105½	105½
Detroit United	64¾	65
Elgin, Aurora & Southern	a30	a30
Interborough Rapid Transit	—	107½
Lake Shore Electric (preferred)	a42	—
Lake Street Elevated	2⅛	2
Manhattan Railway	144⅞	145
Massachusetts Electric Cos. (common)	23	22¼
Massachusetts Electric Cos. (preferred)	79	79
Metropolitan Elevated, Chicago (common)	16	17½
Metropolitan Elevated, Chicago (preferred)	51	52
Metropolitan Street	122½	122¼
Metropolitan Securities	90	89
New Orleans Railways (common)	9⅝	9¾
New Orleans Railways (preferred)	29½	29
New Orleans Railways 4½s	78	a79½
North American	87½	88½
Northern Ohio Traction & Light	14	15¼
Philadelphia Company (common)	40¾	42¼
Philadelphia Rapid Transit	8⅜	†14⅞
Philadelphia Traction	97½	97⅝
St. Louis Transit (common)	10½	11½
South Side Elevated (Chicago)	92	92
Third Avenue	121	121½
Twin City, Minneapolis (common)	91	94
Union Traction (Philadelphia)	46¾	47¾
United Railways, St. Louis (preferred)	52½	52
West End (common)	90	90⅛
West End (preferred)	108	108⅛

a Asked. † Includes new $5 assessment.

Iron and Steel

The principal incident of the week in pig iron was the shading of prices by Southern producers, in order to meet the cut recently made by the Northern interests. In spite of what this competition seems to show, the tonnage of the pig product is reported as fair. It is generally believed that the deadlock in the steel rail trade is likely sooner or later to end in the makers giving way. Their hand is being forced already by the cutting of prices by mills which re-roll old steel rails. In other branches improvement is disclosed in the bar trade, in plates and shapes, and in wire products. Weakness, on the other hand, is still disclosed in sheet steel. Quotations are as follows: Bessemer pig iron, $13.75 and $14, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 12¾ cents, tin 28¼ cents, lead 4½ cents, and spelter 4⅞ cents.

HARASSING THE PUBLIC SERVICE CORPORATION

When the Public Service Corporation took over the several street railway and lighting properties in Northern New Jersey, it naturally found itself in control of a number of systems whose apparatus and methods of management differed greatly. The corporation first set about to harmonize, as far as possible, and at once, all of these systems, and then took up the further simplification of the operation of the properties by standardizing the equipment. With this end in view, a number of changes were made in the method of operating the lighting companies, and then the street railway systems were given attention. A number of changes were made in the operation of the cars and in one or two details of management, and plans were laid out for materially benefiting the service by increasing the rolling stock and readjusting the power supply. The company realized, however, that but few of these improvements could be made before the winter set in, and therefore made the best arrangements possible for getting the maximum of service with the facilities in hand.

The position of the company was thoroughly set forth to its patrons by President McCarter soon after control of the various companies was assumed. Despite this fact, the residents of some of the places through which the company operates have recently become dissatisfied with the service given, and in one or two cases most strenuous measures have been adopted by the Councils, in what they thought was the interest of the community at large. Particularly annoying to the company has been the action of the West Hoboken Town Council in revoking the ordinance passed April 5, 1893, giving the North Hudson County Railway Company, now a part of the Public Service Corporation, the right to change its motive power from horses to electricity. Similar action was contemplated by the North Bergen township committee, but the councilor for that committee advised against any hasty action.

In view of this action and the agitation against the company, President McCarter has found it necessary to make a public statement regarding the position of the company. As in the statement made by him when the companies were first taken over, he again reviews the conditions that existed then, and tells of his hopes for the future, and of the plans for improvements that now are under way. Following this announcement Mr. McCarter secured a writ of certiorari from Justice Dixon, restraining the West Hoboken officials from interfering with the company, and the action of the town authorities will be certified to the Supreme Court for review. The writ is made returnable at the next session of the Supreme Court, on the second Tuesday in February.

CLEVELAND'S THREE-CENT FARE CASE CARRIED TO THE COURTS

The Cleveland Electric Railway Company has secured a temporary injunction restraining the city of Cleveland from enforcing the McKenna 3-cent fare zone ordinance, which was passed by the City Council two weeks ago, and which was to have gone into effect Sunday, Jan. 24. The action of the company was a precautionary one, in case nothing comes of the peace negotiations now on for a settlement of the whole street railway situation, as the company proposes to fortify itself, so as to continue to fight, if necessary. The hearing on the injunction just obtained will be held Feb. 13.

The prospects for a settlement of the company's franchise problem on the zone basis, suggested for trial by Mayor Johnson, are not so bright as they were a week ago. Nothing definite has been done during the past few days, but it is evident that the majority of thinking people are not even in favor of a trial of the zone proposition. It is generally believed that it will not prove satisfactory, either to the public, or to the company. Judging from the hundreds of letters that are being published in the daily papers and from personal talks with business men, there is a growing sentiment that the best and simplest way to solve the problem, is on a basis that will give the company sufficient revenue to make a reasonable profit on its business, and at the same time give the best of service. Even should the city make a contract on an extremely low-fare basis, if the company did not receive a fair return on the investment, the result could not help but be disastrous to the city in the way of poor car service. There is a growing sentiment in favor of a settlement on the present basis—six tickets for a quarter, and universal transfers. While this plan is not altogether satisfactory to the company at present, by reason of abuse of the transfer privileges, it seems as if certain restrictions might be made that would prevent much of the dishonesty now rampant, and at the same time allow the public reasonable transfer privileges. Altogether it is extremely probable that a vote taken at this time on the proposition of testing the zone plan would meet with overwhelming defeat, and Mayor Johnson is beginning to appreciate this fact.

NEW INDIANA ROAD

The Wabash & Rochester Railway Company, which is headed largely by Cleveland people, has established offices at 926 to 928 Williamson Building, Cleveland. The company will build an electric railway between the Indiana towns mentioned in the title. The project has been under way for some time, and the promoters now announce that it has been financed and that contracts have been placed for the construction of the road during the coming summer. The United States Engineering & Construction Company, 930 Williamson Building, Cleveland, has the contract for the construction work, and N. O. Pound, of the Pound Construction Company, of New York, is also interested individually in the construction of the road. The road will be 40 miles long, and will be built on private right of way except in the towns where exceptionally favorable franchises have been secured. The construction company will shortly purchase all equipment. The power house will be located at Roann, and in it will be installed two 680-hp cross-compound condensing engines direct connected to alternating-current generators. The high-tension system will operate with 25,000 volts, and there will be three substations, one of which will be in the power house. Five 200-kw rotaries, with other sub-station equipment, will be purchased. The rolling stock will include two electric locomotives, three passenger coaches, ten gondola cars, ten freight box cars, six open trail cars and one snow plow.

The towns touched by the road and their population are as follows: Roann, 1000; Wabash, 10,000; Gilead, 500; Akron, 1500; Athens, 300, and Rochester, 5000. The total population tributary to the line is 81,000. Subsidies amounting to $110,000 have been granted to the company. The Municipal Bond & Securities Company, of Cincinnati, is handling the securities of the company. The authorized bond issue is $900,000. The annual election of the company was held last week, and the following officials were chosen: Charles B. Crane, of Geneva, Ohio, president; P. E. Wilcox, of Geneva, Ohio, vice-president; E. S. Pratt, of Wabash, Ind., secretary; C. E. Barnum, Cleveland, treasurer. The above, with V. Zimmerman, of Rochester, Ind.; Daniel Van Buskirk, of Roann, Ind.; B. H. Shroeley, of Wabash, Ind.; John L. Griffiths, of Indianapolis; L. A. Smart, of Cleveland; A. Norvale, of Cincinnati, and D. S. Robertson, of Geneva, Ohio, are directors.

FOREIGN ORDERS FOR NATIONAL ELECTRIC COMPANY'S AIR BRAKE EQUIPMENTS

Some important foreign orders for air-brake equipments have been received recently by the National Electric Company, of Milwaukee, Wis. Among them may be mentioned the following: Two hundred automatic air-brake equipments for motor cars for the Underground Electric Railways Company, Limited, of London; ninety automatic air-brake equipments for the Metropolitan Railway Company, of Paris; thirty-four straight air-brake equipments for the Amsterdam Electric Tramways; sixty-four automatic air-brake equipments for the Mount Vesuvius Electric Railway, Naples, Italy. In addition to these European orders, the company has received an order for thirty-seven straight air-brake equipments for the Government Tramways of Sydney, Australia, and nineteen straight air-brake equipments for the Hanshin Railway, of Japan. All of these foreign orders have been received within the past month.

The London order calls for air compressors with a capacity of 50 cu. ft. of free air per minute, which is much larger than the air compressors furnished by the National Electric Company to the New York Subway, which have a capacity of 20 cu. ft. of free air per minute. The air compressors to be furnished for the Metropolitan Underground Railway, of Paris, are also larger than the New York Subway compressors, as they will have a capacity of 35 cu. ft. of free air per minute. The air compressors for the Mount Vesuvius Electric Railway are of the same size as those in the New York Subway, and the other foreign orders call for the company's regular standard No. 1 compressors, which have a capacity of 11 cu. ft. of free air per minute.

THE FLOODS IN OHIO

Events in Ohio the past week indicate that electric railways have more to fear from floods than from heavy snow fall. As stated in a recent issue of the Street Railway Journal, the severe snow storms the early part of the month did not seriously interrupt traffic on any of the roads, either city or interurban, but the melting of this snow last week, accompanied by unprecedented rain storms for this time of year, had a most disastrous effect upon electric railways all over Ohio. The damage was most severe in the case of the interurban lines which have been built in valleys.

The Lake Shore Electric Railway Company was one of the heaviest sufferers. Six bridges between Norwalk and Toledo were wrecked, and this portion of the line was tied up for three days. The boiler room at the Fremont power house was flooded and the fires put out, so that traffic on the division from Norwalk to Ceylon had to be suspended for a day. The Cleveland-Sandusky division was not affected. High water put out the fire in the main power station of the Toledo Railways & Light Company, and, in addition to this, it was impossible to secure coal, so that the city, as well as the interurban service of all lines entering Toledo, was crippled for a short time. Undergrade crossings on the Detroit, Monroe & Toledo Short Line were filled, and this road was tied up. Tracks of the Toledo, Bowling Green & Southern were flooded at several points, and the power house was flooded so that through service to Findlay was discontinued. The Shore Line of the Cleveland, Painesville & Eastern was abandoned, and the Eastern Ohio Traction Company suffered at several points.

The Cleveland, Painesville & Ashtabula Railway was tied up between Geneva and Ashtabula, and Pennsylvania & Ohio Railway was compelled to suspend operations on its Jefferson branch. City traffic in Cleveland was interrupted for part of a day by three large steamers breaking loose from their moorings in the river and crashing into the viaduct which connects the east and west portions of the city. For a time it was feared the bridge would be seriously damaged, and no cars were permitted to cross, but examination of the bridge showed that the condition was not dangerous. Akron was a heavy sufferer, and all traffic between Cleveland and Akron on steam, as well as electric, lines was tied up for several days. The Akron-Barberton line was kept in operation, but passengers were transferred at two points by means of moving vans. The Canton-Akron Company's power station at Canton was flooded, and the Canton-Akron, Canton-Massillon, the Canton city lines and the Canton-New Philadelphia lines were tied up. The Columbus, Delaware & Marion Railway was washed out at two points, and traffic was suspended north of Prospect. At points near Youngstown the Mahoning Valley Railway suffered seriously from floods. The Urbana, Bellefontaine & Northern Railway suspended business, and a sink-hole on the line which has been giving trouble for many months is now a pond several

feet deep. At Franklin a trestle on the Cincinnati, Dayton & Toledo line was washed out, and business between Cincinnati and Dayton was suspended.

Altogether, last week was undoubtedly the most disastrous in the history of Ohio electric roads. Steam roads also suffered to a considerable extent, but in many cases they were saved losses through the fact that heavy stone ballasted roadbeds, steel bridges with stone abutments and concrete and stone culverts are more common with them than with the electrics, particularly the older electric roads.

AUTOMOBILE COMPANY CELEBRATES ANNIVERSARY

In the event of the completion of its new factory building and of its sixth anniversary, the Winton Motor Carriage Company, of Cleveland, recently entertained a party of fifty daily and trade journal newspaper men from New York, Philadelphia, Boston, Chicago, Cleveland and other cities. The Eastern party came in special cars. All the guests were taken to the new Winton factory, which is said to be the largest and most complete automobile manufacturing plant in the world. After an inspection of the plant, the party was taken in automobiles to the Hollenden Hotel, where a magnificent banquet was spread. This was participated in also by Mayor Tom L. Johnson and other prominent automobilists. As announced in the STREET RAILWAY JOURNAL of Jan. 2, the Winton Motor Carriage Company is manufacturing a gasolene touring car which is especially adapted for inspection tours by electric railway operators.

EXTENT OF FIRE DAMAGE AT E. W. BLISS COMPANY'S WORKS

The E. W. Bliss Company announces that the newspaper reports regarding the recent fire at the company's works were greatly exaggerated. The company states that the fire was confined to the upper story of the main works, and the damage was confined practically to burning out the office. This fire will have hardly any effect on its business, even in the main works, where general machinery is manufactured. The company especially emphasizes the fact that the fire will not in any way affect the filling of railroad orders, as all the railroad material is made at the company's projectile works, located in South Brooklyn, about 5 miles from the main works.

ANNUAL MEETING AT TOLEDO

At the annual meeting of the stockholders of the Toledo Railways & Light Company, held at Toledo a few days ago, the old board of directors and all the officers were re-elected. The officers are: Chairman of board, Albion E. Lang, of Toledo; Henry A. Everett, of Cleveland, president; L. E. Beilstein, of Toledo, vice-president and general manager; Herman S. Swift, of Toledo, secretary; Spencer D. Carr, of Toledo, treasurer.

With the exceptions of the two last named, the foregoing, with Edward Moore, of Cleveland; Herbert Holt, of Montreal; Robert B. Van Cortland, of New York, and Barton Smith, of Toledo, comprise the directorate.

The following is a comparative statement of gross earnings of the properties owned by the company for the years 1897 to 1903, inclusive, which shows a constant and healthy growth amounting to 85 per cent in seven years:

1897	$897,361.06	
1898	968,516.59	7.93
1899	1,069,279.88	10.40
1900	1,182,516.83	10.59
1901	1,311,084.25	10.88
1902	1,459,091.39	11.29
1903	1,663,794.03	14.03

	1902	1903.
Gross earnings	$1,459,091.39	$1,663,794.03
Operating expenses	726,779.00	856,526.26
Operating expenses per cent	49.81	51.48
Net earnings	$732,312.39	$807,267.77
Interest paid	459,037.07	488,200.30
Balance for stock	273,275.32	319,067.47
Per cent of capital	2.27	2.66

The bonded indebtedness of the company is as follows:

Underlying bonds bearing 5 per cent interest	$6,000,000
Toledo Railways & Light 4 per cent bonds	4,020,000
Total	$10,020,000

The company has in its treasury Toledo Railways & Light Company 4 per cent bonds certified, $603,000, not included in the above, which were issued for 75 per cent of actual cost of betterments and extensions.

CHICAGO UNION TRACTION MATTERS

Judge Grosscup has been asked to arbitrate the difficulty between the Union Traction Company and its underlying companies, and he, in turn, has referred the matters in dispute to a master for investigation. The representative of the underlying companies, and the receivers for the Union Traction could come to no agreement as to their troubles, and it was determined to put the matter before the judge. The underlying companies claim that the interpretation put on the leases to the Union Traction Company, under the recent plan of reorganization, was not what was intended or thought of by the directors of the underlying companies. Then a committee representing both companies was instructed to meet the receivers of the Union Traction Company. At this meeting the interpretation of disputed points in the case was discussed. In the leases made last August between the three companies it was stated that a "reasonable charge for depreciation of the plant and equipment" be allowed. New cars are now being purchased by the Union Traction Company receivers, and other improvements in the service are being made. The dispute arises as to whether these improvements should be charged to the depreciation account, or to the improvements which the Union Traction Company is expected to make. If they are charged to depreciation the improvements come out of the earnings of the underlying companies and diminish the dividends of the stockholders by so much. If they are charged to new improvements the Union Traction Company bears the expense.

Judge Grosscup, upon reading the petitions which were prepared by Attorney John S. Miller, who is counsel for the receivers of both the Union Traction and the underlying companies, entered an order referring the questions in the petition to Master-in-Chancery Henry V. Bishop. The master-in-chancery is to hear the contentions and evidence bearing upon the questions at issue, and he is to report to Judge Grosscup.

This order of Judge Grosscup delays the question of paying or ascertaining the dividends to be paid to the underlying companies for the first quarter under the new amendment leases. In the meantime the receivers for the Union Traction Company remain also the receivers for the underlying companies, which do not agree to the construction of the amended leases.

In their petitions to Judge Grosscup the receivers asked the court for instructions on the payment of the rentals per dividends due to the stockholders of the North Chicago Street Railroad Company since Jan. 15. These instructions will, in view of Judge Grosscup's order, be given after the inquiry is made by the master-in-chancery, and the judge reaches a decision, and until that time there will be no dividends paid.

WORK OF THE ELECTRIC RAILWAY TEST COMMISSION

A second meeting of the Electric Railway Test Commission of the Universal Exposition, St. Louis, 1904, convened in New York on Jan. 27, 1904. All of the commissioners, namely, J. G. White, chairman; H. H. Vreeland, James H. McGraw, George F. McCulloch, W. J. Wilgus, were present, and a great deal of work was accomplished in furthering the plans for an elaborate series of tests of electric railway equipment at the Exposition.

A great deal of interest has been manifested by electric railway engineers in the proposed tests, and the value of the engineering data, which in all probability can be accumulated in this way, is not to be overestimated. The tests will undoubtedly have the effect of greatly stimulating electric railway undertakings and promoting development along the lines best adapted to effectively meet the conditions most prominent in different classes of service.

The work has been divided into four main divisions, and special committees of engineers, who are specialists in the several divisions of electric railway work, have been appointed to prepare a schedule of the tests which will be made of the equipment offered in each class. These special engineering committees on the scope of the tests are:

First—Special committee on city and suburban equipments.

Second—Special committee on interurban equipments.

Third—Special committee on heavy traction equipments.

Fourth—Special committee on new systems of electric traction.

These committees are expected to prepare and submit their reports to the commission on or before Feb. 22, and the next meeting of the Commission will take place in New York City, on Monday, Feb. 29, at which time the reports of the special committees will be reviewed and passed upon.

AN IMPORTANT DECISION IN OHIO

An important decision has just been handed down by the Supreme Court of Ohio in the case of the Hamilton, Glendale & Cincinnati Traction Company vs. the Hamilton & Lindelwald Electric Transit Company. The action was originally brought by the transit company to enjoin the traction company from constructing, operating and maintaining a street railway on East Avenue, in Hamilton, in pursuance of the provisions of an ordinance passed by the board of control, granting such right to the traction company. The transit company was in possession of the street with a track with a gage of 4 ft. 8½ ins., and the traction company attempted to straddle its track with a 5-ft. 2½-in. gage. The transit company secured a temporary injunction in the Common Pleas Court, which was subsequently dissolved, and it appealed to the Circuit Court, which granted a perpetual injunction. The traction company carried the case up to the Supreme Court, which has announced the following syllabus:

When a city council has, by ordinance, legally granted to one street railway company the right to construct its railway and lay its track on and over a particular part of a designated street within said city, and such company has duly accepted said grant and entered upon and taken possession of the right of way so specifically granted, a subsequent grant by said city council, or its successor in office the board of control, of the same right of way, or substantial part thereof, to another street railway company for like purposes, will not of itself confer upon the second grantee the right to enter upon and take possession of the route or right of way so granted, where such entry and possession by it will materially and injuriously interfere with, interrupt and abridge the first grantee's use and enjoyment of the said right of way. And where said second grantee threatens, and is about to take possession of said route and right of way under and by virtue of its said grant, without the consent and against the will of said first grantee, and without having appropriated the right so to do, it will be restrained from so doing by injunction. Judgment affirmed. Davis, Shauck and Price, JJ., concur.

NEW RATTAN SEAT ENAMEL

One of the most disagreeable features street railway companies have had to contend with in the renovation of old cars is the unsightliness of the seats and backs. To recover them is quite expensive, and yet to leave them untouched greatly mars the general effectiveness of the renewal work and gives a decidedly unfinished appearance to the cars.

The Sherwin-Williams Company, of Cleveland, Ohio, claims to have solved this problem by its new product—rattan seat enamel. It very closely imitates the natural color of the rattan, dries with a hard finish, impervious to water, and by its filling and covering capacity prevents water penetrating into the seat.

The company has issued a card showing on a piece of rattan what this article will do, and if the company's claims are correct this enamel should become very popular.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED JAN. 19, 1904

749,716. Rail-Contact Shoe; George W. Brady and Lawrence R. Jones, Wheaton, Ill. App. filed Jan. 26, 1903. A contact shoe of inverted U-shape construction adapted to contact with the upper corners of the conductor rail, where the least ice is supposed to form.

749,795. Trolley Stand; James Kermath, Detroit, Mich. App. filed Oct. 9, 1903. A base upon which the stand will turn freely to accommodate the lateral movement of the trolley pole, and which is so constructed that the stand is supported close to the top of the car, and thereby offers no hindrance in going under viaducts.

749,835. Electro-Mechanical Switching Mechanism; Walter J. Bell, Los Angeles, Cal. App. filed May 29, 1903. The switch point is moved by a motor, which is connected and disconnected by a clutch controlled by an electro-magnet.

749,878. Fender; George Parisien and Joseph H. Gingras, Fall River, Mass. App. filed Sept. 5, 1903. Relates particularly to means for retaining the fender constantly over the track when traversing curves.

750,139. Electrical Controller for Railway Cars; Harlan P. Wellman, Ashland, Ky. App. filed Nov. 19, 1903. The exhaust from the air-brake system is led into the controller-box, which acts as a muffler while the blast clears the box of foreign matter.

750,207. Electro-Magnetic Brake; John S. Lockwood, Kansas City, Mo. App. filed June 23, 1902. Attached to the core of the magnet with a removable piece acting as a part of the magnet pole and the brake-shoe.

TOURNAMENT TO AID SPANISH WAR VETERANS

The Spanish War Veterans' organization is about to conduct athletic sports in New York for the benefit of members in needy circumstances, and for the widows and children of dead comrades. General Eugene Griffin is corps commander of the State of New York Spanish War Veterans, which comprises about thirty-five commands and nearly 5000 enrolled comrades. The commands in the vicinity of New York city have arranged to hold a military athletic tournament in the armory of the Twenty-Second Regiment, N. G. S. N. Y., on March 5, 1904, the net proceeds to go to the treasuries of the corps and commands concerned.

Numerous prizes have been donated by prominent citizens, and as the services of nearly all participants will be given gratis, the affair should prove very successful. Subscriptions from those interested should be sent to General Eugene Griffin, at 44 Broad Street, New York city, for the prize fund of the tournament.

PERSONAL MENTION

MR. F. D. SAMPSON, who for the past nine years has been manager of the Charlotte Electric Railway, Light & Power Company, has resigned from that position to accept that of designing and consulting engineer of the D. A. Tompkins Company, manufacturers of Charlotte, N. C.

MR. T. E. FELT, of Cleveland, has resigned as superintendent of the Ohio Central Traction Company, of Galion, Ohio. Mr. Felt is considering a proposition from a Western road. He formerly was superintendent of the Richmond & Petersburg Railway, operating between Richmond and Petersburg, Va.

MR. S. B. McLENEGAN has been appointed superintendent in charge of operation of the Los Angeles Interurban Railway Company, the new Huntington corporation which recently took over the Los Angeles Company, California Pacific Railway Company and Los Angeles-Glendale Electric Railway Company. Mr. McLenegan was fomerly superintendent of the Los Angeles Traction Company and the California Pacific Railway Company.

MR. WILLIAM WARD HINCHER, formerly of the chief engineer's office of the Chicago Union Traction Company, of Chicago, Ill., has opened an office in Chicago for the Albert and J. M. Anderson Manufacturing Company, of Boston, Mass., and will give his entire attention to the Anderson interests. His office is at 175 Dearborn Street. Mr. Ernst Waltman, of that company, was in Chicago recently arranging for the opening of the Chicago office.

AS THIS ISSUE is going to press, announcement is made of the resignation of Mr. W. W. Wheatly as general manager of the railway department of the Public Service Corporation. No successor to this position has as yet been selected. Mr. Wheatly is planning to take a short vacation before assuming active work again, but it is understood that he has already received an offer of the office of general manager of an important electric railway system elsewhere.

MR. ERNEST THOMPSON, partner in the firm of Nalder Bros. & Thompson, makers of ammeters, voltmeters and other instruments, London, England, died recently, after a long and painful illness. He had been unable to attend to business for about a year, during which time he undertook a voyage around the world in the hope of restoring his health. On his return to London, however, he was unable to take up business again, and he rapidly became worse. Mr. F. H. Nalder, who is well-known in America as well as in England, will continue the business.

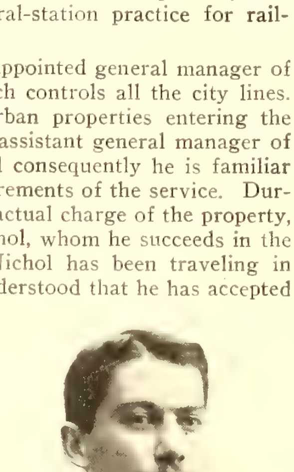
MR. GEORGE G. MULHERN has resigned as general superintendent of the Cleveland Electric Railway Company, his resignation taking effect Jan. 20. Mr. Mulhern has been identified with the street railway system of Cleveland, almost since the first line was built. In 1862 he became driver of a bob-tail horse car, and held this position for a number of years. In course of time Mr. M. A. Hanna became interested in the street car line and took a liking to Mr. Mulhern, and it was not long before he became superintendent. He was for years general superintendent of the Cleveland City Railway Company, of which Senator Hanna was president, and he was appointed general superintendent of the consolidated system after the recent merger. It is Mr. Mulhern's boast that his company has never had a strike, nor has he ever had any trouble with the men under him. He maintained excellent discipline, and, although a bit brusque, he was easy to approach, and always fair with his employees. Some months ago it was reported that Mr. Mulhern was a candidate for the Republican nomination for county sheriff. This was denied up to the time of his resignation, but it is now admitted, and with Senator Hanna's friendship and support, his election amounts almost to a certainty. Mr. Mulhern continues as a

director of the Cleveland Electric Railway. It is probable that his position will not be filled, and that General Manager J. J. Stanley will combine the duties of both offices. A few days ago Mr. Mulhern was pleasantly surprised by about 150 of his former employees, who presented him with a gold watch and chain.

MR. W. H. ABBOTT, who for the last three years has been consulting engineer for the Pomeroy-Mandelbaum railway properties, was probably the first engineer in this country to recommend the adoption of the steam turbine in large units for heavy railway work. Mr. Abbott made a special study of turbines in Europe several years ago, and he has since been an earnest advocate of their development and adoption. He was one of the pioneers in the use of the DeLaval steam turbine for light railway service, and the direct-current machine of this type at the Galien power house of the Ohio Central Traction company, which was described in the Street Railway Journal, April 25, 1903, was installed under his supervision. The equipment of the Cleveland & Southwestern Railway, which was entirely under his personal supervision, affords another instance of his progressive spirit. A complete description of the power plant is presented in this issue. Among the improvements introduced in this plant were 1000-kw Westinghouse-Parsons turbines, the first units of this size contracted for in this country for railway operation. This is not the only innovation which Mr. Abbott has introduced into this system, but it is undoubtedly the most prominent and important, as it marked an entirely new step in central-station practice for railway work.

W. H. ABBOTT.

MR. R. E. DANFORTH has been appointed general manager of the Rochester Railway Company, which controls all the city lines. and has connections with the interurban properties entering the Flower City. Mr. Danforth has been assistant general manager of the company for about two years, and consequently he is familiar with the local conditions and the requirements of the service. During the last six months he has been in actual charge of the property, owing to the absence of Mr. T. J. Nichol, whom he succeeds in the position of general manager. Mr. Nichol has been traveling in Europe for several month, and it is understood that he has accepted a favorable offer in Paris. His resignation as vice-president and general manager of the Rochester Railway Company was submitted at the annual meeting on Jan. 19, and was accepted, Mr. C. M. Clark, of Philadelphia, being elected vice-president, and Mr. Danforth general manager. Mr. Danforth came to Rochester from Cleveland in April, 1902. He is generally recognized as one of the ablest electric railway men in the country, and his experience extends over several years, both in city and interurban service. He was formerly in charge of the lines of the International Traction Company, of Buffalo, and resigned that position to become connected with the Lake Shore Electric Railway Company when that system was being organized. The lack of funds for this enterprise, which greatly handicapped its development in the early stages, led Mr. Danforth to sever his connection with it, as he realized his inability to do justice to himself or the property under existing conditions. During his connection with the Rochester Railway Mr. Danforth has had personal supervision of the operating department, and has also instituted many improvements in the service, so that it is anticipated that he will continue to extend and improve the service.

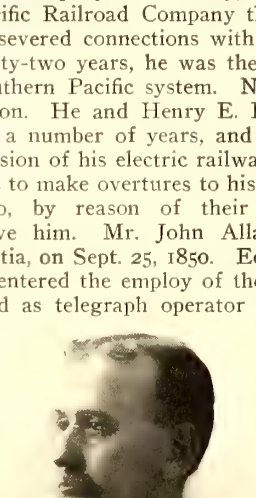


R. E. DANFORTH

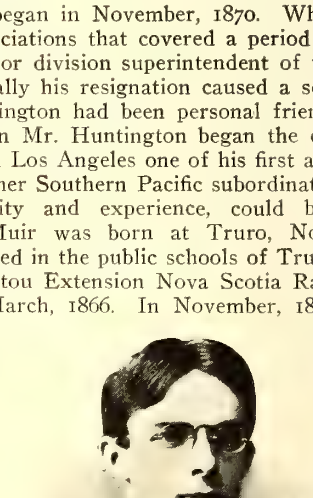
MR. LUKE ROBINSON has resigned as superintendent of the Montreal Street Railway, of Montreal, Que. Mr. Robinson was appointed assistant superintendent of the system in February, 1903, and in March of the same year was appointed to the senior office. Prior to coming to Montreal, he was in Paris, France, and previous to that he was assistant superintendent of the London Street Railway Company, of London, Ont., and became general superintendent of the Montreal Park & Island Railway, of Montreal.

MR. HOWARD E. HUNTINGTON has been appointed general manager of the Los Angeles Railway Company to succeed the late Mr. John A. Muir. Mr. Huntington is the son of Henry E. Huntington, president and chief owner of this railway company, and of the other principal Los Angeles traction systems. Mr. Howard E. Huntington is one of the youngest general managers of a large city traction property in the country, he being only twenty-seven years of age, but despite his lack of years he brings to the position considerable railroad and engineering experience, as well as executive ability, industry and a capacity for hard work. He began his railroad career by driving stakes with an engineering corps of the Southern Pacific, and spent five years in California and Arizona in engineering work for that road. He then went to Harvard, where he took up special civil and electrical engineering work for over two years. Returning to Los Angeles last spring, he was appointed assistant to the general manager of the Pacific Electric Railway Company, under Mr. Epes Randolph, and also fulfilled the duties of superintendent of electric construction. He held that position until his recent advancement. Mr. Huntington is a director in the Los Angeles Interurban Railway Company, and is also connected officially with many of the large corporations in which his father is interested.

MR. JOHN ALLAN MUIR, general manager of the Los Angeles Railway Company, died at his home in Los Angeles on Friday, Jan. 8. His funeral occurred the following Sunday afternoon, from the Second Presbyterian Church in East Los Angeles, and was attended by thousands of citizens who loved and respected him. While the body lay in state in the little church from noon until 1:30 o'clock hundreds passed the white casket to pay their final tribute to the memory of a man whose name has become a synonym for energy, kindness and good fellowship. Mr. Muir accepted the position of general manager of the Los Angeles Railway Company in February, 1902, after a service with the Southern Pacific Railroad Company that began in November, 1870. When he severed connections with associations that covered a period of thirty-two years, he was the senior division superintendent of the Southern Pacific system. Naturally his resignation caused a sensation. He and Henry E. Huntington had been personal friends for a number of years, and when Mr. Huntington began the expansion of his electric railways in Los Angeles one of his first acts was to make overtures to his former Southern Pacific subordinates, who, by reason of their ability and experience, could best serve him. Mr. John Allan Muir was born at Truro, Nova Scotia, on Sept. 25, 1850. Educated in the public schools of Truro, he entered the employ of the Pictou Extension Nova Scotia Railroad as telegraph operator in March, 1866. In November, 1870, having removed to California, he became night operator at Rocklin for the Central Pacific Railroad. In September, 1871, he was made agent of the road at Rocklin, and in 1875 became trainmaster. In July, 1881, he was appointed division trainmaster at Sacramento; May, 1882, he was promoted to assistant division superintendent of the Sacramento and Oregon divisions of the Callifornia, Pacific & Northern Railroad; February, 1884, he was made assistant superintendent of the Southern Pacific Railroad, of Arizona and New Mexico; April, 1886, he was transferred to a similar division of the Southern Pacific Company, and in January, 1893, he succeeded to the position of superintendent of that division. He had headquarters in Los Angeles for almost ten years. In February, 1902, he resigned to accept an offer from Henry E. Huntington, making him general manager of the Los Angeles Railway Company. The present efficiency of the Los Angeles street railway lines is largely due to his untiring efforts. A director in several banks and deeply interested in many industrial enterprises, he will be greatly missed in Los Angeles business circles. He was a prominent Mason. A widow and six sons survive him.



J. A. MUIR



HOWARD E. HUNTINGTON

FINANCIAL REPORTS OF THE OPERATING STREET RAILWAYS OF THE STATE OF PENNSYLVANIA FOR THE YEAR ENDING JUNE 30, 1903

NAME	On June 30, 1903		Year Ending June 30, 1903					
	Capital Stock	Funded Debt	Total Receipts All Sources	Operating Expenses	Charges on Earnings	Dividends Paid Amount	Dividends Paid PerCent	Surplus for Year
	$	$	$	$	$	$		$
Philadelphia Rapid Transit Co.	3,000,000	......	15,436,574	7,234,893	7,795,792	......	..	405,889
Pittsburg Railways Co.	5,000,000	4,579,000	8,603,696	4,569,904	3,880,957	......	..	152,835
Lehigh Valley Traction Co.	2,681,200	2,770,000	811,668	585,197	424,818	7,905	..	df. 206,250
Scranton Ry. Co.	3,000,000	3,000,000	722,228	442,659	233,986	......	..	45,583
Wilkes Barre & Wyoming Valley Traction Co.	5,000,000	2,067,000	678,767	349,578	178,060	150,000	3	1,128
United Traction Co. (Reading)	400,000	149,900	577,689	333,553	228,855	20,000	5	def. 4,719
Central Pennsylvania Traction Co.	2,000,000	75,000	517,485	246,661	99,824	120,000	6	......
Conestoga Traction Co.	4,000,000	1,887,575	409,182	248,600	187,618	......	..	27,036
Pittsburg, McKeesport & Connellsville Ry. Co.	3,000,000	2,978,500	334,199	225,721	107,969	......	..	def. 508
Johnstown Passenger Ry. Co.	2,000,000	1,780,000	329,778	140,713	229,064	40,000	2	59,566
Chester Traction Co.	500,000	250,000	326,805	194,131	107,432	20,000	4	5,242
Schuylkill Valley Traction Co.	500,000	345,000	302,258	233,863	99,116	......	..	def. 30,721
Erie Electric Motor Co.	1,250,000	1,000,000	238,628	146,091	57,593	......	..	34,943
Beaver Valley Traction Co.	1,500,000	1,075,000	214,654	116,994	66,622	......	..	31,037
Altoona & Logan Valley Electric Ry. Co.	415,350	470,500	191,084	119,024	30,306	41,535	10	220
Pennsylvania & Mahoning Valley Ry. Co.	8,000,000	2,500,000	173,849	96,652	151,400	......	..	74,203
Pottsville Union Traction Co.	1,250,000	735,000	169,461	117,055	60,477	......	..	8,073
Philadelphia & Lehigh Valley Traction Co.	1,500,000	1,948,000	169,114	171,149	60,824	......	..	def. 62,859
The Holmesburg, Tacony & Frankford Electric Ry. Co.	750,000	400,000	150,147	100,457	28,280	21,000	2.8	410
City Passenger Ry. Co. (Altoona)	200,000	50,000	145,834	120,261	5,502	20,000	10	69
Philadelphia & Westchester Traction Co.	597,175	390,000	136,532	84,499	36,608	......	..	15,426
Williamsport Passenger Ry. Co.	338,550	169,000	116,206	88,970	15,350	......	..	11,886
Pittsburg, McKeesport & Greensburg Ry. Co.	1,030,000	1,100,000	115,841	64,492	45,882	......	..	5,467
Lehigh Traction Co.	1,000,000	585,000	113,693	70,234	37,254	......	..	6,155
York Street Ry. Co.	300,000	150,000	107,089	58,198	17,450	42,350	14.1	def. 10,908
Schuylkill Traction Co	2,000,000	558,000	104,079	68,629	35,950	......	..	def. 501
Allentown & Reading Traction Co.	250,000	550,000	101,725	48,171	42,774	......	..	10,779
Delaware County & Philadelphia Electric Ry. Co.	300,000	64,000	87,788	59,698	7,007	21,000	7	83
Harrisburg & Mechanicsburg Electric Ry. Co.	144,500	144,500	87,421	56,555	23,564	......	..	def. 7,301
Warren Street Ry. Co.	200,000	200,000	82,707	53,229	13,960	......	..	15,519
Lebanon Valley St. Ry. Co.	500,000	500,000	76,847	40,120	26,531	10,000	2	195
Washington & Canonsburg Ry. Co.	1,000,000	125,000	71,991	27,561	7,340	......	..	37,090
Jefferson Traction Co.	243,700	......	66,046	53,759	419	2,870	*3.59	8,997
Erie Traction Co.	500,000	440,000	65,669	43,091	33,897	......	..	11,319
Media, Middletown, Aston & Chester Electric Ry. Co.	116,671	......	64,716	56,383	10,736	......	..	def. 2,402
Olean, Rock City & Bradford R. R. Co.	210,000	200,000	64,602	46,364	13,062	......	..	def. 5,176
Sharon & Wheatland St. Ry. Co.	50,000	50,000	63,995	56,710	11,359	......	..	def. 4,074
Shamokin & Mt. Carmel Electric Ry. Co.	697,950	302,000	62,726	32,768	19,017	......	..	10,941
Columbia & Montour Electric Ry. Co.	375,000	345,000	61,179	28,398	16,067	......	..	16,714
Lewistown & Reedsville Electric Ry. Co.	150,000	275,000	58,185	26,976	12,851	......	..	18,458
Tamaqua & Lansford St. Ry. Co.	200,000	200,000	57,090	31,672	11,588	10,000	5	3,830
Newtown Electric St. Ry. Co.	300,000	300,000	54,559	42,355	22,762	......	..	def. 10,556
Southwestern St. Ry. Co.	400,000	400,000	52,369	33,423	20,192	......	..	def. 1,247
Bradford Electric St. Ry. Co.	130,000	125,000	52,240	34,872	8,537	9,100	7	def. 269
Tarentum Traction Passenger Ry. Co.	100,000	100,000	51,411	28,083	6,000	......	..	17,327
Butler Passenger Ry. Co.	50,000	100,000	47,001	31,418	2,312	......	..	13,270
Wilkes-Barre, Dallas & Harvey's Lake Ry. Co.	200,000	150,000	45,005	34,781	9,062	......	..	162
Pottstown Passenger Ry. Co.	87,500	75,000	44,262	28,831	5,345	......	..	10,086
Philadelphia & Easton Ry. Co.	641,000	641,000	44,026	19,289	23,263	......	..	1,474
Erie Rapid Transit Co.	500,000	350,000	43,130	33,368	22,120	......	..	def. 12,358
The Valley St. Ry. Co.	150,000	150,000	42,431	32,541	14,230	......	..	def. 4,341
Kittanning & Ford City St. Ry. Co.	50,000	50,000	42,313	21,181	4,235	......	..	16,897
Meadville Traction Co.	350,000	300,000	35,797	27,636	7,500	......	..	661
Westchester St. Ry. Co.	350,000	350,000	35,502	24,220	13,770	......	..	def. 2,488
Philadelphia, Bristol & Trenton St. Ry. Co.	1,000,000	650,000	32,261	28,186	27,191	......	..	def. 23,116
Titusville Electric Traction Co.	100,000	100,000	31,862	23,197	6,361	......	..	2,304
Mauch Chunk, Lehighton & Slatington St. Ry. Co.	600,000	500,000	29,668	23,099	228	......	..	6,341
Shamokin & Edgewood Electric Ry. Co.	60,000	60,000	28,502	18,525	10,096	......	..	def. 120
Vallamont Traction Co.	101,700	100,000	28,063	14,327	7,032	......	..	6,704
Cumberland Valley Traction Co.	446,400	277,500	27,251	26,859	205	......	..	187
Peoples St. Ry. Co. (Nanticoke)	100,000	100,000	25,620	13,680	6,233	......	..	5,707
Susquehanna Traction Co.	200,000	100,000	24,910	19,601	2,480	......	..	2,829
Lewisburg, Milton & Watsontown Passenger Ry. Co.	150,000	150,000	24,193	17,401	8,014	......	..	def. 1,222
York & Dallastown Electric Ry. Co.	106,000	......	24,047	10,884	857	15,680	8 & 12	def. 3,374
Connellsville Suburban St. Ry. Co.	25,000	175,000	22,196	12,216	9,623	......	..	358
Latrobe St. Ry. Co.	100,000	100,000	21,632	14,013	2,668	......	..	4,951
Philadelphia & Chester Ry. Co.	350,000	350,000	21,459	22,110	18,468	......	..	def. 19,119
Red Lion & Windsor St. Ry. Co.	800	......	20,887	6,539	11,709	......		2,540
York & Dover Electric Ry. Co.	121,000	......	20,533	7,067	840	11,050	5 & 10	1,576
Carlisle & Mt. Holly Ry. Co.	100,000	100,000	19,780	10,581	5,466	......	..	3,733

* On $80,000.

Financial Reports of the Operating Street Railways of the State of Pennsylvania for the Year Ending June 30, 1903—*Continued*

Name	On June 30, 1903		Year Ending June 30, 1903					
	Capital Stock	Funded Debt	Total Receipts All Sources	Operating Expenses.	Charges on Earnings	Dividends Paid Amount	Dividends Paid PerCent	Surplus for Year
	$	$	$	$	$	$		$
Lykens & Williams Valley Ry. Co	188,500	174,300	19.767	7,938	389	......	..	11,442
Sunbury & Northumberland Electric Ry. Co	125,000	5,000	19,257	18,352	3,875	......	..	def. 2,971
South Side Passenger Ry. Co	25,000	25,000	18,025	14,511	1,968	......	..	1,546
Montoursville Passenger Ry. Co	75,000	75,000	17,371	13,310	4,045	......	..	16
Montgomery & Chester Electric Ry. Co	55,000	100,000	16,871	12,706	5,033	......	..	868
DuBois Electric & Traction Co	50,000	49,800	15,630	10,290	4,114	......	..	1,227
Northampton Traction Co	500,000	400,000	15,706	14,291	10,000	......	..	def. 8,585
Highland Grove Traction Co	23,000	......	11,327	10,248	890	......	..	189
Stroudsburg Passenger Ry. Co	51,200	8,000	10,650	5,398	365	......	..	4,886
Ashland & Centralia Electric Ry. Co	60,000	60,000	10,375	6,341	4,937	......	..	96
East End Passenger Railway Co	18,000	18,000	10,054	8,051	1,211	......	..	782
Ringing Rocks Electric Ry. Co	50,000	54,000	5,757	12,172	......	......	..	def. 6,414
Gettysburg Transit Co	100,000	100,000	7,730	7,403	296	......	..	30
Bangor & East Bangor St. Ry. Co	40,000	40,000	8,178	5,784	1,194	......	..	1,200
Hanover & McSherrytown St. Ry. Co	30,000	......	8,144	5,347	304	......	..	2,483

NEWS OF THE WEEK

CONSTRUCTION NOTES

HOLTON, CAL.—The Holton Power Company is developing water power on the large Imperial irrigating canal, and will build an electric railway, 12 miles long, to Imperial, where connection will be made with the Southern Pacific Railroad. Samuel Starrow, of Los Angeles, is the engineer for the Holton Power Company.

LOS ANGELES, CAL.—Articles of incorporation have been filed in San Diego by the San Diego Bay Terminal Railway Company. The incorporators are: George W. Marston, U. S. Grant, John E. Boal and others, all of whom are also incorporators of the San Diego & Eastern Railway. The capital stock is $50,000. The purpose of the new company is to build 5 miles of railway within San Diego.

LOS ANGELES, CAL.—Grading will soon begin on the new Pacific Electric Railway Company's line to Anaheim Landing. This road will be a branch from the Long Beach line, about 10 miles from Los Angeles, turning southwest. When completed it will be 26 miles long. One trestle will be needed over a bayou, but otherwise the construction will be simple. The road will be double track of standard gage.

LOS ANGELES, CAL.—Henry E. Huntington has issued orders for the extension of the Pasadena Short Line to Lamanda Park. The line will be built on Huntington Drive from the Monrovia Division, and will supply a connection with the Colorado Street line in Pasadena. Later the line will be completed to Sierra Madre. Work has also been begun on a branch line to run south on the Alhambra Division to Shorb's winery, in order to land supplies intended for Dolgeville. Orders have been issued to rush construction of the Los Angeles Railway Company's new line to Garvanza. Mr. Huntington denies the story of the absorption of the Ventura-Bakersfield electric road.

STOCKTON, COL.—J. T. Burke, acting for J. R. Paddock, has made application for franchises in this city and San Joaquin County for permission to run pole lines for supplying electric light, heat and power. It is said that the interests which Mr. Paddock represents will use the power for the electric railway that is proposed between Stockton and Bakersfield.

ORANGEVILLE, IDAHO.—The surveying crew of the Southeastern Electric Railroad Company under Chief Engineer W. Hill is running the line from Orangeville to the power station on Clearwater, and between Cottonwood and Denver. The surveys will be completed by March 1.

BELLEVILLE, ILL.—The Belleville City Council has granted a franchise to the Southern Illinois Electric Railway Company to operate an electric line on Mascoutah Avenue, Abend Street and Second Street to Illinois Street, where the line will connect with the East St. Louis & Suburban Railway. The company was represented by its president, J. R. Piercy, and Superintendent Isaac R. Smith, of Mount Vernon, Ill. These officials signed agreements before the franchise was granted that the fare from Mascoutah to Belleville would be 15 cents one way for adults and 7½ cents for children under twelve years of age, and that cars would be running from Salem to Belleville by July 1.

CHICAGO, ILL.—The sub-committee of the council committee on local transportation, which has had the Northwestern Elevated Company's ordinance for the Ravenswood extension in hand for some months, has recommended a change in route which would permit the company to run only two blocks in Irving Park boulevard. The sub-committee has also adopted an amendment proposed by Alderman Butler requiring the company to build a 4½-mile surface extension west of Western Avenue to Irving Park, Mayfair and Jefferson. Attorney Knight, for the company, has given notice that this amendment is not acceptable.

HILLSBORO, ILL.—The City Council has granted Isaac Hill a franchise to construct and operate an electric railway in Hillsboro, the work to be begun in one year and completed in two years. If the work is done the franchise will last twenty years.

VENICE, ILL.—The management of the Granite City & Venice Electric Railway Company is preparing plans for a new power house and car houses at Venice.

BEDFORD, IND.—The City Council has granted an electric street railway franchise to a company of local men, including Col. A. C. Voris, W. M. Mathews, J. W. Gouser, M. N. Messiek, E. B. Thornton, V. V. Williams, I. N. Glover and Frank Owens. The line will be extended to Ooletié, in the quarry district. The total cost of construction is estimated by the engineers at $125,000. The company will incorporate at once.

BROOKVILLE, IND.—Charles N. Wilson, of Indianapolis, representing the Columbus, Greensburg & Richmond Traction Company, addressed a mass meeting at Carthage, Rush County, recently, in the interest of a traction line from Greenfield to New Salem, to connect with the company's main line from Columbus to Richmond. All Mr. Wilson asked for was a free right of way through Carthage. The proposition was favorably received.

COLUMBUS, IND.—The Columbus, Greensburg & Richmond Traction Company has awarded the contract for the survey of its road to Jeup & Moore, engineers, of Indianapolis. The work is to begin in ten days. The progress of this company has been very rapid and the contract for actual construction will soon be let. C. N. Wilson, of Indianapolis, is secretary.

CRAWFORDSVILLE, IND.—The Consolidated Traction Company is arranging to build a large power house in Crawfordsville in the spring. Edward Hawkins, president.

KINGMAN, IND.—Col. A. G. Smith and other local capitalists are promoting an electric railway from Kingman to Covington.

RICHMOND, IND.—The City Council has made formal demand upon the Big Four Railroad, requiring it to raise its bridge on West Main Street, so that interurban cars from Indianapolis may enter the city. At present this bridge is the only thing which prevents the operation of through cars from Indianapolis to Dayton, and as soon as it is put in shape so that cars can pass under it, it is generally understood that the Holland sleeping cars, illustrated in a recent issue of the Street Railway Journal, will be placed in operation from Indianapolis to Columbus.

SHELBYVILLE, IND.—A. U. Blessing, W. H. Henderson, E. M. Boyd and other local men are promoting an electric railway between Shelbyville and Columbus, via Hope. A civil engineer has been secured to survey the route of the line and report as to the feasibility of the project.

VINCENNES, IND.—The Western Indiana Traction Company has elected officers, as follows: Samuel Williams, of Vincennes, president; F. S. Robinson, of Cloverland, vice-president; John Le Croix, of Vincennes, secretary-treasurer. The company will build a line from this city to Terre Haute this spring.

WABASH, IND.—The stockholders of the Wabash & Rochester Railway Company, organized to build a traction line from this city to Rochester, 35 miles, and in aid of which $112,000 in subsidies has been voted, has elected officers as follows: Charles Crean, of Geneva, Ohio, president; C. E. Barnum, of Cleveland, Ohio, treasurer.

NORTH ADAMS, MASS.—The Selectmen of Williamstown have given a hearing on the petition of the Hoosac Valley Street Railway Company for an extension to the Vermont State line, there to connect with a line for Bennington, Vt. The line in Vermont will be controlled by the owners of the Hoosac Valley Street Railway Company.

INDEXED

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, FEBRUARY 6, 1904 No. 6.

Published Every Saturday by the

McGRAW PUBLISHING COMPANY

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York,"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Canada and Mexico......................$4.00 per annum
Single copies, first issue of each month, 25 cents; other issues, 10 cents.

To all Countries outside of the United States, Canada and Mexico.... { $6.00, £1-5s, M 25, Fr. 31 }

Single copies, first issue of each month, 40 cents; other issues, 15 cents.
Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

The New Jersey Situation

As stated elsewhere in this issue, President Thomas N. McCarter, of the Public Service Corporation, announced on Jan. 29 the resignation of W. W. Wheatly as general manager of the railway department of that company and that the practical operation of the system hereafter would be under the personal direction of Albert H. Stanley, as general superintendent. As readers of this paper know, there has been considerable public dissatisfaction with the service furnished by the company during the last few months. This fact, coupled with the announcement of Mr. Wheatly's resignation, has caused considerable surprise to those who are acqainted with his high reputation as a railway manager. It is generally understood, however, that the policies of the company which have provoked the greatest public dissatisfaction have never met the approval of Mr. Wheatly, and that they were carried out by him only because they were insisted upon by the board of directors and against his protest. Many new cars were ordered under Mr. Wheatly's management and other improvements were commenced which will soon show their effects in an improved service.

It is the belief of all those who have studied the situation carefully, that the causes for the dissatisfaction which now exists can be made to disappear and that success will crown the efforts of President McCarter and Superintendent Stanley, provided they receive the support of their board of directors. If, however, the latter does not adopt a broad and harmonious policy, the new management will be able to do little more than that lately in charge of the property, and the sacrifice of the recent manager to appease the public will have been useless.

Trippers and Time Tables in St. Louis

In another column is given an interesting interview with A. B. Du Pont, second vice-president of the St. Louis Transit Company, in which he outlines briefly the policy which he has pursued since taking the management of that company, in the matter of fast schedule speeds and increasing the number of trippers as compared with regular cars. Mr. Du Pont probably stands as the most radical advocate of fast city schedules to be found among the prominent managers of the country. It will be seen from this interview that the St. Louis Transit Company's city service is remarkable not only on account of the average speed, which is high for a city the size of St. Louis (being a little over 10 m. p. h.), but also on account of the enormous increase in the number of cars in operation during the rush hours, as compared with the regular mid-day schedule, this increase amounting to about 144 per cent. While all will probably agree with Mr. Du Pont's position that fast schedules are economical as far as ordinary operating expenses are concerned, providing motor equipments are of the proper size, many managers will take issue with him on the question of accidents, on the ground that very fast schedules are dangerous in city practice. Mr. Du Pont's position in this matter, however, is consistent with his convictions, even if quite radical, as he maintains that accidents are less frequent with fast than with slow schedules, when once the public has been educated to the fact that a fast schedule is in force. There is, undoubtedly, much in the theory that the more the public is fraternalized and surrounded by safeguards, the less care each individual takes to look out for himself, and while it may work out well in St. Louis and some other places, we apprehend trouble for many managers elsewhere should such a course be pursued. For instance, any attempt at fast runs on Broadway or other congested thoroughfares in New York, State Street in Chicago, or Chestnut Street in Philadelphia, would result in a panic, and settle forever the question of high speed in any of those cities.

As regards the unusual number of trippers put in service in St. Louis during the rush hours, there will be few managers to disagree with Mr. Du Pont in the statement that ample and quick service during the crowded hours is conducive to short distance riding during those hours, and hence results in increased gross revenue. That more companies have not adopted the same plan during the rush hours to the extent practiced by Mr. Du Pont is due to a number of causes. In some of the largest cities, there is simply not room on the down-town tracks for such an increase. In others the company's supply of rolling stock has not kept pace with unexpected increases in travel. In the smaller cities the number of cars is not reduced during the middle of the day to correspond with the traffic to such an extent as in St. Louis. That this reduction is not made may be due to a desire on the part of the manage-

ment not to have the cars too far apart on any one line during the quiet hours, or to a desire to increase the number of working hours of the conductors and motormen, so that they will be satisfied with the wages they are earning. Indeed, the question of giving the trippers work enough to permit them to earn good wages is an important one on every large road.

As to the way the ideas adopted by the St. Louis management actually work out in the service, it has been the observation of the writer that, leaving out of account small blockades, which are frequent though unavoidable, very few passengers are not provided with seats during the rush hours at St. Louis. This is as would be expected where such a large number of tripper cars are turned loose on the streets during the rush hours. Brief blockades, however, are sure to occur, and St. Louis people, like those in every other city in America, invariably pile on to the first car to be let out of a blockade, even though several cars following it are half empty. The writer's observation has been that while there are seats enough as a rule, it is a tolerably frequent occurrence to see one crowded car followed by a number partially empty. It might be supposed that with so many trippers on the streets there would be few "kicks" in St. Louis on the rush-hour service; but, apparently, the people of that city exercise the American citizen's inalienable prerogative of kicking as vigorously, as often and as inconsistently upon the transportation service as anywhere else. If numbers of cars during the rush hours could silence complaints, the service in St. Louis should certainly accomplish this.

The Repulsion Railway Motor

We are pleased to be able to present to our readers the interesting Institute papers of Messrs. Slichter and Steinmetz. There has been so much enthusiasm aroused by the coming of single-phase alternating railway motors, as evidenced by the almost simultaneous announcements of Eichberg and Winter, Finzi and Lamme, that a pronounciamento from the immediate propinquity of Dr. Steinmetz has been awaited with some eagerness. It has been an open secret for some time that very interesting work with the Thomson repulsion motor was in progress, and this pair of papers may be taken as a sort of preliminary report. They are exceedingly well worth reading, but hardly illuminating as regards the actual properties of the machines thus far turned out. In fact, lest we be thought hypercritical, all the data yet published regarding any one of the single-phase motors thus far announced could be crowded under a very small hat without the least need of stretching it. Of course, commercial necessity sometimes makes it desirable to keep details out of print for long periods, but under this condition we think general statements, which, backed by the reputation of a great company, will pass current at their face value, are quite as instructive as fragmentary technical data like those proffered by Mr. Slichter. We do not wish to be censorious in the matter, but merely to call attention to the fact that in his paper, Curve Sheet 1 is from the tests of an actual machine of a rather early type; Curve 2, which gives a comparison with a d. c. railway motor, relates to another and later form of repulsion motor, and to a "standard" railway motor of unnamed type and size. Curve 3, which gives comparative running tests, relates to unspecified motors, both a. c. and d. c., which may or may not be those previously mentioned, and finally Curve 4 gives the expected charactertistic of a motor which exists merely on paper.

When one has to pick up such incoherent scraps of knowledge as these, he not unnaturally feels a certain disappointment. It is apparent, however, that the motors referred to are machines well worth serious consideration in railway service. Like all the others of the new crops of a. c. motors they are of rather low power factor at or near starting, but give satisfactory results when up to speed. Their efficiency is likewise lower than that of d. c. motors, but, as we have several times remarked, one may as well lose efficiency in the motor itself as in a rotary converter and the rest of the outfit. The weight of the motors alluded to by Mr. Slichter is not given, but it should, from the type of motor represented, be not materially in excess of ordinary railway motors of a similar output. As to the theory of the motor, Dr. Steinmetz elucidates that in his usual workmanlike manner, and by his customary symbolic methods, although in the abstract of the paper, as published in this issue, the mathematical discussion is omitted. We wish, however, that in this instance he would step out of the beaten track and give a discussion of the repulsion motor without recourse to the fiction of a rotating field, or, still worse, two rotating fields spinning simultaneously in opposite directions. Considering the fact that a typical repulsion motor has but a single magnetizing coil, supplied by a simple alternating current, and a commutating armature with its polar line definitely located by the short-circuited brushes, its theory, although containing some annoying details, ought to be expressible in less artificial terms. The repulsion motor is, indeed, one of the most straightforward and effective types of alternating motor, and likewise one of the earliest. It would have long since taken a prominent place in the art but for its possession of those very "series characteristics" which render it so valuable for the present purposes. The demand for alternating motors in the past has been of a kind requiring constant speed, a condition best met by polyphase induction motors.

Now, however, that a demand for alternating railway motors has made itself felt, the repulsion motor is thoroughly available. The difficulties of commutation are probably rather less in the repulsion motor than in a series-alternating type, and at the frequencies now used upon a large scale, ought to be in great measure overcome. When the customary frequency was 125 cycles per second, or thereabouts, the commutation of an alternating current was a pretty serious matter, but at 25 cycles or less, it is far more practicable. The repulsion motor is certainly somewhat easier to insulate properly than an alternating series-wound machine and its connections seem a bit simpler. It also can, when reversed, act as a generator, and turn back power into the line even at moderate speeds. Whether this property can be made commercially valuable is a matter to be determined in practice, although in the case of direct-current motors we are not aware that the saving of power thus possible has been of any material value in electric railroading. Certain it is that the repulsion motor has been evolved into a form that compares on, at least, practically even terms with any other commutating alternating motors yet proposed.

We earnestly hope that the cover will soon be taken off the entire subject, so that practical electric railway men may get a clear insight into the actual working properties of these very interesting machines. In this connection it should be pointed out that although most necessary for the improvement of interurban work, the alternating motors are the subject of very strong claims on economical regulation of speed. In the present case Mr. Slichter shows gains from this source more than enough to compensate for the lower intrinsic efficiency of the alternating motor. Since the final test of practical efficiency is

the power taken to run a car on a given schedule and track, gains in regulation are important, and particularly so in ordinary tramway service in which a motorman may run for several miles without ever getting the resistance fully out of circuit.

Heating Cars

The Legislature of New York has under consideration a bill providing for "the proper heating of steam, elevated and surface cars." The proposed measure is the result of complaints made during the last few months, when unusually severe weather has prevailed throughout the State, and it has been simply impossible for the operating companies to keep the cars comfortable at all times. Representatives of steam roads have protested vigorously against the enactment of the bill, on the ground that conditions over which the railways had absolutely no control whatever, made it impossible for them to heat the cars. At times during the winter, it was pointed out, the most powerful engines employed have been unable to make sufficient steam to haul the trains and make the schedule without furnishing any heat whatever for the coaches. Yet, on these lines, if anywhere, it would seem, heat should be furnished, owing to the fact that the passengers ride much longer distances than upon electric lines. On the surface street railways the difficulties are even greater, owing to the frequent stops that are necessary to permit passengers to enter and leave, thus admitting enough cold air to chill the cars. Although the stops on the elevated trains are much less frequent than on the surface lines, it is even more difficult to keep them warm in extremely cold weather, owing to the fact that both front and rear doors are thrown open at every station while the train is still in motion, thus creating a draft through all excepting the front and last cars. Last month trains were started out comfortably heated, but before making the third stop they were invariably cold, and no amount of heating apparatus that was practicable for such service could keep them warm.

Under the circumstances it can readily be seen that legislation on this subject is wholly uncalled for, that the proposed measure suggests the possibility of endless litigation and much acrimonious discussion, and that the entire movement looks suspiciously like a raid upon the transportation interests. There is scarcely any other subject upon which there is such a wide divergence of opinion as that of the proper temperature for a public conveyance. Some patrons are constantly complaining because the cars are too hot and "stuffy," others as vigorously protesting every time a ventilator is opened to admit fresh air, so that it is certainly a difficult task to satisfy any considerable number of passengers.

A Movement for a Track Association

In another column is given a copy of the circular letter now being sent out by Fred. G. Simmons, superintendent of construction and maintenance of way of the Milwaukee Electric Railway & Light Company. This letter invites the co-operation of track and way superintendents in the organization of an association devoted especially to their interests. This definite move on the part of Mr. Simmons comes as the culmination of considerable quiet agitation on the subject which has been going on, among those interested, during the last six months, or since the American Railway and Mechanical Association committed itself definitely to the policy of not taking up subjects connected with the construction and maintenance of track. Indeed, it is not unlikely that the next street railway convention will see a profitable convention of track men. There are those who decry multiplication of organizations, but it is only by specialization that results can be accomplished in these days. One argument urged against dividing up the work among so many associations is that on the smaller roads one man looks after all departments. On the other hand, it is undoubtedly true that the greater part of the attendance and support of such organizations comes from large and medium-sized companies with whom the work is divided among different department heads. The company which can afford to send its master mechanic and superintendent of power to a convention can equally afford to send its superintendent of track. A large amount of money is going to waste every year in electric railway tracks for the lack of interchange of knowledge and the results of experience among track men of various companies. Although it has been thought by some that track men were not numerous enough to have an organization of their own, Mr. Simmons believes that it will be demonstrated that there are more available men for membership in a track organization than for membership in the Master Mechanics' Association. This belief is probably based on the fact that practically every company having a master mechanic has also a track superintendent. The formation of a track and way association will undoubtedly tend to bring out many track superintendents who have heretofore remained in the background, as far as conventions were concerned. The same thing happened at the time the Accountants' and Master Mechanics' associations were formed, and there is no reason to suppose that it will not be true in this case. All interested in the formation of a track and way association should communicate at once with Mr. Simmons so that further plans of organization can be formulated.

Snow Removal and Blockades

An old-fashioned winter brings sorrow to the street railway superintendent as surely as it causes joy among the small-boy contingent, and in about the same relative proportion. Operating forces on city lines have always had their troubles in winter, and these are in no degree lessened by the universal dependence that is placed upon trolleys nowadays in every community, especially during periods of bad weather. When it is most difficult to operate cars, the demand is greatest upon the system and patrons are most exacting. But the troubles of the city superintendent are as nothing in comparison with the lot of the interurban manager, whose line extends through an exposed district with many opportunities for drifts. However, it must be admitted by the most severe critics of interurban roads that during the unusually severe weather that has visited all parts of the North this winter the electric lines have given a good account of themselves, and have nothing to fear by comparison of their record with those of the steam lines in their immediate vicinity.

A new problem has come up in some localities, which is due to the unusually heavy snowfall; namely, complaints on account of the delays occasioned by teamsters using the tracks, thus compelling the trolleys to crawl along at a snail's pace, and the demand of city officers that companies carry away the snow on streets occupied by car lines. Teamsters arrested for obstructing traffic pleaded that they were compelled to use the tracks, as the embankments of snow thrown up on either side effectually closed the rest of the street so far as traffic was concerned. The city officers contended that the railway companies must cart away the snow and not pile it upon the sides of the roadway. In one instance a compromise was effected, the company agreeing to divide the cost of carting away the snow on the streets occupied by its lines.

THE CONNEAUT & ERIE INTERURBAN SYSTEM

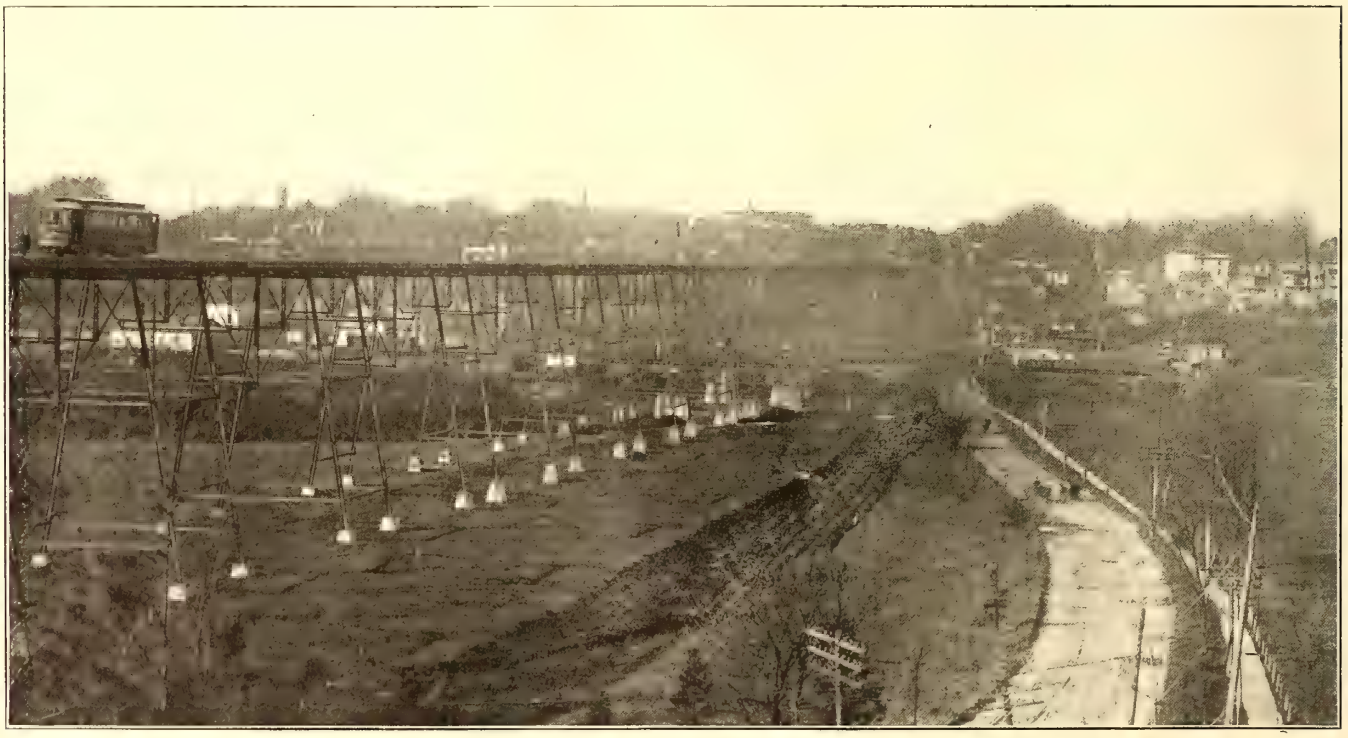
When the Conneaut & Erie Traction Company, on Nov. 7 last, completed its line from Conneaut, Ohio, to Erie, Pa., the necessary connecting link was supplied, making it possible to travel from Detroit, Mich., to Westfield, N. Y., entirely by electric cars. At its west end the line connects with the Pennsylvania & Ohio Street Railway, and at the east end with the Erie Rapid Transit Railway, the total distance between these points being about 35 miles. Beginning at Erie the intermediate localities of importance are Weigeltown, West Millcreek, Swanville, Bear Creek, Fairview, Doblers, Girard, Milesgrove, Elk Creek, Cudneys Corners, East Springfield, West Springfield, East Conneaut and Conneaut. As is usually the case the road was opened in sections as fast as they were built; the first division connected Erie and Swanville being 6 miles long, and the first car ran over it on June 14, 1903. About one month later the second section, 8 miles long, was extended from Swanville to Girard. The third section, Conneaut to East Springfield, 8 miles long, was completed on Sept. 26, and finally the entire line, as indicated on the map on page 195, was put in operation on the date already given.

THE LINE

The country through which the road passes is fairly level for long stretches and required but little grading. For a few short distances, however, it is very rocky and irregular, and in these places considerable cutting, filling and trestle work were necessary. One of the most serious difficulties was encountered near Conneaut, where, as shown in one of the views on this page a steel viaduct was built, 1860 ft. long and 68 ft. high, at the deepest part of the valley it spans. The roadbed, as at present completed, is very good, having been leveled so that there is nowhere a grade steeper than 4 per cent. The only criticisms that can be made of it are, that there are a number of short curves, the consequence of right-of-way compromises (about 80 per cent of the line is on private right of way), and that in some parts the track is exposed to sweeping winds, which give trouble in winter by drifting snow over the rails. Both of these faults will be corrected as rapidly as experience suggests remedies and circumstances allow their application.

The numerous views taken along the line give some idea of the variety of scenery passed through—urban and rural, flat and hilly, open and wooded. Probably the most beautiful sections are along the gorges near Elk Creek, Crooked Creek and especially in Walnut Canyon, between Swanville and Fairview. Erie, one of the terminals, is a city of 60,000 inhabitants; Conneaut, at the other extremity, has in the neighborhood of 15,000, and the population of the entire territory served by the road is about 100,000. An average total of about 4000 passengers daily, or 1,250,000 annually, is carried, with ordinarily five cars runing at a time. These start hourly from each terminal, the road being single track, and pass one another at long, properly spaced turnouts, of which there are ten. The schedule time required to make the trip from end to end of the line is 2 hours and 20 minutes. This makes the average speed, including stops for passengers and waiting on switches, 14.5 m. p. h.


STATE STREET AND POST OFFICE, ERIE


LONG VIADUCT AT CONNEAUT

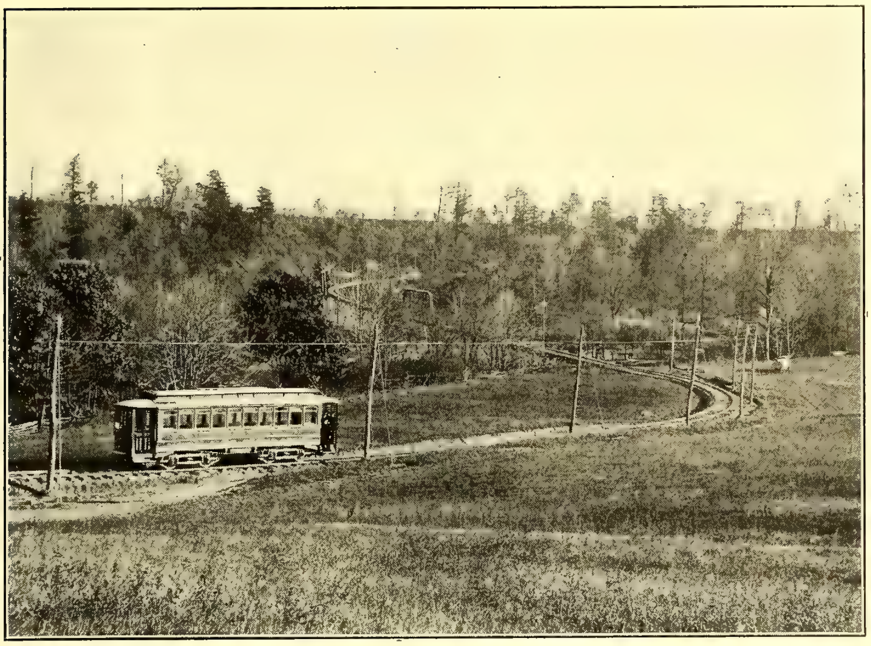
OVERHEAD CONSTRUCTION

The overhead construction throughout is of very substantial character and has in all possible details been arranged to secure

permanence both of alignment and operation. The road is equipped with double trolleys from end to end, which are divided into three sections by section insulators, located at the power station and at Swanville. The sections from the power station west to Conneaut and east to Swanville are operated directly from the station bus-bars, while the third section from Swanville to Erie is operated through the booster.

The general construction of the pole line, as well as all details and sizes of the materials and fittings used, is shown by the cut on page 200. Between the power station and Erie 35-ft. chestnut poles are used, each carrying two cross-arms, double banked, and located so as to allow sufficient room at the top of the pole for a future alternating current feeder for the operation of the Erie end of the line by a rotary converter, if the traffic develops beyond the capacity of the present booster. From the power station to Conneaut 30-ft. chestnut poles are used, each having a single cross-arm at the top of the pole.

DEEP CUT AND FILL BETWEEN SWANVILLE AND FAIRVIEW



LONG REVERSE CURVE AT ELK CREEK

The feeders are of copper, and are of two sizes, No. 0000 and 500,000 circ. mil. They are all carried by the main pole line, except where several cut-offs have been arranged, by which the feeders are carried on a special pole line in crossing the ravines and long curves, representing a material saving in the distance of transmission. The main pole line also carries two No. 12 hard-drawn copper wires, forming the telephone circuit.

About 25 per cent of the line is span construction, and the remainder of bracket construction, carried by 10-ft. Ohio Brass Company Richmond type brackets of 2-in. steel tubing. The cross-arms are four-pin, heart yellow pine, 4¼ ins. x 3¼ ins. cross-section by 5 ft. long, with 1½-in. boiled locust pins and No. 2 and No. 2½ saddle top, triple-petticoat, glass insulators. At curves, corners and all points of heavy strain, iron pins and composition insulators have been used. The trolley wires are No. 00 hard-drawn round wire, and were erected in mile lengths. They are continuous from end to end of the road, so as to pass around all turnouts without frogs or switches, and are carried by 15-in. deep groove clinch ears, which are also soldered. All overhead materials and fittings are of extra heavy weight, and were furnished by the Ohio Brass Company. In addition to the lightning arresters on the station switchboard and the main arresters at the outside of the station, the line is thoroughly protected by lightning arresters, spaced every half mile from end to end of the road and grounded in special charcoal-filled holes.

CAR EQUIPMENT

Six double-truck Brill interurban cars and two Jackson & Sharp combination passenger and baggage cars, similar to those shown in the illustrations a rotary snow-plow, a box car with ball-nose snow pusher, and two flat cars make up the present rolling stock. The rotary plow, said to be the second largest in the United States, is an eight-wheel Ruggles, having four 1000 G. E. motors on the trucks and a 200-hp motor to drive the fans. The cars are about 45 ft. long over the end panels, and weigh with full equipment in the neighborhood of only 20,000 lbs., the manager having insisted on the lightest

EAST APPROACH TO ELK CREEK TRESTLE

weight consistent with strength. Six are each provided with four G. E. No. 1000 motors and G. E. controllers, and two are equipped with four Westinghouse No. 56 motors and K-14 controllers. The cars are heated by electric heaters, built by the Gold Street Car Heating Company, and have double side seats

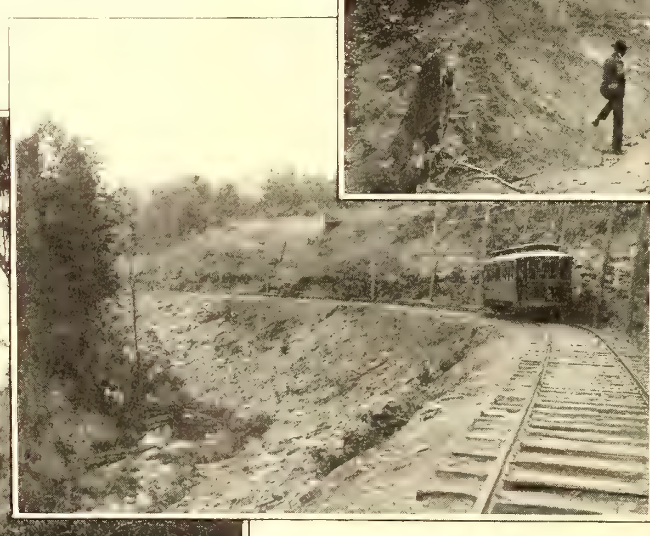
STANDARD CAR

with an aisle in the center. There are ten seats on each side so that each car will seat forty passengers outside of the baggage compartment. Air brakes and whistles are provided, compressed air being furnished by a motor-driven pump, built by the Christensen Engineering Company, and a special form of cash register is used, manufactured by the Ohmer Cash Register Company, of Dayton, Ohio. It is arranged to record and indicate the total number of fares at each of the several rates charged, according to the distance traveled by the passenger—5, 10, 15, 20, 25, 30, 35, 40, 45, 50 and 60 cents and "ticket." To set the register for any one of these points, there is a long spindle extending the length of the car, having frequently spaced handles, which rotates a pointer on the dial and shows when the proper position is reached. The register cord is then pulled when the amount of the fare and its sequential number is shown on the face of the register, and at the same time printed on a slip of paper inside of it.

POWER PLANT

At Elk Creek, not quite in the center of the system, being about 17 miles from Erie and 14 miles from Conneaut, the company owns about 22 acres of land, upon which the power plant has been erected. It is admirably located near a source of spring water for boiler feeding and condensing purposes, and at the same time has favorable facilities for receiving coal. The water from this creek has already proved of an unusually good quality for use in the boilers, as shown by analysis, and has so far caused no discernible deposit in the tubes. The plant comprises two buildings, a boiler house and engine house, placed back to back with a common separating wall. The boiler house is 42 ft. long by 40½ ft. wide, and 37½ ft. high to the center of the glass-sided monitor which extends its length. The engine room is 54 ft. long by 44 ft. wide, and since it receives ample light from its large windows, has an ordinary timber-trussed gable roof, the center of which is 42½ ft. from the floor, and the eaves 31½ ft. The floor level in the boiler house is about 10¼ ft. below that of the engine room, as indicated in the accompanying cross section. This arrangement has two advantages, it facilitates the coal handling and reduces the length of the steam piping. From an opening into the engine room a gallery extends between the boilers at about the center of the room. This allows the engineer to keep watch of the conditions in the boiler room, and enables him to give his firemen instructions in case of an emergency.

The steam generating outfit includes three Babcock & Wilcox boilers, containing 1508 sq. ft. of heating surface each,

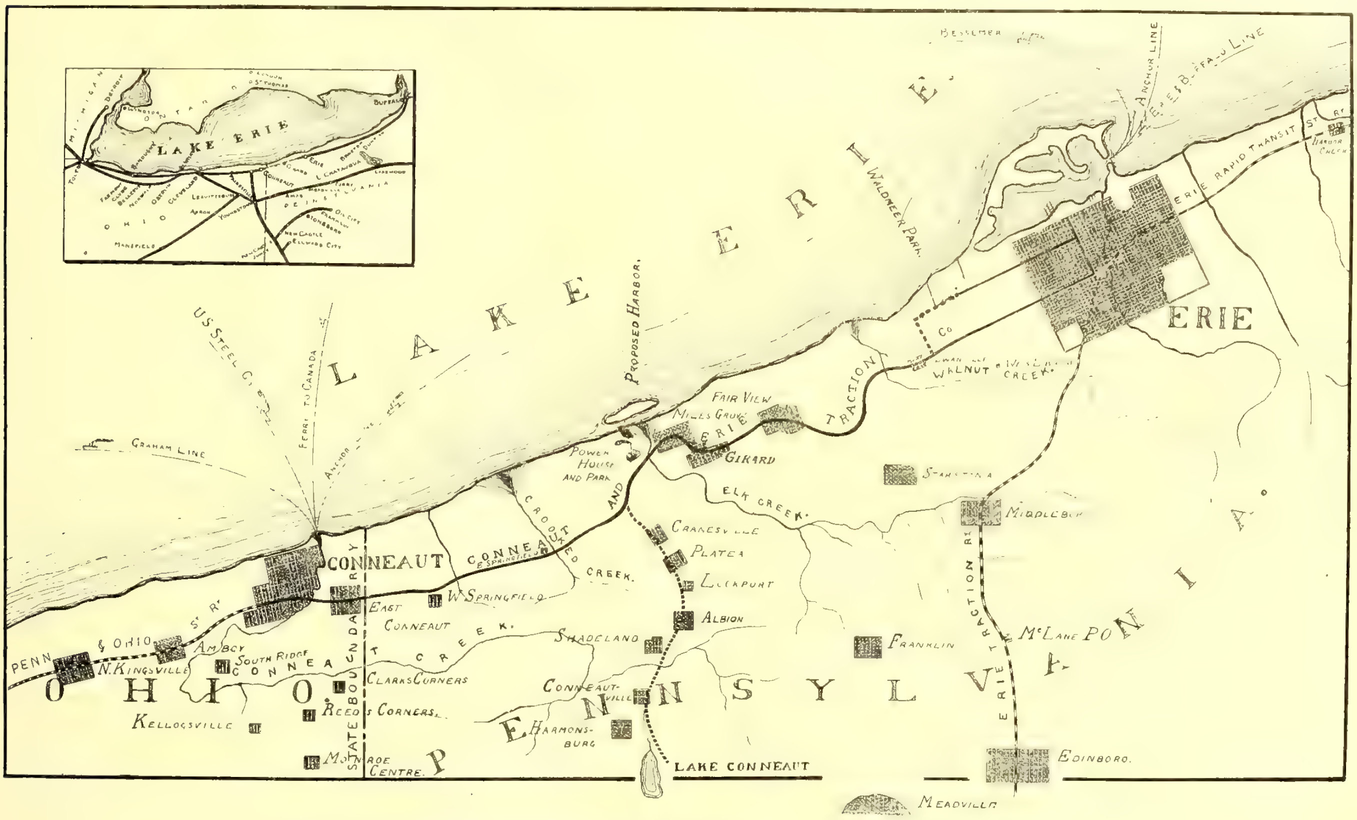


VIEWS IN AND NEAR WALNUT CANON

placed with their backs towards the engine room. Space is allowed for the future installation of one more of the same size. Each boiler contains seventy-two 4-in. tubes, 18 ft. long, arranged in a bank eight wide and nine high, and a drum of 7-16-in. steel, 42 ins. in diameter and 20 ft. 4 ins. long. The usual water columns, feed and blow-off connections, gages and safety valves are provided, the latter being set to open at a pressure of 150 lbs. Each furnace has a grate area of 35 sq. ft., made up of ordinary flat grate bars, containing about 40 per cent of air space in 9-16-in. openings. The smoke breeching is 66 ins. x 48 ins. in area at its largest cross-section, and delivers into the base of a Custodis chimney, 5 ft. in diameter and 125 ft. high. The coal is delivered to the rear of the boiler

plant in cars on a spur trestle extended from the tracks of the Nickel Plate Railroad, and is chuted through the coal doors onto the floor in front of the furnaces.

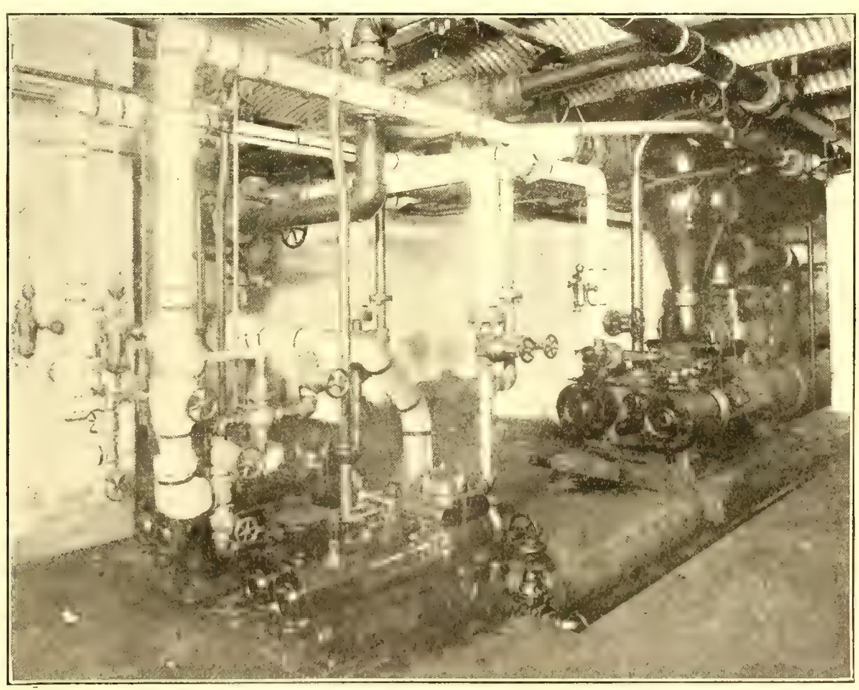
As will be seen from the plan the steam lines are quite short, so short in fact that it was unnecessary to install steam separators on the engines. From each boiler a 5-in. branch, taken with a sweeping right-angle bend, leads to a horizontal 10-in. header, extending along the dividing wall on the engine room side, the joints of which are of the improved recessed Van Stone type with rolled steel flanges. On the boiler room side these branches are tied together with 6-in. connections, containing valves. Valves are also placed in the branches on both sides of these connections, on the 10-in. header between each of the branches, so that it is possible to supply either engine from any boiler in two ways. The connections from the header to the engines are vertical 180-deg. bends of 6-in. pipe, which serve to prevent any considerable amount of moisture from passing over into the engine cylinders. Whatever condensation collects in the header is removed through a trap and drain.



MAP OF THE LINES OF THE CONNEAUT & ERIE TRACTION COMPANY

In the engine room there are two direct-connected generating sets, each composed of a Pennsylvania Iron Works' cross-compound engine, with cylinders 18 ins. and 36 ins. x 56 ins., and a 400-kw Crocker-Wheeler 448-D railway-type generator. The generators have fourteen poles, are cumulative-compound wound, deliver current at about 560 volts, and have a normal capacity of over 700 amps. each. Traffic is generally nearly

VIEW IN BOILER ROOM



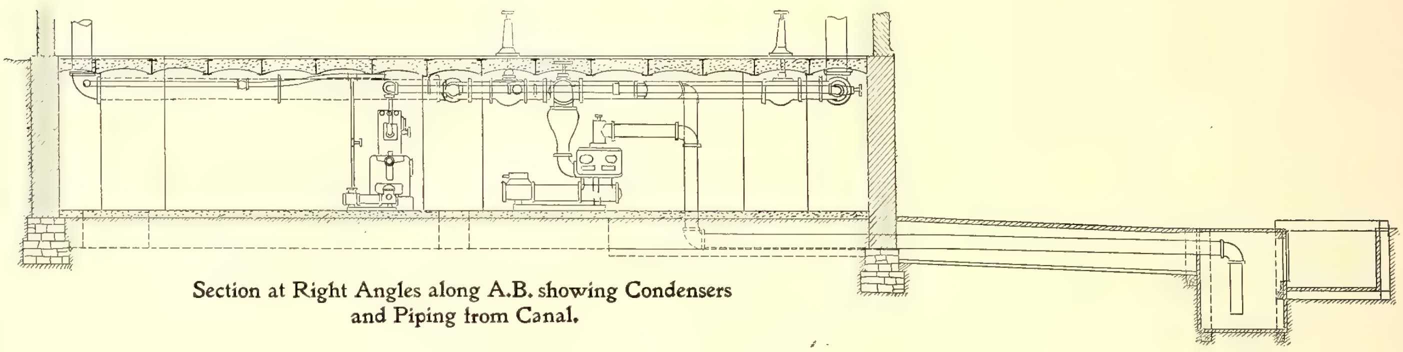
VIEW IN BASEMENT, SHOWING CONDENSER AND FEED PUMPS

constant during the day time, and the maximum average load is but 450 amps.; consequently, either set will carry it alone. The maximum load possible with both machines running without overload would be about 1500 amps. The generators have cast-iron, internally-flanged magnet frames, in which the mild steel poles are cast-welded, and iron-clad armatures, consisting of toothed cores of laminated mild steel, the windings being secured in the slots by wooden wedges fitting in notches near the tips of the teeth. To improve the heat radiating qualities of the field coils they are individually wrapped, taped and insulated, and separated from one another by small wooden wedges. Another characteristic feature is the parallel-movement type of brush holder. On each one, four sets of copper leaves carry the current and control the movement of the brush from or toward the commutator, always maintaining the same angle with its surface. This causes the brushes to wear away evenly, and as they become shorter allows them to be extended and clamped in a new position without altering the surface of contact. To regulate the brush pressure there is a helical spring, which, since it carries no current, is less inclined to heat and vary its tension. To compensate for any inequalities among the magnetic circuits, the brush-holder arms may be shifted independently, and to secure the position of sparkless commutation, when the various circuits are in equilibrium the entire rocker ring may be revolved by the hand wheel.

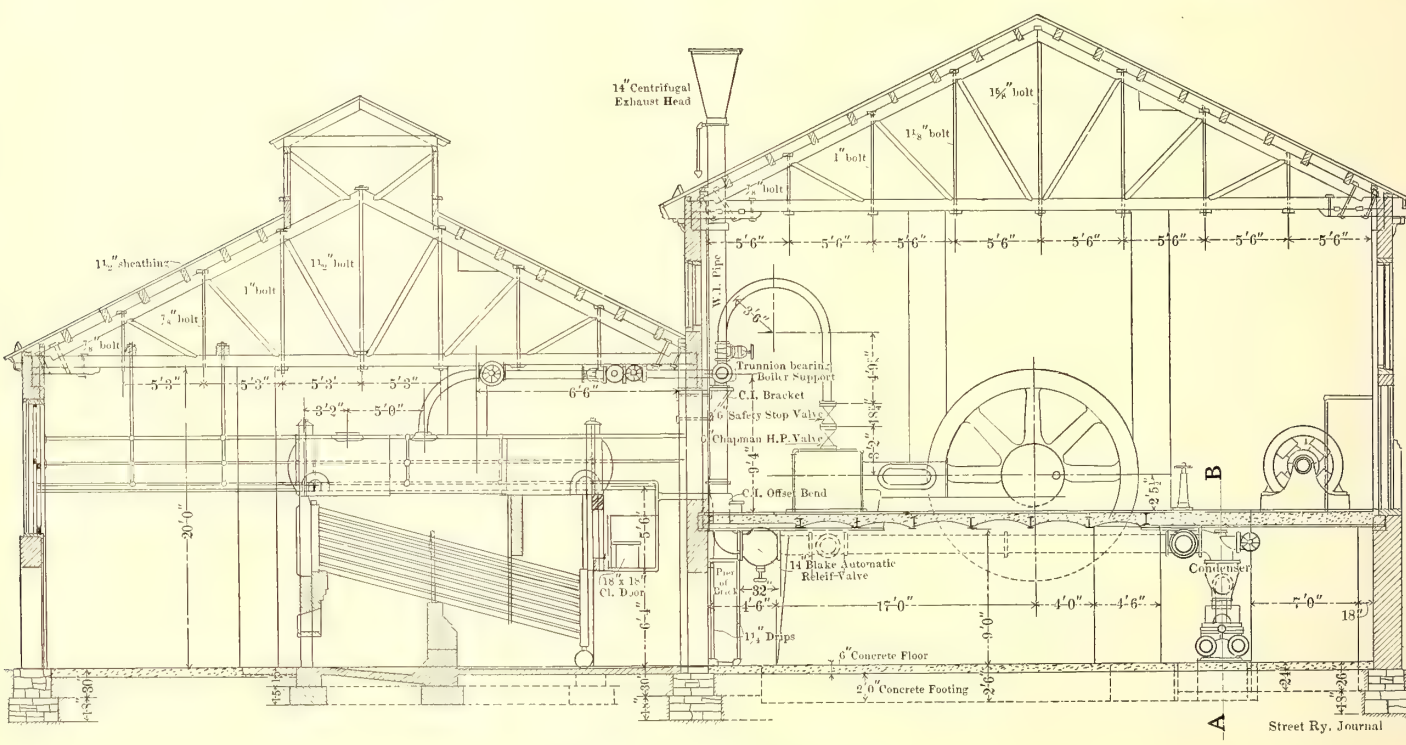
The engines are rated at 600 hp when supplied with steam at 140 lbs. and running at their present speed, 120 r. p. m. They have Corliss-type valve gear, with separate eccentrics for the admission and exhaust valves of each cylinder. Speed regulation is afforded by means of a ball governor, which is connected with the shaft through bevel gearing, and alters the point of cut-off on both high and low-pressure cylinders simultaneously. There is also a separate trip governor embodied in the fly-wheel of each unit, which for an increase in speed of 7 revolutions automatically closes a butterfly valve on the steam supply, just above the throttle valve.

Between the high and low-pressure cylinders there are receivers, 2½ ft. in diameter by 6 ft. long, placed horizontally below the floor. Each is equipped with a relief valve and a live steam connection controlled by a stand valve on the floor above, so that, whenever one of the engines stops with the high-pressure side on dead center, live steam may be temporarily admitted to the low-pressure cylinder through the receiver. All bearings and rubbing parts on the engines have brass-mounted lubricating fixtures, fed by a gravity-oiling system, and cold water is circulated over the bearings which have the greatest tendency to heat. No oil is wasted. Drip pans at various points collect the oil from whence it drains to an oil filter, built by the Capilar Company, of Philadelphia, Pa. After passing through this it is pumped by a 2-in. x 1⅛-in. x 2¾-in. Worthington pump to a tank well above the engine room floor, so as to give a sufficient head to force it to all of the surfaces to be lubricated. The lubricating system and metal housings were installed by Bingham & Company.

Near each engine there is an equipment of gages, including



Section at Right Angles along A.B. showing Condensers and Piping from Canal.

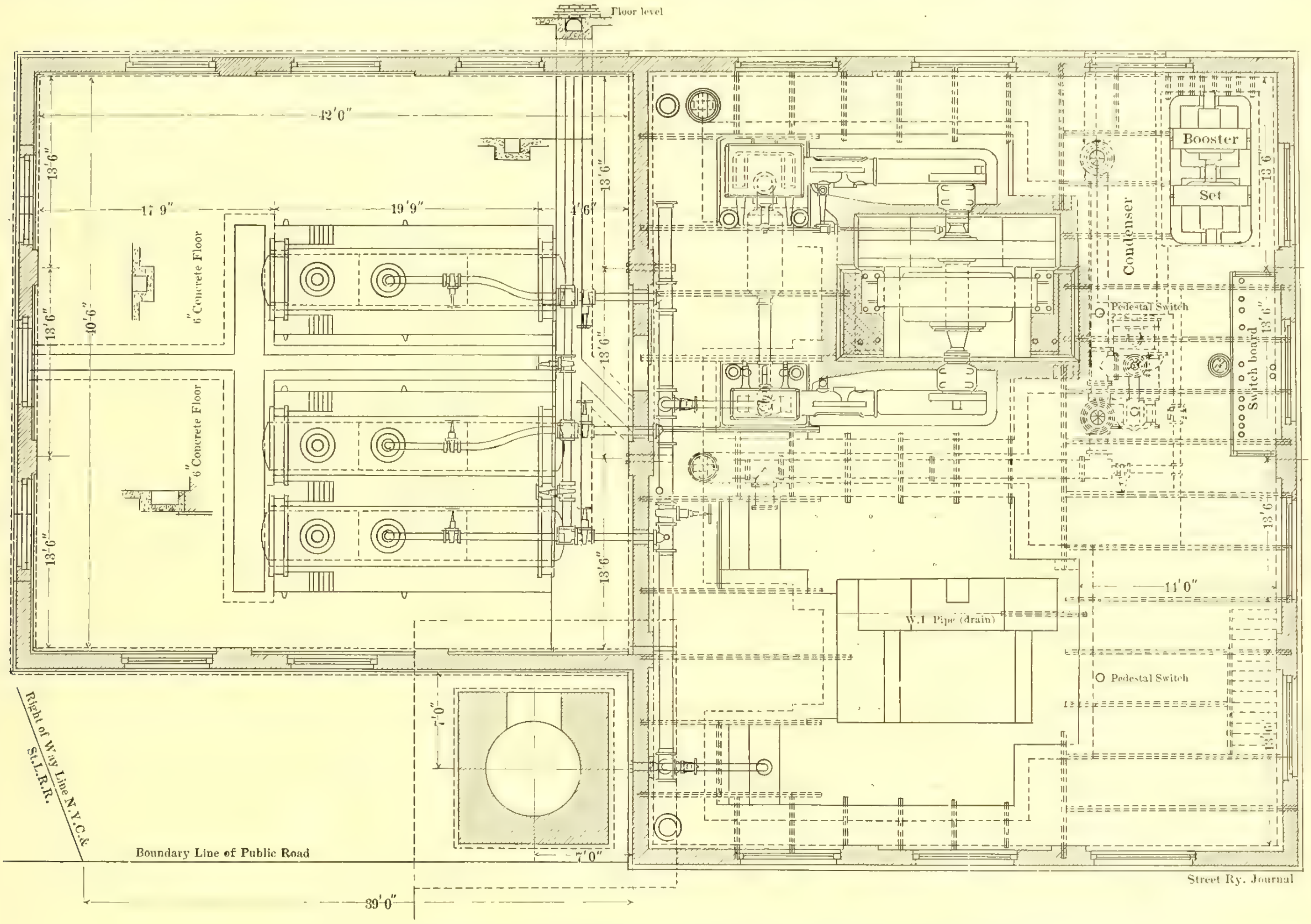


SECTIONS OF POWER STATION

one pressure gage on the live steam main at high-pressure cylinder, one on the receiver and a vacuum gage on the exhaust. These are mounted on a board, which is supported on a hollow cast-iron pedestal, the lower part of which serves as a closet for wrenches, etc., while the upper part holds the bars used in setting up the admission valves and butterfly valves before starting. The throttle valves on the engines each have a small by-pass and valve, by the opening of which the main valve may be more easily operated.

Ordinarily, the engines are operated condensing, the exhaust being led through 14-in. pipes under the floor to a 12-in. x 15-in. x 15-in. Worthington condenser, located in the basement; but provision is also made for exhausting the engines to the atmosphere individually. The atmosphere exhausts, which are also 14-in. lines, contain Blake automatic free-exhaust valves, and are surmounted by William L. Simpson centrifugal exhaust heads. When it is desired to run the engines non-condensing, the branches of the exhaust lines leading to the condenser are closed by means of Schutte swinging check valves, which are controlled by hand wheels from the floor above, and the free-exhaust valves at the base of the risers to the roof open automatically. The Schutte swinging checks take the place of regular stop valves, and at the same time prevent damage to the engines when shutting down, due to air-pump action of low-pressure cylinders, and avoid the consequent flooding of the cylinders with water. As an illustration of the advantage of running the engines condensing it may be stated that two of the three boilers, under a pressure of 125 lbs., will carry the same load when the engines are running condensing that would require all three boilers under a pressure of 145 lbs. were the engines running non-condensing.

The accompanying plan of the engine room shows the piping layout. Water for condensing purposes is taken through a 10-in. main from a sluice, which has its origin in Elk Creek. Since the condensers are of the jet type, the condensed steam and condensing water are mixed, and a small per cent of this mixture is used for boiler feed. The remainder is wasted and discharges through a 10-in. pipe back to the canal at a point lower down in its course, after it has passed over two small falls. The greasy drips and blow-off from the boilers are discharged in the same manner to avoid contaminating any of the water above, from which is taken the supply for boiler feeding, washing and drinking and condensing purposes. The canal is about 232 ft. long, 4 ft. deep and 6 ft. wide on the inside, and is walled with boards its entire length, even where excavated below the surface. The sides and bottom are of 2-in. white oak, and every 6 ft. a rectangular frame work surrounds it. These consist of 8-in. x 8-in. timbers on the sides and bottom, and 3 ins. x 8 ins. on the top.

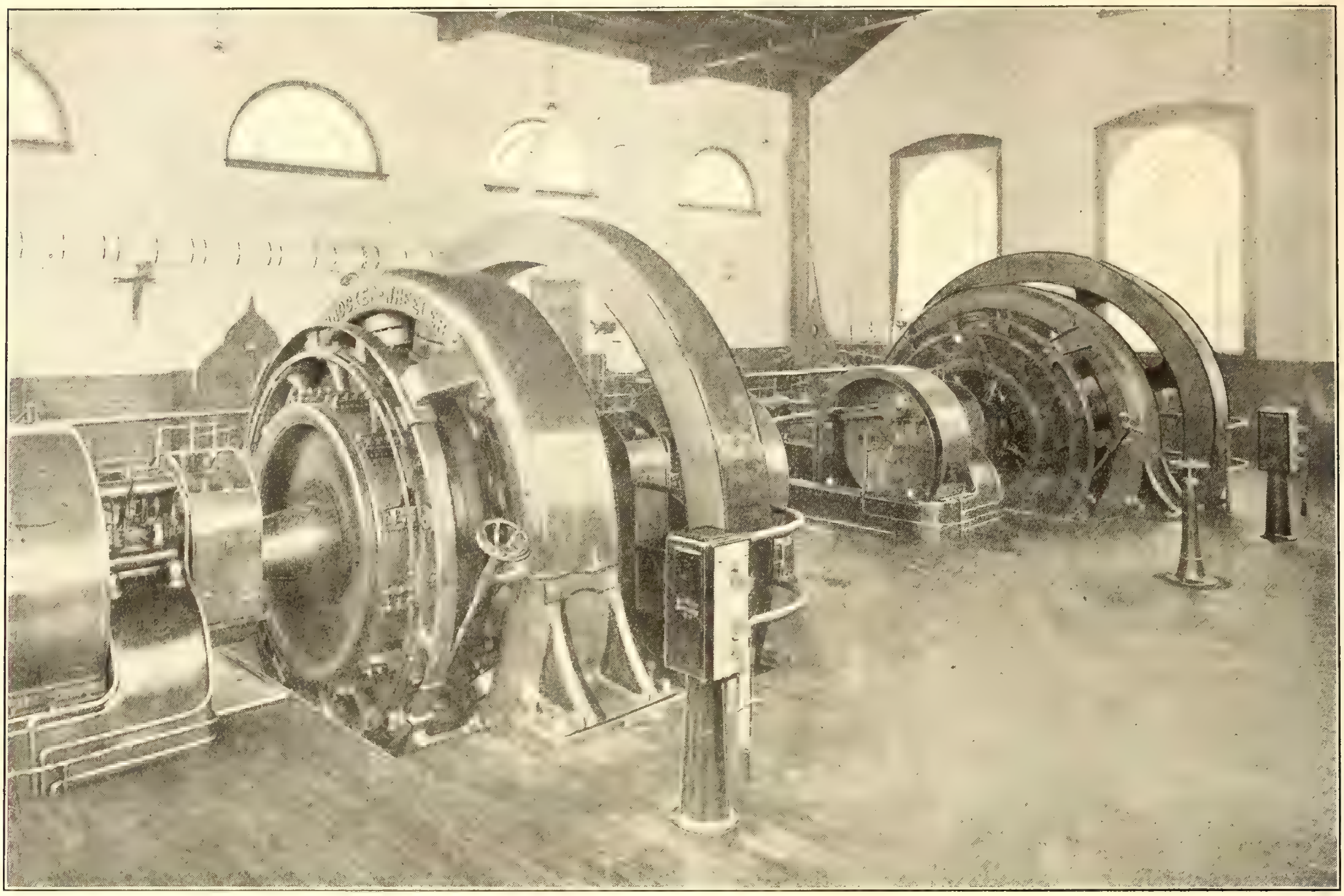


PLAN OF POWER STATION BEFORE INSTALLATION OF SECOND UNIT

It is necessary to clean that portion of the discharge from the condenser which is utilized for boiler feed, and it is, therefore, passed through a Webster star vacuum feed-water heater, purifier and filter. This has a rated capacity of raising 12,000 lbs. of water per hour, 100 degs. in temperature, and is of the open type; consequently, but slight pressure is required to pass the water into it. To provide this pressure the discharge pipe from the condenser contains a loop seal, the top of which is 4 ft. above the inlet to the heater, this head producing sufficient back pressure to force the water required for boiler feed into the heater. The water is admitted to the heater through a 2½-in. pipe, which contains a loop seal to allow the escape of air and prevent any water from drawing back from the heater. The supply is regulated by a float valve; but in case this should fail to shut off, an overflow pipe will waste the excess water.

Two Worthington 6-in. x 4-in. x 6-in. pumps are used for boiler feeding. These are also located in the basement under

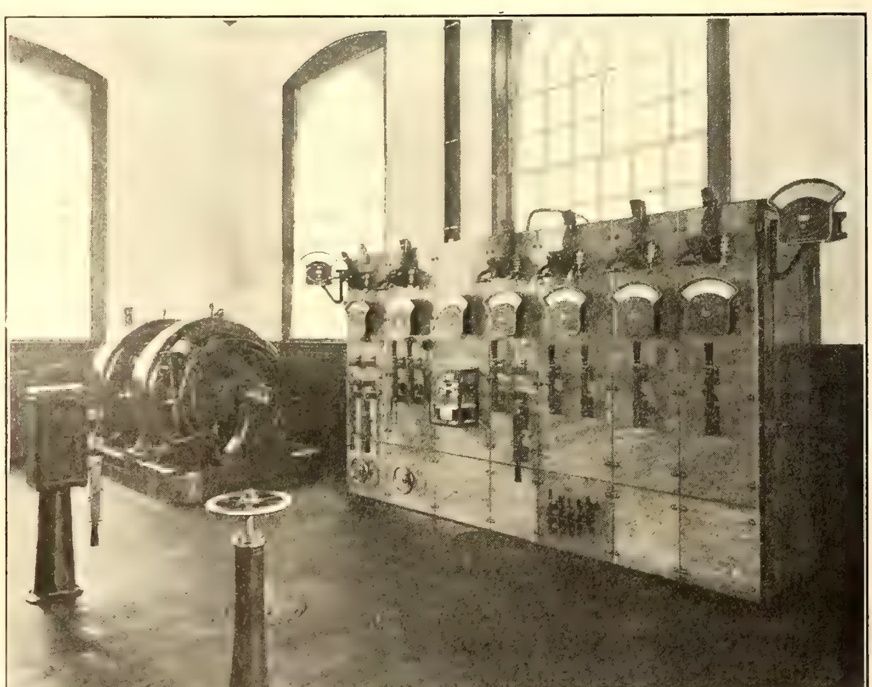
the engine room, and are cross-connected so that they may be used interchangeably in any one of three different ways—either one may draw the heated water from the heater and pass it to the boilers; either one may pass cold water directly to the boilers, or one may pass cold water into the heater, when the engines are not running condensing, while the other passes the heated water on to the boilers. For water supply to the building and for fire purposes a 6500-gal. tank has been provided. It is mounted on a steel tower 52 ft. high, and was built by the W. E. Caldwell Company, of Louisville, Ky. A 6-in. x 5¾-in. x 6-in. Worthington pump has been installed for filling the tank, but it is also possible to use either one of the feed pumps for the same purpose.



INTERIOR OF ENGINE ROOM

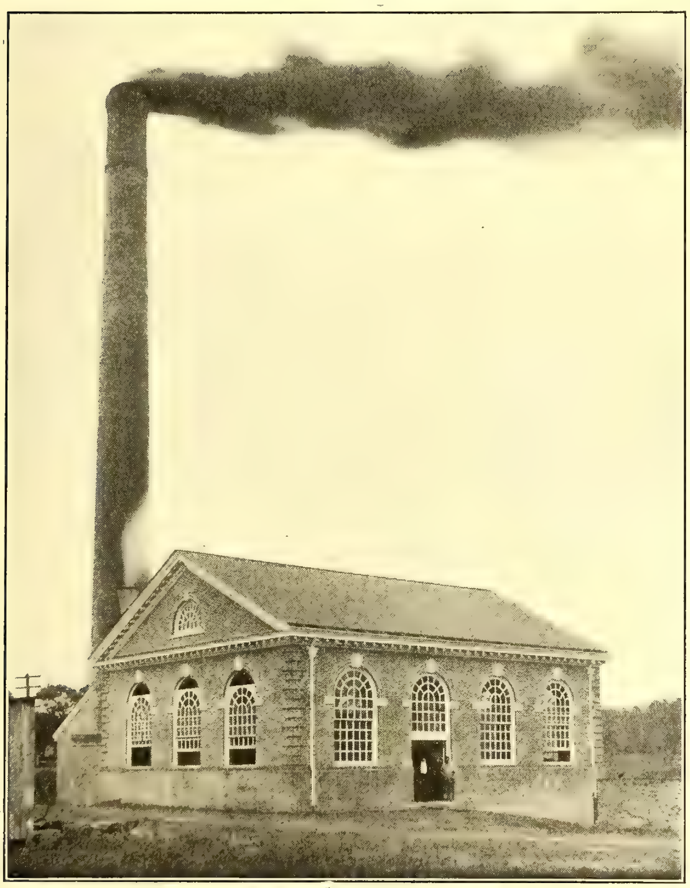
The steam supply to pumps and condensers in basement is taken off at the bottom of the steam main through two 2½-in. connections, join in one 3-in. pipe, leading downward through the engine room floor. The condensation and entrainment is removed by a 3-in. separator (in the basement), which is bled by a 1½-in. trap. Normally, the exhaust steam from the pumps and condenser is utilized in the feed-water heater, but it is also arranged so that any or all of the pumps may be exhausted into either of the engine exhaust pipes near the condenser, or to the base of one of the exhaust risers to the atmosphere. All piping work in the station was done by W. K. Mitchell & Company, of Philadelphia, and all high-pressure steam pipes are covered with Monarch asbestos train pipe covering, made by the Franklin Manufacturing Company, Franklin, Pa.

The switchboard, shown in an accompanying cut, is 13 ft. long and 7ft. 6 ins. high. It was furnished by the Crouse-Hinds Electric Company, of Syracuse, N. Y., and includes seven panels of gray Tennessee marble, which, from left to right, are as follows: Two generator panels, one station panel, two booster panels and two distributing panels. On the swinging bracket at the left, near the top, there is a Weston voltmeter, which may be connected to either generator by means of plug switches on the corresponding panels, and at the opposite end



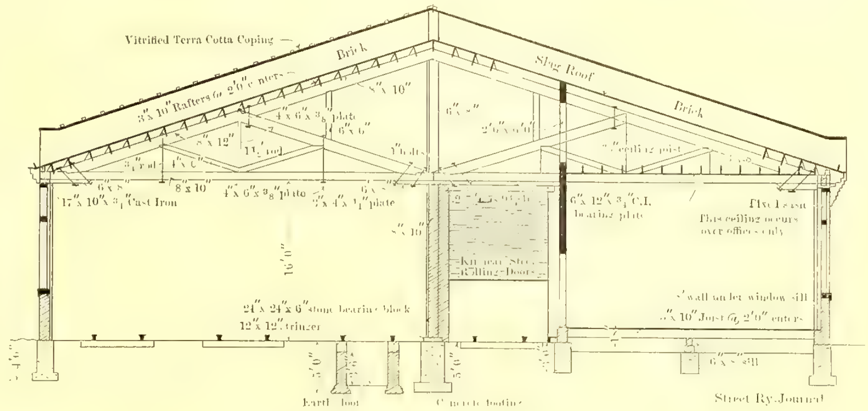
SWITCHBOARD AND BOOSTER

of the board there is a voltmeter similarly mounted, which indicates the pressure obtained through the booster. Each of the generator panels contains a circuit breaker, an ammeter, a pilot lamp, two single-pole dynamo switches, a single-pole field switch for the plant lighting, and a field regulating rheostat. The equalizer switches are not placed on the board but are mounted on stands near the generators, as will be seen in the view of the engine room interior. The station panel contains an ammeter with a scale range of 3000 amps. and a Thomson integrating wattmeter. Of the two booster panels the left one is for use in connection with the dynamo end of the machine and the right for the motor end. The former carries a circuit breaker, an ammeter and two single-pole switches, one having double throw, so that the booster may be connected to the feeder which leaves that board, or may be cut out to supply directly from the generator. The motor panel also contains a circuit breaker, which is connected with the circuit breaker on the dynamo panel in such a way that the tripping of either one will throw out the other and protect the machine from injury. An ammeter, two single-throw switches and a four-blade automatic Crocker-Wheeler starter complete the equipment of this panel. The distributing panels are equipped with a circuit breaker, an ammeter and a single-pole switch for each feeder. The extreme right-hand panel controls two feeders leading to the Conneaut end of the line. The other panel connects to a feeder to Fairview, in the opposite direction from the plant, about 6 miles distant. The dynamo panel for the booster controls two feeders leading to Erie.



VIEW OF POWER STATION

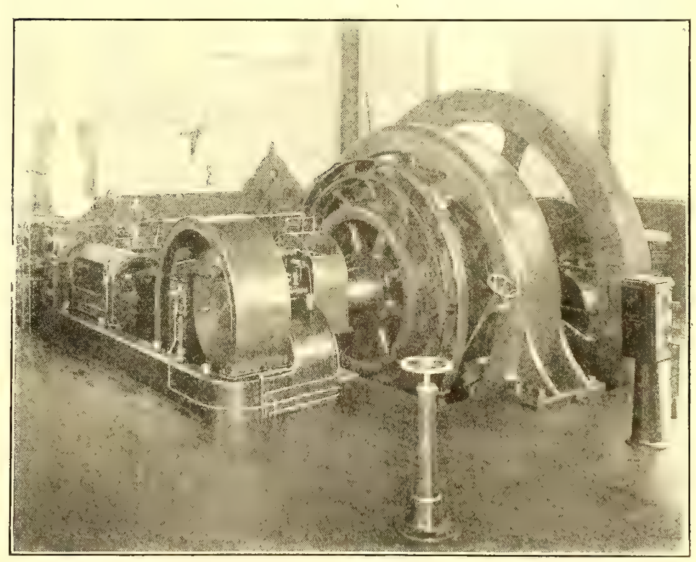
The booster is made up of two Crocker-Wheeler 150 Form-D machines mounted on the same base, direct connected and designed to run at about 600 r. p. m. The motor is shunt-wound for about 575 volts, and the dynamo series wound for 175 volts, with a full-load current capacity of about 300 amps. It raises the pressure at the station to nearly 750 volts. The circuit breakers are of the Cutter I-T-E type, the indicating meters are of Weston make, and Ward Leonard rheostats are used.



CROSS SECTION OF CAR HOUSE

CAR HOUSE

The car house, shown in plan and elevation in the line drawing herewith, is located about 500 ft. from the power plant. It is 127½ ft. long, 78½ ft. wide, and 16 ft. high to the bottom of the horizontal chords of the roof trusses. At present it contains a repair shop, storage room for twelve cars, a stock store room, lounging room for the men, and two offices; but provision has been made so that it may be readily extended when occasion demands it. The foundations are of stone, the walls of brick, the framing and trusses of wood, and the whole is surmounted by a slag-covered wooden roof. With the exception of the repair shop, which is enclosed by brick walls, the inside partitions are of wood. Where the tracks pass through the walls, Kinnear steel rolling doors are used. In one-half of the building there are three tracks, one of which has a pit its entire length. A fourth track, on the right of the center line of the car house, extends into the repair shop, where there is a short pit. The repair shop is 43½ ft. x 37 ft. 10 ins. in plan, and is equipped with the following tools: A 28-in. Cincinnati drill press, a 34-in. Porter lathe, a 14-in. Reed lathe, a 20-in. steptoe shaper, a 36-in. 60-ton wheel press, a Buffalo forge, and a complete complement of small tools, all driven by a 5-hp motor. In one of the repair pits there is a pneumatic hoist for raising the motors into position on the trucks, and a Barrett armature lifter for use when it is only necessary to

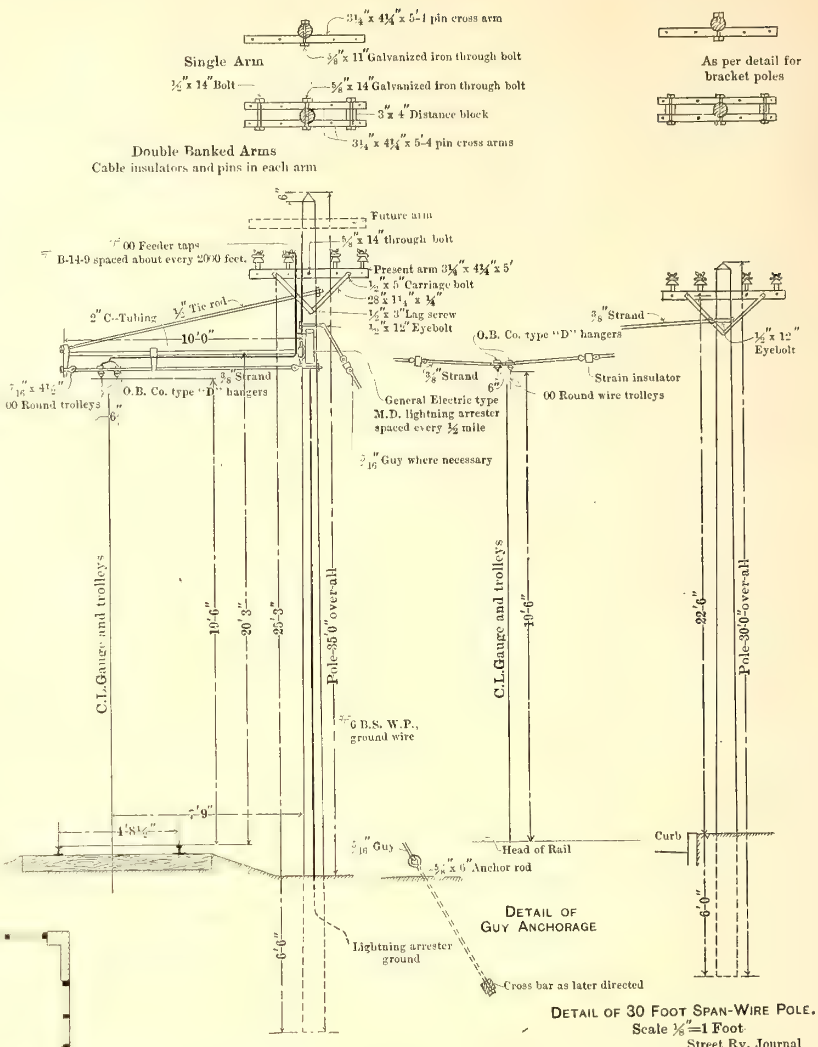


ENGINE AND GENERATOR

remove that part of the motor. At one point of the large pit it is so arranged that the wheels may be lowered without lifting the car body. The building is amply lighted by day from its closely-spaced windows, and will be provided with both gas and electric light. Subsequently, it is very probable that the heating will be obtained through the use of natural gas, which is extremely abundant in this region. A well has already been sunk which gives promise of a generous and apparently lasting supply of gas. Should the supply prove as plentiful as is expected it is possible that an attempt will be made later to use it under the boilers in the power plant.

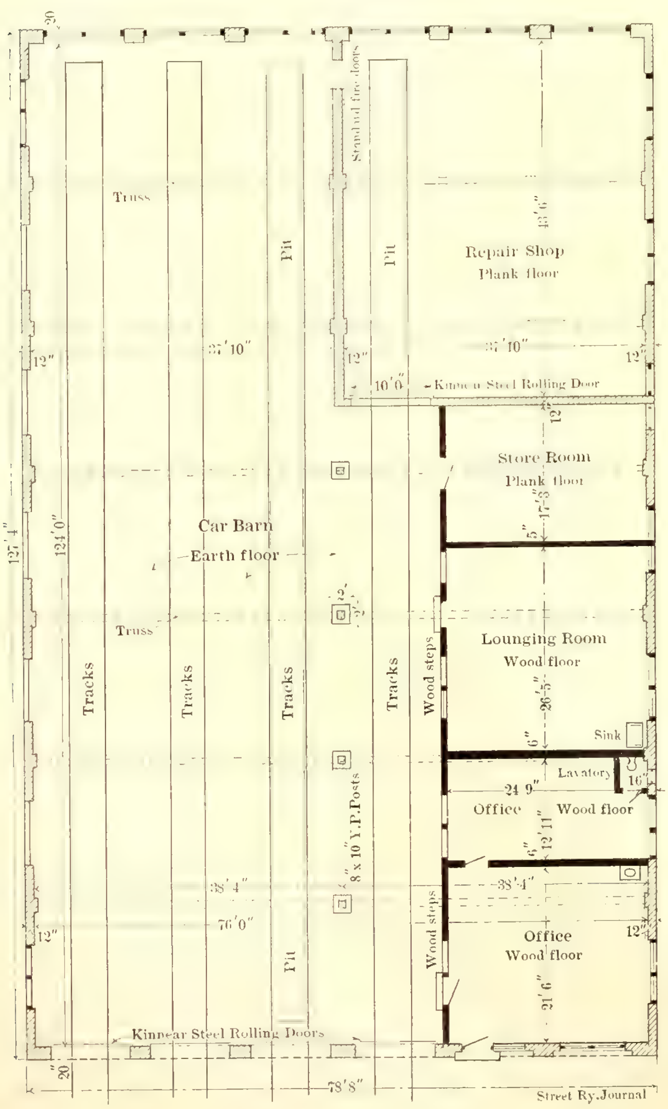
ORGANIZATION

The Conneaut & Erie Traction Company has its main office and headquarters at Girard, Pa. George E. Moffat is the manager, and being connected with the road at the time of its construction is responsible many of its mechanical and engineering details as well as those entering into its operation, such as the devising of all forms used, etc., for which he was well fitted by his previous experience. The work of building the line and equipping the plant was undertaken by the Lake Construction Company, Philadelphia, Pa., of which J. J. de Kinder is president. Charles Barton Keen, of Philadelphia, was the architect for the power house building and the car house; A. C. Wood, of Philadelphia, was the consulting engineer for the power plant work; Charles L. Reeder, of Baltimore, Md., was the con-



DETAILS OF 35-FT. BRACKET AND 30-FT. SPAN WIRE POLES

sulting engineer, and had charge of all details connected with the electrical equipment of power house and rolling stock as well as the overhead work, and Chauncey Ives, C. E., formerly chief engineer of the Cumberland Valley Railroad, was the engineer in charge for the Conneaut & Erie Traction Company. The present engineer in charge of the power plant is William H. Wheaton.



PLAN OF CAR HOUSE

STEAM ROAD IN NEW YORK STATE OPPOSES ELECTRIC RAILWAYS

The memorable fight of the New York Central & Hudson River Railroad against the Buffalo, Rochester & Niagara Falls Electric Railway Company, and of the New York, New Haven & Hartford Railroad Company against the New York & Port Chester Railroad, are recalled by the action recently taken by the former company against the Rochester, Syracuse & Eastern Railroad Company and the Monroe County Electric Belt Line Company. In both cases the relator seeks to review by a writ of certiorari the determination of the State Board of Railroad Commissioners that public convenience and necessity require the construction and operation of the two electric railways. In the first case the Rochester, Syracuse & Eastern Company purposes to equip its line with cars to run 45 m. p. h., with a maximum of 60 m. p. h., 90 miles between Syracuse and Rochester. The Monroe County Company proposes to build from Monroe Avenue to Pittsford, Fairport, Despatch and back to the eastern limit of Rochester, a distance of 20 miles.

The New York Central & Hudson River Railroad has lost much passenger business throughout Central and Western New York due to the competition of interurban electric lines, particularly in the neighborhood of Rochester.

THE ELECTRIC RAILWAY SYSTEM OF VIENNA

On Jan. 1, 1904, the city of Vienna assumed the entire management and operation of its electric street railway and lighting system. This event was reached only after a number of years of preparation, the first important steps of which were taken in the year 1897, when the Siemens-Halske Company, of Berlin, purchased the Vienna tramway system, and made a contract with the city of Vienna by which the franchise was extended and the company agreed to equip the horse car lines with electricity, and to construct a number of extensions. The Siemens-Halske Company formed the Building & Operating Company for the purpose of constructing the lines. The contract was closed on November 28, 1898, and the franchise was to run until 1925, with options of purchase by the city at different intervals.

The new company took over the operation of the new system and reconstruction was commenced. But as many of the same difficulties which had been experienced with the Vienna Tramway Company were encountered with the new company, the city decided to hasten matters, and on Dec. 27, 1902, financed a loan of Kr. 285,000,000, of which 101,600,000 ($20,520,000) was paid on April 14, 1902, for the system. In consideration of this the Building & Operating Company turned over its franchises and plans to the city, while the Siemens-Halske Company, during the period from Jan. 1, 1902, to the end of 1903, as the representative of the city, finished the contracts along the lines already laid down, operating both old and new lines during this time.

The remainder of the loan was used as far as necessary in the purchase of the power plants from the erecting companies, mention of whom will be made later. The Neuer Wiener Tramway, 20 miles in length, was purchased for Kr. 15,600,000, but another short line, 4 miles in length, which will be referred to later as being equipped with the trolley wheel instead of the bow-contact, could not be purchased. Almost all the lines of the city are equipped with overhead wires and the bow trolley, although those in the center of the city have the side conduit system. The motor cars usually draw trailers, and are for the most part equipped with both overhead bows and plows for operating on either section. When the present construction is completed the Vienna tramway system will comprise 215 miles of track. Although the two power plants were completed and ready for connection in April, 1902, the street railway construction was not correspondingly advanced until the following October, when the motive power of almost the whole system was changed to electricity. The current developed at the power houses at the beginning of 1903 was 10,046,000-kw hours, of which 9,223,000-kw hours were for the use of the street railway system. Of this amount the street railway power plant furnished a large proportion.

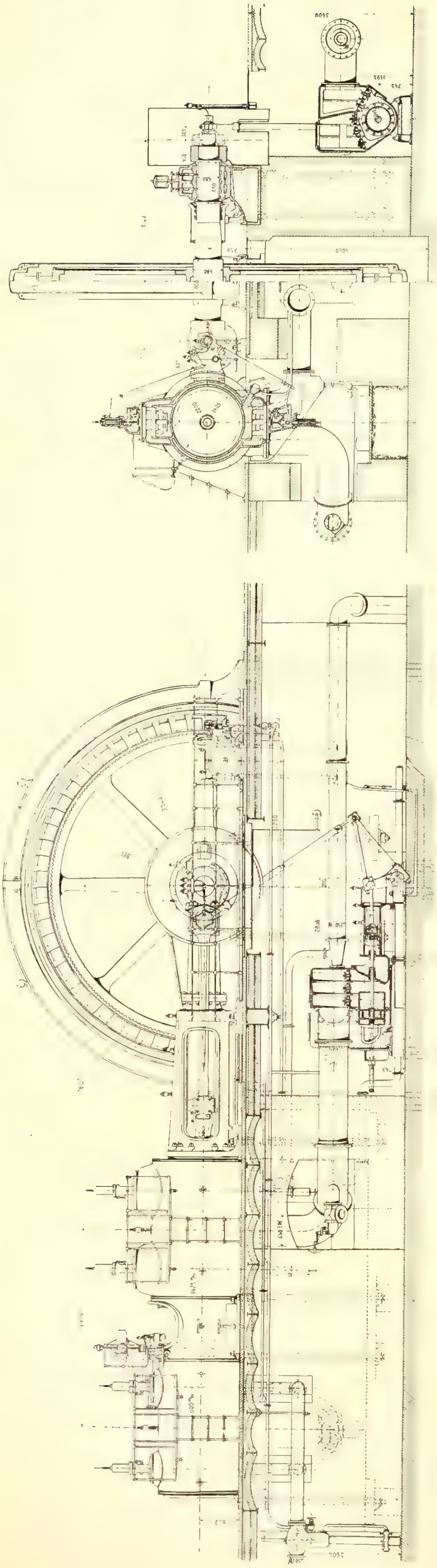
VIEWS OF THE VIENNA TRAMWAY SYSTEM

TRACK CONSTRUCTION

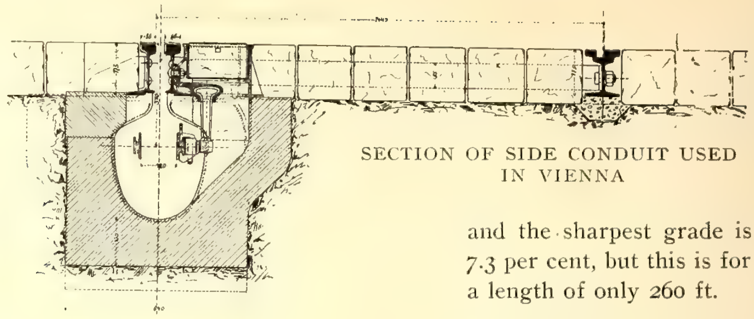
The standard rails are 6.8 ins. high, and weigh 102 lbs. per yard (50.61 kg per meter). They are laid in 50-ft. lengths on steel ties, spaced 8.4 ft. Only where the conditions required are wooden ties used. Over filled land the rails rest on concrete stringers.

The side conduits are constructed under the outside rail. This groove rail is made up of two slot rails, 6.8 ins. in height, which are bolted to the cast-iron yokes. The latter are 22½ ins. in height and 24½ ins. in width, and form a conduit 16 ins. in height from the bottom to the base of the slot rail, and 12½ ins. in width. The contact-rails are 4½ ins. apart, with vertical faces, and are supported by porcelain insulators, which are spaced 13.8 ft.

Standard gage is employed. The smallest radius is 49 ft.,



SECTIONS OF 3000-HP ENGINE USED IN VIENNA

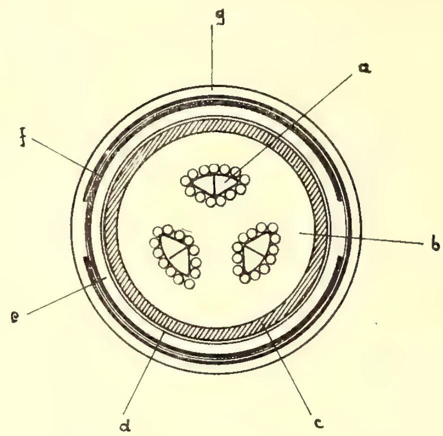


SECTION OF SIDE CONDUIT USED IN VIENNA

and the sharpest grade is 7.3 per cent, but this is for a length of only 260 ft.

OVERHEAD CONSTRUCTION

The overhead system is provided with the Siemens-Halske sliding contact, with the exception of a stretch of 4 miles passing from Kronprinz Rudolf's Bridge to Kagran. With the sliding contact construction, fewer poles are necessary, and on the Hauptzollamts Bridge the poles are 328 ft. apart.



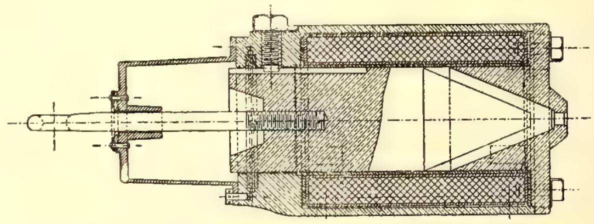
a Copper wire, 150 sq. mm.
b Cable isolation, paper and jute, impregnated
c Lead cover, 3.2-mm shell thickness.
d Asphalt paper.
e Asphalted jute packing.
f Iron band.
g Asphalted jute-compound and cord binding.

SECTION OF CABLE

ROLLING STOCK

When the road was opened to traffic there were 895 cars with two axles, and fifty were double-truck cars. Trailers are extensively used, and at the beginning of 1904 the company owned 700 cars of this type. The maximum speed allowed is 15 km (9½ miles) in the center of the city, 18 km (11½ miles) in the less crowded sections, and 30 km (19 miles) outside the city limits. Each car is provided with two plows, so that contact can be made on either side with the underground conduit, in addition to the bow.

The plow itself has a wooden frame, reinforced with metal. The contacts are hinged so that they can be folded against the shank when the plow is inserted or withdrawn from the conduit, and when in use in the conduit are at an angle of 90 degs. with each other, and 45 degs. below the horizontal plane. The plows are raised and lowered by a crank, which fits on the end of a rod extending through the end panel, instead of from the dash, as in Brussels, or from the side, as in Buda-Pest.



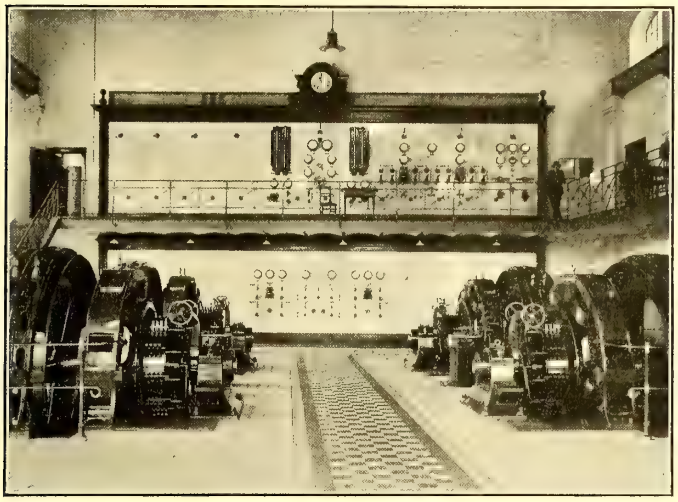
SECTION OF SOLENOID USED FOR ELECTRIC BRAKE

The trailer, or both trailers, are fitted with electrical brakes, which are furnished with power by the motors of the motor cars when acting as generators. Some motor cars are provided with solenoid and some with disc brakes. The former is preferred.

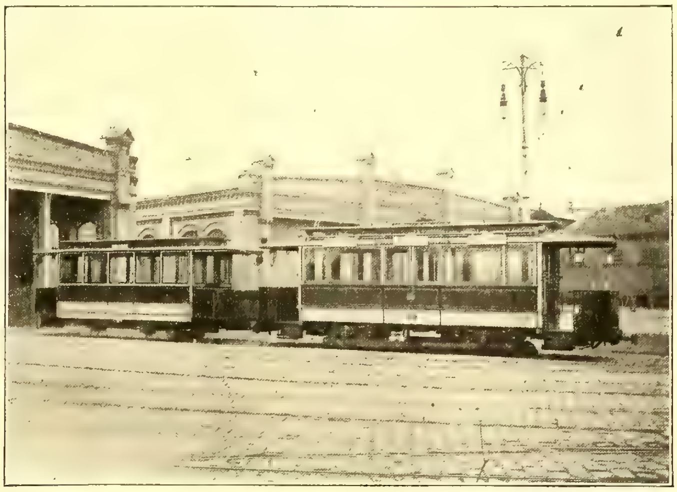
The fares are based on the zone system, and vary from 10 heller to 30 heller (2 cents to 6 cents) within the city, with an extra charge of 10 heller when the city limits are passed. On Sundays and holidays the same rates prevail, except that the minimum fare is 4 cents. For children under 4.26 ft. (1.3 m) half-fare is charged, while school children for any journey pay only 2 cents.

POWER STATIONS

The power stations were constructed by the Oesterreichischen Schuckert Werke, the Oesterreichischen Länderbank, and the Union Baugesellschaft, of Vienna, the first installing the entire mechanical and electrical equipment. The contract was completed in nineteen and one-half months, an unusually short time for a plant of such magnitude, work being carried on both day and night. The original intention was to construct separate power houses for light and street railway power, as municipal difficulties rendered this necessary. It was found possible, however, to consolidate the operation of the plants, and the one first intended for lighting is used with the larger for both light and power purposes.

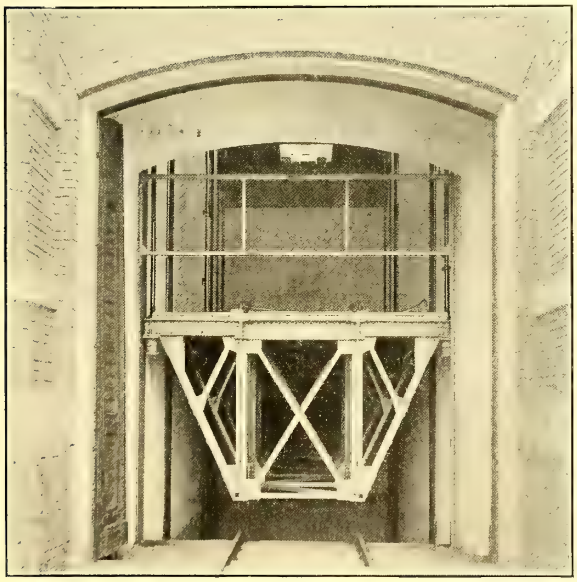


WAERING SUB-STATION



STANDARD TRAIN WITH MOTOR CAR, EQUIPPED WITH BOTH BOW AND PLOW

The plant is situated adjacent to the Danube Canal, at its intersection with the Vienna Stadtbahn, being thus in a convenient location for fuel and water.



30-TON COAL CAR ELEVATOR

POWER STATION, WITH ELECTRIC-LIGHTING STATION AT LEFT

The two power station buildings are separated by a track, upon which the coal cars enter. They are then lifted on a platform, operated by a 35-hp 300-volt synchronous motor, to an elevated roadway, which runs the entire length of the coal bunker in either building.

The boilers in the larger plant are of the Babcock & Wilcox type, and generate steam at a pressure of 205.8 lbs., and have a heating surface of 3228 sq. ft. each. A superheater of seventy-two tubes and 560 sq. ft. surface is placed between the header tubes and the drum, which increases the temperature to 540 degs. F. Green economizers are used.

The coal consumption for the month of October, 1902, was 1.117 kg (2.46 lbs.) per kilowatt-hour, which includes heating-up coal and the consumption for pumps and other purposes.

The engines, which are of the Sulzer type, built in Austria, are triple-expansion, with two low-pressure cylinders. The cylinder dimensions are 31½ ins., 46 ins. and 68 ins. x 59-in. stroke, and they run at 172 lbs. pressure and 90 r. p. m. Each has a normal horsepower of 3400, with a maximum of 4200. There are five engine units now in place, but the remaining three, when installed, will be of greater capacity.

The rotors of the three-phase alternators used are 24.6 ft. in diameter, weigh 43 tons, and have sixty-four magnet poles each. The stator frame is 28.8 ft. in diameter and 31 ins. wide. The normal load is 2000 kw and the voltage 5500.

A two-story switchboard of marble slabs is placed at one side, about the middle of the building.

The preceding description relates to the larger plant of five engine units and ten batteries of boilers, which, when completed, will have eight engine units and sixteen batteries. The other power house has three engine units and six batteries, with space for another unit and two more batteries. The buildings are of the same dimensions except as to length, and when the future demands it both will be extended further.

The following are the results of a test made on the engines to see whether they met the manutacturers' guarantee:

RESULTS OF THE GUARANTEE TESTS.

Subjects of the Tests.	Terms.	Mfr's Guarantee.	Test Results. Generator No. 4 Ry. Plant.	Test Results. Generator No. 2 Light Pl't
Weight of water, vaporized, per 1 sq. meter per hour	Kg.	15	16.80	16.08
Water raised from 32 deg. to 212 deg. per 1 kg. of coal	Kg.	7.14	7.53	7.73
Total efficiency of boilers	Pr. Cent.	70	71.80	72.80
Calorific value per 1 kg. of coal consumed	Calories	6500	6743	6765
Efficiency of economizer	Pr. Cent.	......	7.60	8.30
Efficiency of superheater	Pr. Cent.	......	4.80	4.80
Indicated work of steam engine	H. P. i.	......	3320	3388
Output of generators	Kw.	2000	2091 2	2086
Efficiency of generators	Pr. Cent	82.7	85.6	83.7
Steam consumption per Ind. H. P. hour, with superheater	Kg.	4.55	4.55	4.28
Coal consumption per Ind. H. P. hour	Kg.	......	0.65	0.60
Coal consumption per kilowatt hour	Kg.	1.100	1.037	0.962
Coal consumption per kilowatt hour in calories	Calories	7150	6992.5	6508
Maximum output of generator	Kw.	2500	2600	2550

For the purpose of distribution, five sub-stations are erected at convenient distances, from 2 miles to 5 miles, from the central station. Each contains its storage batteries, from four to ten 550-kw motor generators for lighting and power, and a set of two coupled boosters. The efficiency of the motor generators is 87½ per cent. In the largest sub-station, Mariahilf, with ten units, six are for power, two for lighting and two in reserve. The batteries are of the Tudor system, of 276 cells, and have a total capacity of 3800 kw, one and one-half times the power of a unit in the central station for from 1 hour to 3 hours.

With coal at $3.60 per ton (Kr. 18) the cost of generation per kilowatt-hour was 0.36 cents (1.8 heller) in the power plant, while in the sub-station the cost was 0.4 cents.

DISTRIBUTION SYSTEM

The cables are laid together with telephone wires in sand-carpeted trenches and covered with tiling. The high-tension cables, as shown in the illustration, are made up of three centers or cores of copper, surrounded by paper and jute. The cores are of unusual design, being two triangular wires with their bases adjacent, and the pair surrounded by round wires, the whole of 150 mm (6 ins.) cross-section. Lead, asphalt paper, jute, iron and asphalt jute with cord binding make up the remainder of the cable, which is tested for 10,000 volts for a space of 15 minutes.

From April, 1901, to November, 1902, a space of fourteen working months, the winter months being omitted, the following work was done in cable laying:

	French Length in Miles.	Length of Cable in Miles.	Weight of Copper in Tons.	Cost in Dollars.
Street Railway work	45	190	840	800,000
Lighting	120	555	830	1,100,000
Total	165	745	1670	1,900,000

The total cost of cables and cable laying was $1,900,000. The mechanical equipment of the two plants, $1,200,000; for the sub-stations, $650,000, and for the power plant buildings, $1,040,000. The total cost was $6,800,000, of which $3,000,000 was for the lighting plant. These figures represent the initial cost, and are a portion of the expense for which the city authorized the Kr. 285,000,000 loan.

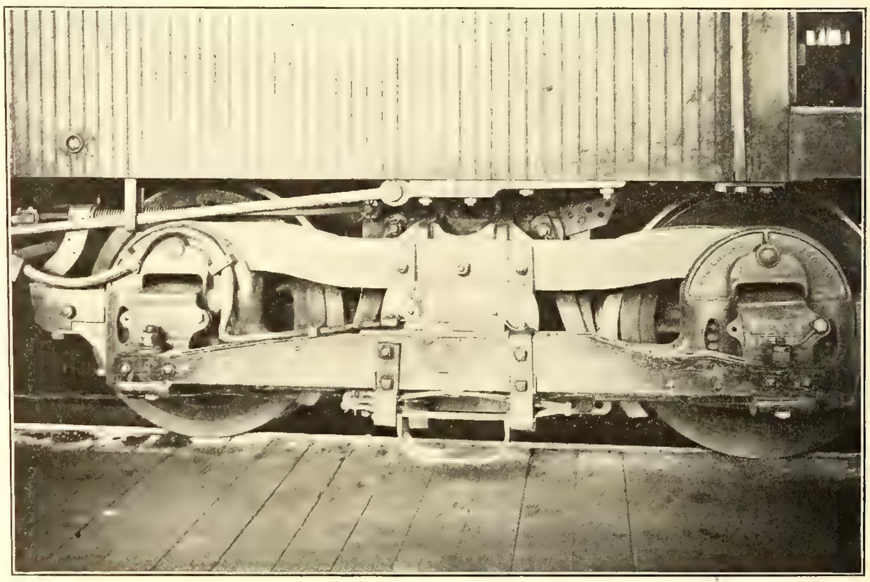
The Tamaqua & Lansford Electric Railway extension to Mauch Chunk has caused the steam road to discontinue through trains from Mauch Chunk to Pottsville.

NEW THIRD-RAIL SHOE ON THE BOSTON ELEVATED RAILWAY

All cars on the Boston Elevated Railway, to the number of 151, have been operating since Nov. 15, 1903, with a new type of third-rail shoe, which has been on trial for the past eight months with very satisfactory results. The shoe differs radically from the "slipper" form, which, with various modifications, is used on all other third-rail roads and which was also employed on the Boston elevated until superseded by the new form just adopted.

The principal new feature in the present Boston shoe is the substitution of spring pressure for gravity in making contact. The equipment, complete, consists of a short, flat bar of steel, with two right-angle bends at each end, two wrought-iron hangers in which the ends of the bent steel bar rest, an iron strip for uniting the two hangers electrically, and a thin elliptical steel spring for holding the ends of the shoe in the hangers. The combined weight of these parts is about 28 lbs. The weight of the moving parts alone of the old shoe was about 25 lbs.

In the mechanism of the new shoe the soft steel bar with



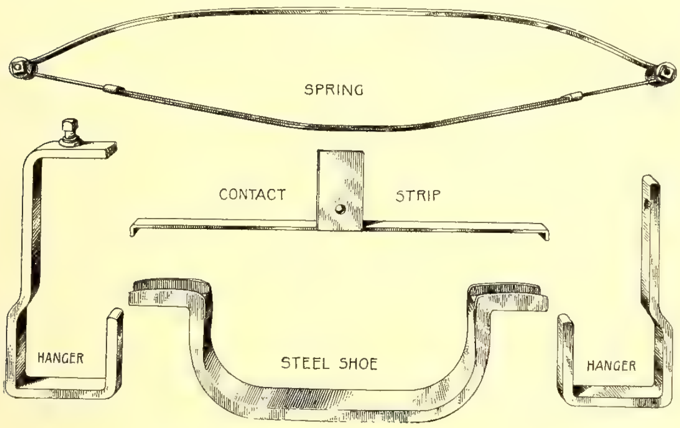
NEW SHOE ON BOSTON ELEVATED CAR

which contact with the rail is made is the vital part. This bar, before it is bent, measures 23 ins. long, 3½ ins. wide, and ½ in. thick, and weighs 10½ lbs. After being bent into the proper form a channel is forged in the flat part of each end to receive the side of the elliptical steel spring. The lower side of the contact-shoe is 3½ ins. wide, and is worn from contact with the top of the third rail into a concave form. Measurement of this concave surface on a worn-out shoe gave a length of 10 ins., and a width clear across the 3½-in. under surface of the shoe. As the top of the third rail is 2½ ins. wide, it seems that the maximum possible contact surface between each shoe and the third rail is 25 sq. ins.

Each of the two hangers is bolted to the wooden bar carried on the boxes, and the bolts used for this purpose also hold the thin iron strip in contact with both hangers. The elliptical spring is bolted to this same spacing strip, and is thus in permanent electrical contact with the two hangers. To one of these hangers the motor cable is connected through a long wire fuse, as shown. Together the two hangers weigh 9 lbs., and the weight of the spring is 6½ lbs. Each end of the steel shoe is simply laid into one of the hangers, and is held down by its own weight of 10½ lbs., and by the pressure of the spring above. In a vertical direction the greatest possible motion of the contact-shoe is 1½ ins., but in its normal operation on the

rail it can rise, or rock, ⅝ in. from its seat in either hanger. Each shoe is pushed, not pulled, along on the third rail by that hanger which happens to be nearer to the rear end of the car, depending on the direction in which the car is moving. A result is that the shoe tends to bunch up and make harder contact with the third rail as the speed of the car increases, since a component of the pushing force acts perpendicular to the third rail.

The elliptic spring is constructed to give a downward pressure of 50 lbs. on the contact-shoe when the latter is at its lowest position in the hangers. When the third rail lifts the shoe from its seats in the hangers the pressure between the shoe and rail is thus about $50 + 10\frac{1}{2} = 60\frac{1}{2}$ lbs., without regard to any motion of the shoe along the rail. The push given by a hanger to each shoe is imparted close to the right-angle bend near one end of the shoe, and wears a bright contact surface across the entire width of the shoe at this point. Through this contact surface most of the current entering the shoe passes



PARTS OF CONTACT SHOE

to the car motors. As may readily be seen this contact-shoe has a rocking motion both crosswise and lengthwise of the car, by lifting at either end or on either edge of the parts that rest in the hangers. These motions enable the shoe, impelled by the spring, to follow readily any irregularity of the third rail, prevent all jumping at inclines and joints, and avoid most of the blow that was common with the old shoe when it took a new section of the rail. This tendency of the shoe to cling to the third rail results in the almost total prevention of sparking between the contact surfaces.

Steel shoes of this type are operated until nearly worn through at the center of the contact surface, and it has been found that the life of a shoe is about ninety days on a car that covers 150 miles per day, a run of about 13,500 miles. The steel shoes are hardened a little to increase their life. Very little current seems to pass through the steel spring, most of it going directly from the shoe to the hangers, and there has been no trouble about over-heating of the springs. It has been found that this form of shoe is more effective than the old type in the removal of ice and sleet from the third rail, although a steel wire sleet scraping brush is also used.

These facts have been secured through the kindness of C. S. Sergeant, vice-president; Paul Winsor, and John Lindall, the inventor of the shoe, all of the Boston Elevated Railway Company. It is understood that patents on this contact-shoe are now pending.

MOVEMENT TO ORGANIZE TRACK SUPERINTENDENTS

The discussion which has been carried on in this journal and elsewhere regarding the advisability of forming an association of track engineers and superintendents, after the manner of the master mechanics and accountants, has attracted considerable attention, and an effort is now being made to secure expressions of opinion on the desirability of forming an association from those most interested. The following circular letter, accompanied by the necessary blanks, has been sent out:

MILWAUKEE, Wis., Jan. 25, 1904.

Dear Sir—An editorial article in the Nov. 7 issue of the STREET RAILWAY JOURNAL, entitled "Comparing Notes on Track," which has probably received your attention, also an editorial article in the Jan. 16 issue upon the same subject, and calling particular attention to the necessity for organizing this department, have brought very forcibly home to the writer the necessity of pushing a plan to effect an organization of electric railway "way" men, which has been in contemplation for several years.

The editorial articles cited very truthfully state that there is probably more money expended through this division of the various electric railways of the country than any other single department; that less discussion of matters pertaining to this important work has been had, and that the practice of no one department is probably less uniform.

It is reasonable to assume that an intelligent, painstaking and thorough comparison of results obtained throughout the country could in no other case lead to such far-reaching economy for all concerned as in the practice of track laying. "Will your track last ten, twelve, fifteen of twenty years?" What more important question can you ask the electric railways of the country?

In order somewhat to broaden the scope of the proposed organization, it has been suggested that under the title of "Way" be included the right of way, roadbed, track, poles, overhead line and underground conduits and feeders.

A plan of organization similar to that of the American Railway Mechanical and Electrical Association might be used, or such changes made therefrom as would be suggested as advisable.

The membership of that association might be briefly outlined as follows:

Active Members—Heads of departments; membership fee, $5 per year.

Associate Members.—Owning or operating companies or individual owners; membership fee, $20 per year.

Junior Members.—Lesser employees engaged in this work, where either their company or departmental head is a member; membership fee, $3 per year.

In order that a concensus of opinion on this important matter may be arrived at, a form of blank circular is enclosed herewith, which we would very much like you to fill out and return to the undersigned, after which the work of organization would be taken up and continued by the persons and in the manner indicated by a majority of said replies.

The rough idea as now in the mind of the writer contemplates an association similar in aims and purposes to the Mechanical and Electrical Association already cited; to meet at the time and place chosen by the American Street Railway Association for its yearly convention, and to act as an offshoot of the said American Street Railway Association, receiving and furthering suggestions therefrom, and endeavoring in every way to improve and perfect, toward some reasonable degree of uniformity, the practice of the way departments of the gigantic electric railway interests represented therein.

The writer has reason to believe from interchange of ideas with many of the department heads in charge of this class of work throughout the country that a large number of them are as firmly convinced as himself that such an organization cannot be formed too soon, and it is therefore with considerable hope of good results this letter is launched, upon the idea that there must be a beginning if there is to be progress.

A plan of organization may be advisable by which the heads of departments can become active members, even though the company they represent does not affiliate with the association.

We think the companies should join wherever possible, as we are convinced that the matter of $20 or $25 for a membership fee and the expense of a representative at the annual meetings would soon be repaid an hundredfold by the benefits to be derived therefrom.

Your advice and help is earnestly solicited in order that a thorough and comprehensive organization may be effected.

Trusting that your approval and assistance may be secured in the furthering of this project, I am

Sincerely yours,
FRED. G. SIMMONS,
Superintendent of Construction and Maintenance of Way,
The Milwaukee Electric Railway & Light Company,
Milwaukee, Wis.

ST. LOUIS TRANSIT COMPANY'S NEW CARS AND MOTORS

As mentioned a number of times in these columns the St. Louis Transit Company has ordered 450 new cars to take care of World's Fair Traffic. Drawings showing the dimensions of this new standard type of semi-convertible car adopted by this company were shown on pages 354 and 355 of the STREET RAILWAY JOURNAL of Aug. 29, 1903. A number of these cars have now been completed, so that it is possible to reproduce photographs of them herewith. Fig. 1 shows the exterior appearance of this new car. The car bodies were built by the St. Louis Car Company, and, as can be seen, have the channel steel side sills peculiar to that company's patented construction, which allows the windows to be lowered between the channels, and so permits a low window-sill. The front platform is very short, as it is occupied only by the motorman, although used as an exit and entrance. This platform is 4 ft. 3¼ ins. from the end of the car body to the bumper, leaving an actual platform space at the widest point of about 3 ft. The car body is 33 ft. 4¾ ins. over the corner posts and has seats for forty-eight passengers. The seats are 32 ins. wide, 30 ins. between centers. The aisles are 32 ins. wide. The car body is unusually wide, being 9 ft. 1 in., which is the widest in use in any of the large cities of the United States.

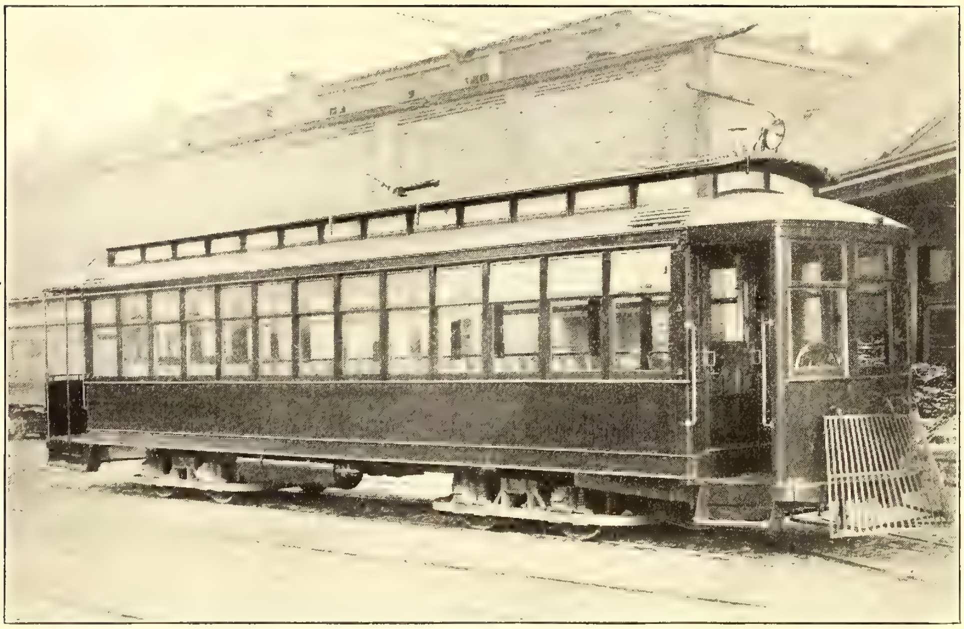


FIG. 1.—NEW SEMI-CONVERTIBLE CAR IN ST. LOUIS

The rear platform is 7 ft. long, and represents the extreme development of the Du Pont type of platform. The platform is shown in Fig. 2. It is divided into three parts by two hand rails for the support of the passengers standing on the platform. These hand rails, however, are short, so that there are passages around the ends of both.

One special feature of the car shown in Fig. 3 is the unobstructed view which the conductor has of passengers at the rear step when in the car collecting fares. Much less room is taken up by the window sash in the vicinity of the corner posts than is usual.

The heating of the car is accomplished with a stove placed directly in the middle at the front end, as shown in Fig. 4. The front entrance is at the right of this stove. In this location the stove does not take up room which would otherwise be used for seats, as the seat in the front left-hand corner is simply placed with its back to the window. A further advantage of this location of the stove as against placing it, as usual, in the middle of the car, is believed to be a better circulation of warm air.

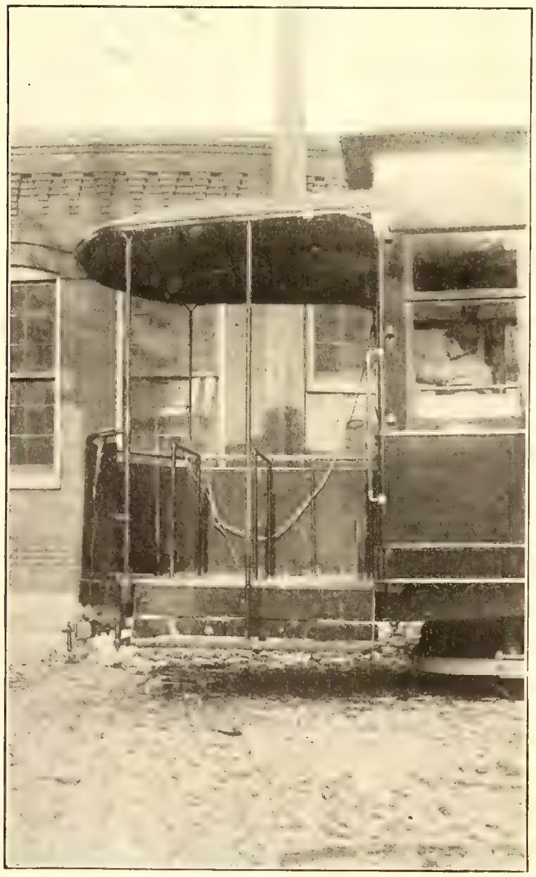


FIG. 2.—LONG PLATFORM WITH TWO RAILINGS IN ST. LOUIS

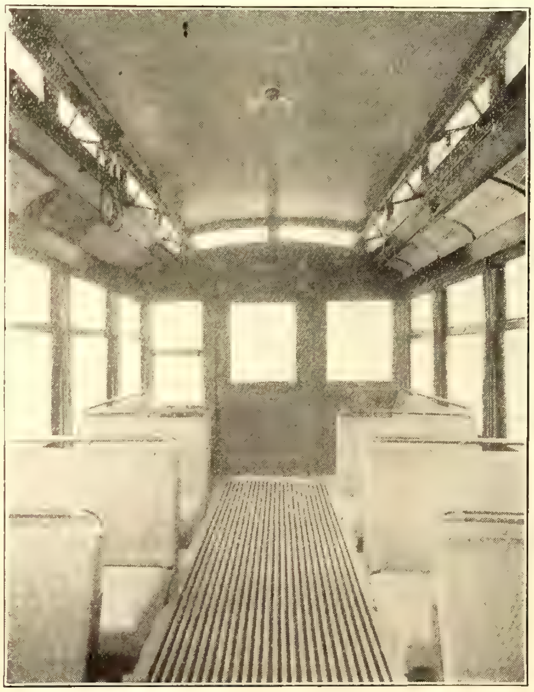


FIG. 3.—LOOKING TOWARD REAR PLATFORM IN ST. LOUIS CAR

Both upper and lower sashes of the windows lower into a space in the side of the car. As far as their raising and lowering is concerned, the ordinary passenger or conductor would notice nothing unusual, as they operate like any street car type of sash. They have, however, a very novel patented design, which makes it possible to take out both sashes without removing any screws. Fig. 5 shows the windows and grooves in which they slide. Although it is not intended to take out the sashes in the summer, this feature is nevertheless valuable, as a sash can be removed quickly while the car is on the road, in case the glass is broken, and it is but the work of a few

minutes to remove all the sashes before the car is run in to paint or for cleaning. The trucks under this car are the Du Pont type, with 4-ft. 6-in. wheel base. They are being made in the shops of the St. Lolis Transit Company, where many labor-saving methods have been introduced in their manufacture, as mentioned in the article on the St. Louis Transit Company's shops in the issue of Nov. 14, 1903.

NEW DESIGN OF MOTOR

The motors under these cars are the new Westinghouse No. 95 motor, which is a 40-hp motor, with oil lubrication, designed especially to meet the specifications of the St. Louis Transit Company. A truck equipped with these motors is shown in Fig. 6, and a side view of a motor by itself, as shown in Fig. 7. The motor opens from above, as it is intended to do away with pit work entirely in the repair of these cars. The armature bearing shells of this motor are held in larger shells, which are bolted to the lower part of the motor casing, as shown in Fig. 7. By opening the top of the motor and removing the bolts which hold the bearing shells to the lower case, the armature with its bearings and these shells can be lifted out. The large shells surrounding the bearings are made necessary from the fact that oil is used for lubrication, and, consequently, an oil well is needed in the shell. An opening extends from the oil cup cast on the shell, around one side of the bearing to the oil chamber under the bearing. This passage is filled with wool waste. There is an opening through the babbitt shell into the waste chamber on one side of the bearing. This space being full of waste, the oil is fed by capillary attraction from the oil well to the armature shaft. The motor axle gearings have similar lubrication, but the oil chamber is differently arranged, and the opening from the journal to the oil chamber is in the bottom of the bearing, and the oil chamber forms a part of the lower motor casting, as seen in Fig. 7. Particulars of the company's storage air brake system to be used on these cars are given on on another page.

FIG. 4.—LOOKING TOWARD FRONT PLATFORM, ST. LOUIS CAR

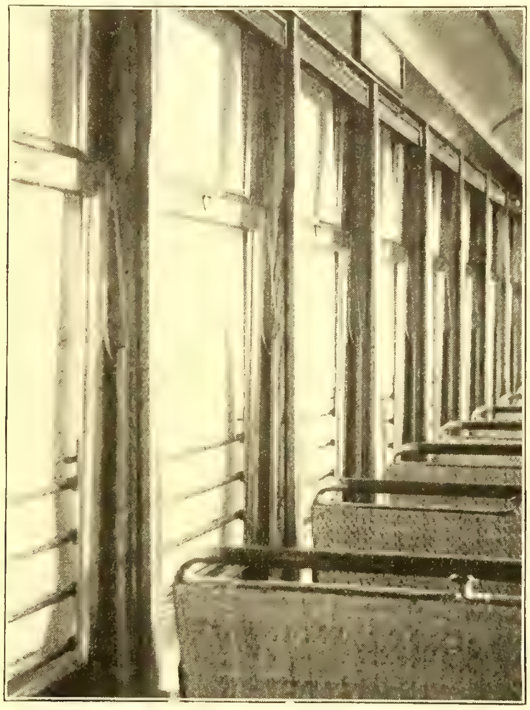


FIG. 5.—ARRANGEMENT OF WINDOWS

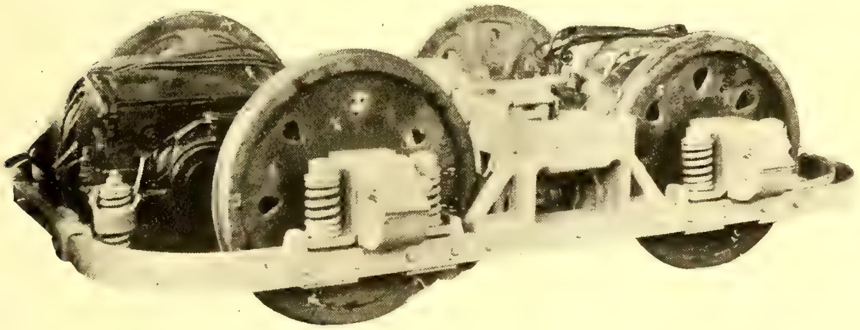


FIG. 6.—STANDARD TRUCK

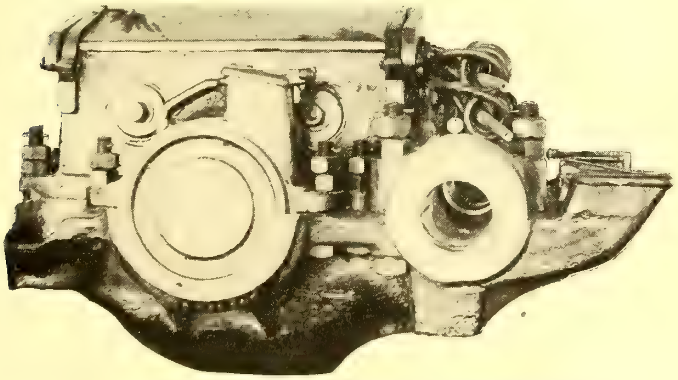


FIG. 7.—NEW MOTOR WITH OIL LUBRICATION

HEATING CARS IN NEW YORK

Senator Russell's bill to compel the comfortable heating of elevated and surface railroad cars in cities of the first class in New York was favorably reported in the Senate from the committee on codes. The original bill was defectively drawn, so the committee reported a new bill which adds a new section to the Penal Code as follows:

"A railroad corporation, or any officer or director thereof having charge of its railroad, or any person managing the same, which railroad is owned and operated wholly or partially within the limits of a city in the first class and not including railroads whereon the trains are propelled by steam power, who fails to keep any passenger car on any such railroad while in motion, for the carriage of passengers, so heated between Oct. 1 and April 1, that the temperature of the atmosphere in such car shall not be less than 50 degs. above zero Fahrenheit, is guilty of a misdemeanor."

At the hearings much opposition was offered, especially by the New York Central, which claimed it a physical impossibility to heat steam cars during such extreme weather as has prevailed this winter. The company's representative said that it was doing its best to heat the cars and should not be held criminally liable, as the engineers had difficulty in making steam at a temperature of 20 degs. below zero.

STORAGE AIR BRAKE SYSTEM IN ST. LOUIS

As announced elsewhere in this paper, the St. Louis Transit Company has been making a large number of important improvements to its rolling stock and system in preparation for the traffic which is expected during the coming summer on account of the Louisiana Purchase Exposition. Among the largest contracts which it has awarded during the last six months is for a system of storage air brakes for all its cars. This order has attracted considerable attention from the fact that while storage air brakes have been used to a considerable extent during the past four or five years they have not been adopted exclusively on any large system, and only one order, that given in Detroit a short time ago for this type of air brake, at all approximates that recently placed by the St. Louis Company. For this reason an examination into the reasons for the adoption of this type of system and the particulars of the system itself are of more than usual interest.

According to the officers of the St. Louis Transit Company the storage system rather than an independent compressor system was adopted on its cars, because of the smaller investment required for the equipment of the road and the greater economy in the maintenance and operation of a few stationary compressor plants as compared with those of a compressor on each car. The officials also state that they consider the system more reliable and less likely to fail on the road than the individual compressor system.

The St. Louis Transit Company has ordered 1500 car equipments of storage air brake apparatus. This will equip every car on the road. It has also ordered forty motor-driven compressors, all of the same size and design. These compressors will be placed at eighteen different compressor stations. A compressor station, for instance, will be located at the outer end of each line, and others will be placed at different points within the city. All of the compressor plants will be so located that cars can charge while lying over at the end of a line, so as not to delay traffic. The largest compressing stations will be equipped with three compressors. In most cases the compressing equipment will be located in neat brick buildings, although in some cases where the terminus is in a fine residence district it may be located in a vault under the street.

Besides the compressing stations permanently located, a number of portable compressing stations mounted on cars will be built. These will serve several purposes. They can be used on the ends of lines operated only in summer, they can be employed during construction for various purposes as well as to supply air for brakes, and they can also be used in emergencies to take the place of a stationary compressor during repairs.

CAR EQUIPMENT

Fig. 1 shows a plan, elevation and section of the storage air brake equipment on the cars, which is being supplied by the Westinghouse Traction Brake Company. As will be seen, there are two storage reservoirs, one on each side of the car, each being 18 ins. in diameter by 6 ft. long. Each has a capacity of about 10 cu. ft., so that the air storage of 20 cu. ft. at 300 lbs. pressure, carried in these reservoirs, is equivalent to approximately 100 cu. ft. at 45 lbs. pressure, which is the pressure used in the service reservoir and brake system. The outlets for charging the reservoirs are at the side near one of the storage reservoirs, and consist of a pipe fitting which is very similar to the standard air brake coupling head, and which is arranged to screw into a 1-in. pipe. Between the charging coupling and the branch to the first storage reservoir are a cock and check valve, so that when the reservoirs are fully charged the cock is closed, and any tendency of the air to leak through it after the coupling is detached will be at once stopped by the check valve.

The service reservoir, which corresponds to the ordinary reservoir in the straight brake system, is 14 ins. in diameter by 33 ins. long, and contains approximately 4400 cu. ins. Near this service reservoir in the main high-pressure supply piping is placed the reducing valve. This valve, in its operation, is in every way identical with the feed valve of the engineer's brake valve, as used in the ordinary steam railroad air brake system. The function of this valve is, of course, to keep the pressure in the service reservoir at 45 lbs., which it does very accurately and independently of the pressure in the storage reservoir.

The operating valve on the front platform is the standard O. V. J. valve of the Westinghouse Traction Brake Company, and is practically a three-way valve, which is operated by a handle which can be inserted only when the valve is on the lap. The brake cylinder is the standard 10-in. x 12-in. stroke cylinder of the Westinghouse type, and operates the brake rigging in the usual way, with a wire cable connection to a hand-brake handle for emergency use. As will be noticed from the plan all of the tanks are within easy reach of a man standing beside the car, so that they can be easily drained. All the valves, including the reducing valve between the storage and the service reservoirs, are also within easy reach. The piping to the front platform is carried under one side, and that from the platform to the brake cylinder is carried under the other side. The wire cable to the hand brake is also carried on one side just inside the side sills, so that there is no interference with the swivel trucks.

AIR COMPRESSORS

The air compressors will be electrically driven from the trolley circuit, and are being supplied by the Ingersoll-Sergeant Drill Company. They are of the straight, tandem-compound, single-acting type, arranged with the Westinghouse electric motors, directly connected to Morse silent-running chain drive, and are designed for a final discharge air pressure of 325 lbs. per square inch. The cylinders are 6¼ ins. and 14¼ ins. in diameter by 12-in. stroke. Both cylinders have standard mushroom-type discharge valves, the air passing from the low-pressure cylinder through a specially constructed intercooler to the high-pressure cylinder, thence to the storage reservoirs. The storage capacity at each station is, of necessity, somewhat in excess of usual practice in compressed air installation. This is caused by the fact that during the rush hours the stations will be called on to furnish more air for charging cars than the actual capacity of the air compressor could supply. As a rule, there will be at least two compressor units in each station, as well as two storage tanks, 36 ins. in diameter by 18 ft. long. The actual capacity of the compressors when operating at their specified speed of 110 r. p. m., will be about 100 cu. ft. free air per minute. This gives a maximum capacity to each station of 200 cu. ft. free air per minute. The storage tanks are charged at the higher pressure, 325 lbs. per square inch, while the cars will be charged to about 275 lbs. per square inch. This excess storage capacity, however, is counted on to supply extra air for a short duration only, when there is an extra heavy demand for air, and the compressor units are of sufficient capacity in themselves to supply the air required during the heaviest average duties.

On account of the severe conditions to be met with, the compressor being practically on duty for 24 hours per day, it was decided by the St. Louis Transit Company to make these outfits as nearly automatic in their operation as possible. They are, therefore, equipped with an automatic starting and stopping control, governed by a predetermined range in air pressure drop, viz., 325 lbs. maximum and 275 lbs. minimum.

Fig. 2 is a wiring diagram of the electric connections of the automatic controlling device, which in the half-tone engravings is shown as operated directly from the compressor shaft through worm gearing. This gearing drives an automatic magnetic clutch, which, through a connecting link, raises the rheostat arm over the resistance plates. In the wiring diagram the main circuit is showed by dashes, and the auxiliary circuit by

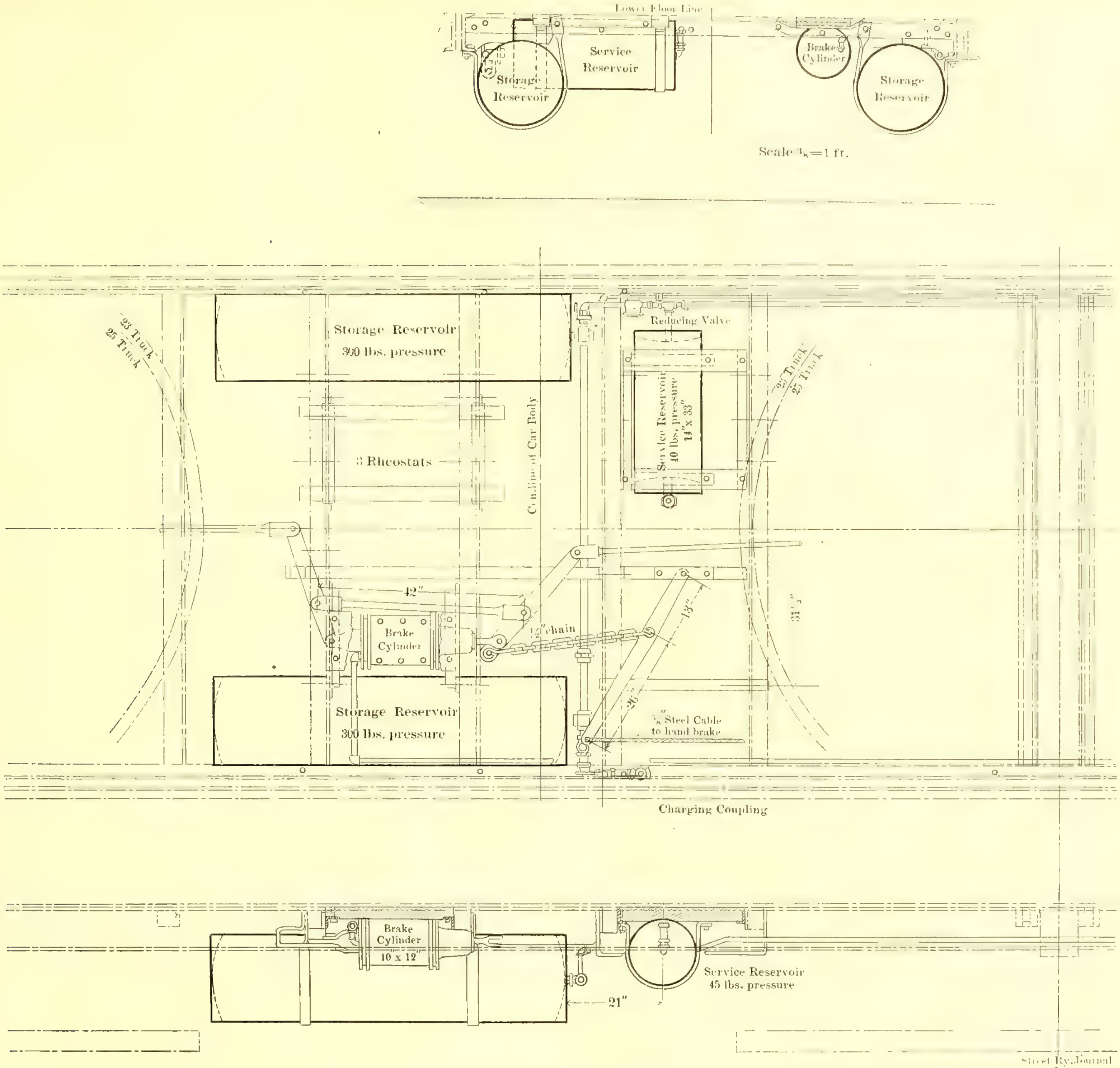


FIG. 1.—STORAGE AIR BRAKE EQUIPMENT ON CAR

dots. These controlling circuits are all shunted off the main line, having high-pressure resistance rods in their circuits. *G* is the hand switch for closing the main circuit, which is also open until closed by the magnetic switch at *C* in making contact at *M*. *A* is an air-pressure controlled pilot switch, which consists of a standard Bourdon gage, which, when the pressure in the receiver falls, will contract, allowing the pilot finger, as shown, to make contact on the upper point, which in turn short circuits the lower coil of the secondary contactor shown at *B*. The upper coil acting as a solenoid immediately raises its core, making contact through the secondary circuit at *B*, thus throwing the current through the operating coil of the magnetic switch at *C*, the holding coil of the rheostat at *D*, and the operating coil of the magnetic clutch at *E*. The effect on the magnetic switch, *C*, is that it closes the main circuit at *M*. The main circuit is then made through the rheostat to the motor, and the rheostat is gradually cut out as the worm gearing gradually rotates the disc *E*, raising the rheostat arm, *F*, through the link *H*.

To keep down the initial current, the motor is started without load. This is accomplished by the unloading device, shown in the lower part of the diagram and in the side view of the compressor on the side of the low-pressure cylinder. It con-

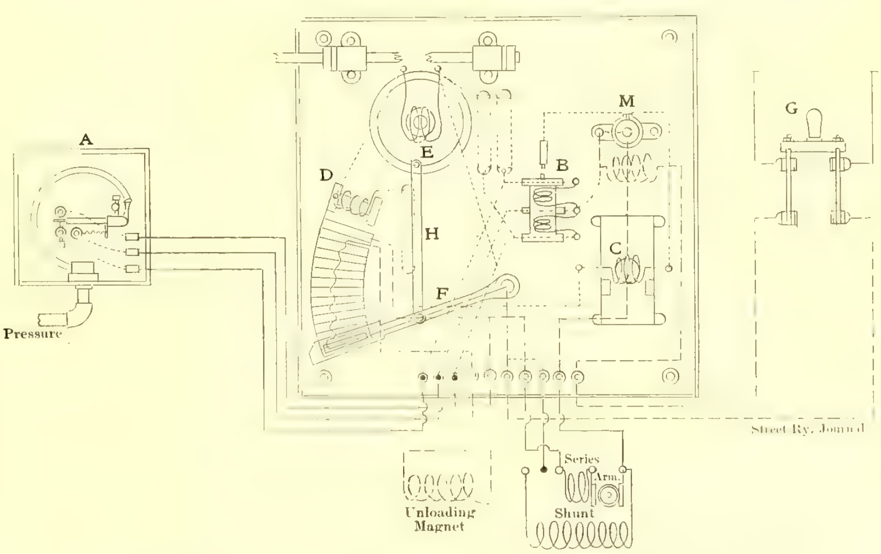
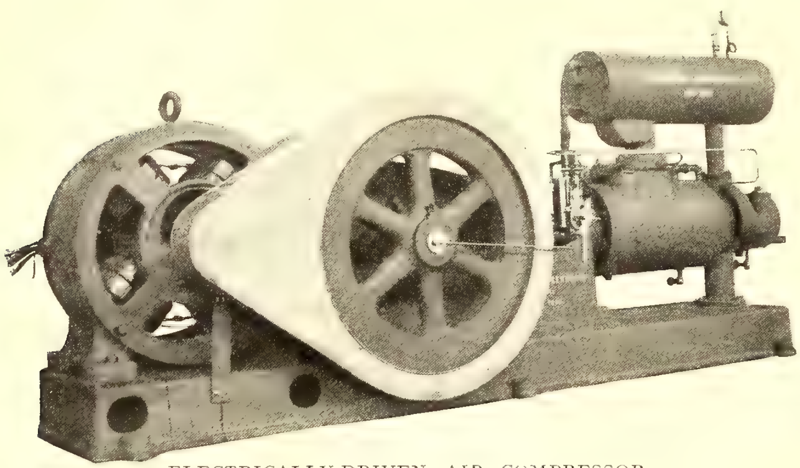


FIG. 2.—DIAGRAM OF CONNECTIONS OF AUTOMATIC STARTER

sists of the Sergeant type of compound air compressor unloader, arranged to be operated by a powerful solenoid in place of the air piston, which is used on compressors operated by steam. When contact is made through the main circuit at *M*,

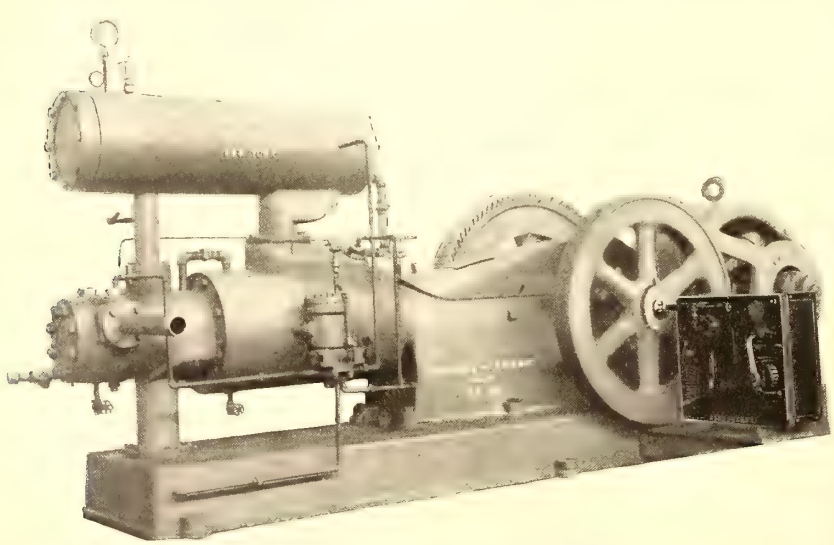


ELECTRICALLY-DRIVEN AIR COMPRESSOR

as described, current is also thrown on this unloader, which is connected in between the last two steps of the rheostat. This keeps the load off the motor until the last step on the rheostat is reached, when it is automatically short circuited. In practice it is found that the in-rush starting current required is about 52 amps. This drops off while the motor is getting up speed to about 27 amps. When the load is thrown on, the current required is from 47 amps. to 52 amps.

When the maximum pressure desired is reached in the reservoir, the pilot finger of the pilot control switch, *A*, makes contact again, this time on the lower contact point, short circuiting the upper coil of the solenoid contactor *B*, thus breaking the secondary controlling circuit at *B*, and releasing the entire apparatus from "no voltage release."

The arrangement of the air compressor units which are installed in duplicate in the various stations is such that, by throwing a double switch in the pilot control circuit, it is possible to make either one or the other unit carry the brunt of the load. This is done by setting one of the low-pressure contacting points of the two air-pressure controlled pilot switches at about 5 lbs. lower than the other. The compressor thrown in at the lower pressure would then only be called on to



ELECTRICALLY-DRIVEN AIR COMPRESSOR

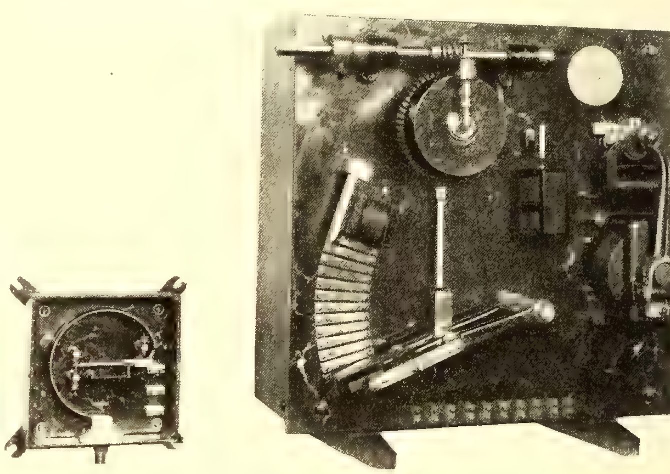
operate when the load is more than can be carried by one unit.

This arrangement permits of equalizing the work on the two compressors, and in case of accident to one it can easily be put out of service for repairs. It is the intention to have an inspector call at the sub-stations about once or twice a day, at which time any irregularities in the operation can be looked into by him and taken care of. This inspector will also fill up the oil reservoirs of the automatic oiling devices. No other attention is necessary.

A number of points were considered in connection with the selection of the type of air compressor and of controlling device, which are of interest to engineers contemplating the use of this type of apparatus, and they will be briefly mentioned.

On account of the high pressure used it was considered desirable to do away with any form of high-pressure packing which is liable to give out. It was decided, therefore, to use the tandem construction as shown, in which there is only one low-pressure stuffing box. These stuffing boxes are equipped with approved metallic packing, and form practically the only air joint on the compressor which requires any adjustment, with the result that the necessity for adjustment is reduced to a minimum.

The intercooler between air cylinders is of a special horizontal receiver type, so arranged that it can be tested for leaks and the same repaired without removing any part except the heads at each end. It is also arranged to take



AUTOMATIC STARTING DEVICE

up the expansion or contraction resulting from differences in temperature without any extra undue strains. The capacity of this intercooler is sufficient, so that a practically constant pressure is maintained within it, thus allowing the passage of air through it at a comparatively low velocity, giving ample time for cooling. The compressors themselves are equipped throughout with ample cooling jackets on air cylinders and heads, and are piped for circulating water connections through the intercooler and jackets. Caution should be used in placing the inlet and discharge valves in the high-pressure cylinder, where 260 lbs. unbalanced pressure is encountered, in such a position that if any accident befell these valves the broken parts would not enter the cylinder and cause extra damage. It was, therefore, specified that these valves should be placed on the sides of the cylinders and arranged so that the trouble mentioned could not happen.

Among other points specified by the St. Louis Transit Company was that these compressors would be arranged for entire automatic lubrication. The cross-heads, crank pins, connecting rods and main bearings are, consequently, lubricated by a system of splash lubrication, and a double-feed mechanically-operated oil pump was furnished for the air cylinders.

The electric conditions under which the motors operate are comparatively severe, the voltage varying over the different parts of the line from 400 volts to 650 volts. This necessitated a special study of starting devices, which would not show a material change in operation over this wide range of voltage. This fact practically eliminated the serious consideration of any form of controlling device in which solenoids are used, as the starting period of this type of controller is dependent upon the voltage, and with a fluctuation as large as that at St. Louis it would be impossible to adjust for the even in-rush of current necessary.

The motors, which are furnished by the Westinghouse Electric & Manufacturing Company, and are of the "S" type, having the field slightly over compounded to make a strong starting motor, and built so as to have a comparatively slight fluctuation in speed over the above range of voltages.

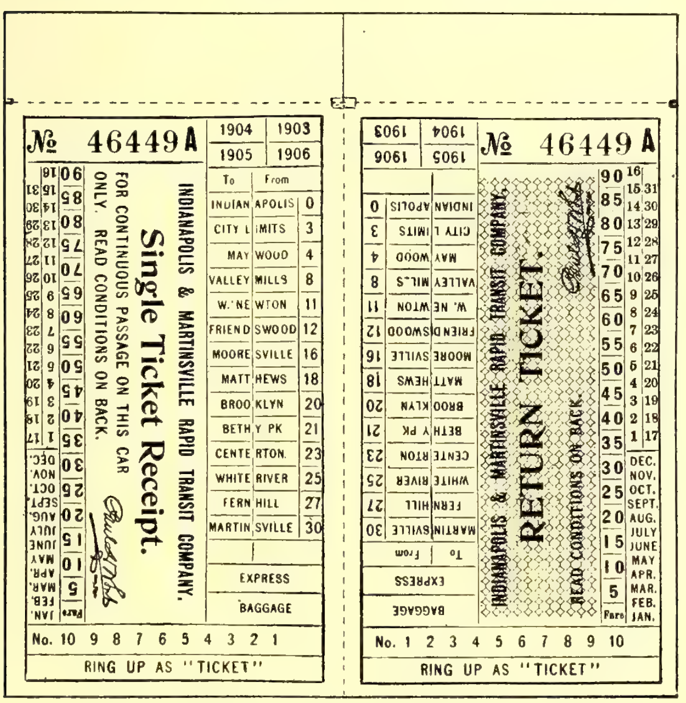
CORRESPONDENCE

INTERURBAN TICKETS

INDIANAPOLIS & MARTINSVILLE RAPID TRANSIT COMPANY,
Indianapolis, Jan. 12, 1904.

EDITORS STREET RAILWAY JOURNAL:

The modern interurban railway exists in the Middle West because of its successful solution of the operating problems involved. Elimination is the process that makes these undertakings what they are, and the extent of this process governs the per cent of income to expense. Were these properties compelled by custom to maintain depots, agents and all the incidental expenses thereto, the financial burden would soon outweigh the other good points, and the undertaking would be a poor attraction for the investor.



TICKET FOR SINGLE OR ROUND TRIP, OR BETWEEN ANY TWO POINTS ON THE LINE

One of the incidentals referred to is the ticket and its uses. Where a system of stations is maintained, the printing, recording and issuing to each station its supplies involves an amount of work that is considerable. The audit'ng of all these forms demands an office force sufficient to keep the business records up to the day's work. Of course, the agent and his expenses are imperative in this system. By eliminating all these ticket forms and doing the business through the conductor entirely, the whole of the business is simplified. The conductor must always be supplied with cash fare receipts and flag station tickets. By extending this so as to cover the operation of the whole road, very little is added to his labors, and the auditing is brought all under one head, and materially reduces the chance for error or confusion.

A ticket system has been installed by the Indianapolis & Martinsville Rapid Transit Company that meets the conditions of simplicity and flexibility, coupled with cheapness and accuracy in auditing. The sample shown illustrates a ticket that

Conditions Upon Which This Ticket is Sold.	Conditions Upon Which This Ticket is Sold.
This ticket must be punched and torn from the book in the presence of the purchaser, and rung up as a "TICKET" on the car register when issued, and must be again punched and rung up on the car register as a "TICKET" when taken up for return passage. The conductor is required to register separately, in addition to the car register, each passenger riding into or out of Indianapolis. Passengers riding in the city only must be registered on the car register and also on the City Company's register. Separate tickets must be issued for passenger, baggage or express, and rung up on the car register. If conductors fail to comply with the above, passengers will please report to the General Manager.	This ticket is good for continuous passage only on the train upon which it is sold. This ticket must be punched and torn from the book in the presence of the purchaser, and rung up as "TICKET" on the car register. The conductor is required to register separately, in addition to the car register, each passenger riding into or out of Indianapolis. Passengers riding in the city only, must be registered on the car register, and also upon the City Company's register. Separate tickets must be issued for passenger, baggage or express, and rung up on the car register If conductors fail to comply with the above, passengers will please report to the General Manager.

CONDITIONS PRINTED ON BACK OF TICKET

is good between any two points on the line, and may be sold as a one-way or a round trip. One form only is used in the business of the company. All tickets are sold by the conductors. They are the ticket agents and attend to all the business outside of the general office.

The ticket is punched at the time of sale as follows: The point of origin, the destination, and the fare, three punches only. The balance of the punching is done previous to the sale and at the convenience of the conductor. The same method of punching and the same points are punched out, whether selling single trips or round trips. A mistake on this score cannot be made.

The ticket is printed and bound in the duplex style into pads. Half of the ticket (that used for the round trip ticket) has a green-colored background in the center, to distinguish it from the other half, which is used for a one-way ticket.

The tickets can be torn from either the top or bottom of the pad. When one-way passage is paid the ticket is torn from the pad, with uncolored side up, and is then properly punched. The one-way half is given to the passenger, and the conductor retains the other half. Should a round trip passage be next called for, the pad is simply turned over and a colored half is sold from that side, punched in duplex each time. This leaves in the pad the portions of the duplex ticket not sold. These are placed in an envelope at the conductor's convenience, and are handed by him to the auditor at the end of each trip. The auditor knows that for every one-way slip returned to him a round-trip ticket has been sold, and, vice versa, for every round trip slip returned a one-way ticket has been sold. A check on this is also the punching of the fare; as between the same points the round trip being higher than the one-way. There is absolutely no confusion either with the conductor or the auditor, and the stock of printed tickets for the entire road is always known.

Any number of either one-way or round trip tickets can be sold from the same pad, and the sum of both kinds will be equal to the number of tickets bound in the pad.

Any interurban road that assumes the burden of card and station tickets must have agents to handle them. This requires an additional force at the main office to handle the business. The conductor must, in any case, be supplied with cash fare receipts. Why not let that feature cover all cases? It is just as safe, simpler, much cheaper, more accurate and highly satisfactory in the auditor's office and to the patrons.

Interurban roads must not follow the steam road practice,

unless they have all the conditions of the steam road, and they have not. Much that is done is wholly or in part experimental, and in this form of transportation the functions must be as elemental and free from complexity as they can be made. Every vestige of superfluous system and work must be eliminated, and the expense kept at a point that cannot be questioned. Properties adhering to this policy will be the ones to command the respect and confidence of the investing public.

PAUL H. WHITE, General Manager.

SHOP KINKS AT JOLIET

CHICAGO & JOLIET ELECTRIC RAILWAY COMPANY

Joliet, Ill., Jan. 12, 1904.

EDITORS STREET RAILWAY JOURNAL:

I have in use in our shops an armature truck for carrying armatures to and from the armature room, which has some features in its design that I have not seen used in other places on such trucks but which may prove of interest to some other small shop situated as we are. The wheels of this truck are 40-in. buggy wheels, which permit the armature to be hung below the axle, so that the center of gravity is low and the truck can be run directly over an armature so as to pick it up off the floor. A sketch giving the essential dimensions is shown in Fig. 1. The gage or distance between wheels is 20 ins. A bar 5 ft. long, terminating in a handle, rests on the middle of the axle between the wheels. From this bar another bar, 42 ins. long, is hung by links, as indicated in the accompanying sketch. Each of these links is 5 ins. from the axle. The 42-in. bar which is hung by these links carries the hooks by which the armature is hung. These hooks are large enough so that they will take in armature-bearing shells if necessary.

The peculiar feature of the device is the removable pin, from which the link nearest the operator is suspended. When an armature is to be picked up the removable pin is taken out of the link, allowing the hinged hook farthest from the operator to hook under the armature shaft, and allowing the hook nearest the operator also to hook under the armature shaft.

The handle is then brought down as a lever until the removable pin can be again placed in the link. Then, by raising the handle the armature is hoisted clear of the floor and the truck can be pushed wherever desired. This truck is narrow enough so that it will pass between cars as they stand in the car house. Another advantage of the large wheels not previously mentioned is that they go over small obstacles easily, but, of course, the chief advantage of this peculiar construction is in allowing an armature to be picked off the floor without the aid of any other devices and by one man. The distance between the hooks can be varied to suit different lengths of armature.

We have found that there is a tendency for the brake-shoes on some of our double-trucks to wear more on the flange side than on the outer side. This tendency, of course, if unchecked, would result in shortening the available life of the brake-shoes. As the brake-shoes wear in this way the hangers tend to draw inward, as shown in an exaggerated way in the accompanying sketch, Fig. 2. The way to counteract this tendency on a new truck would be to fix the brake-shoe hangers a little farther out, so that there would be an equal pressure on both sides of the shoe; but changing the location of hangers is likely to be an expensive job on a truck already built. A simple substitute in use on this road was devised by our car-house foreman. It

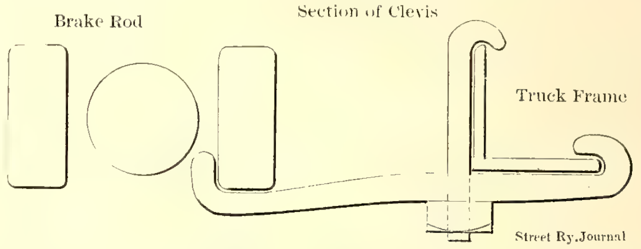


FIG. 3.—HOOK FOR KEEPING BRAKE-ROD AND HANGERS TO CENTER AT JOLIET

consists of a hook attached to the angle-iron of the truck frame, as in the sketch, Fig. 3. This hooks into the fork in the rod between the brake-shoes, and keeps the rod and hangers from swinging inward, as they would naturally do when the brake-shoes begin to wear too much on the flange side. By this simple device the life of our brake-shoes has been much increased, as they now wear evenly and can be run very thin. We use two of these clamps on each side of a truck. This is also a safe guard which would hold the brake rigging should the hanger break, when, ordinarily, the whole rigging would drop to the track and might derail the car.

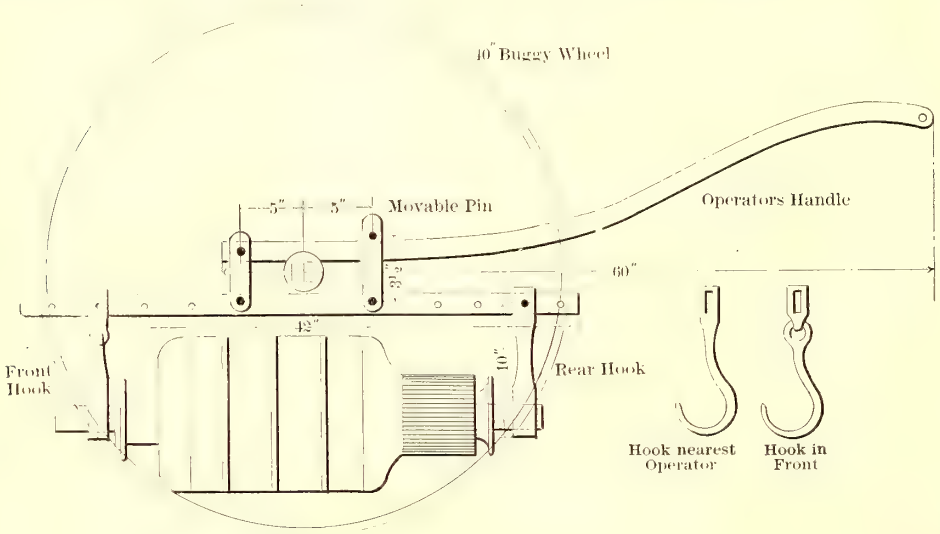


FIG. 1.—ARMATURE CARRIAGE—JOLIET

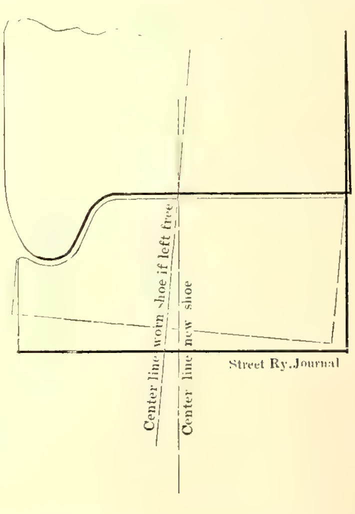


FIG. 2.—SHOWING WEAR OF BRAKE SHOES WITH HANGERS OFF CENTER

G. S. PATTERSON, Master Mechanic.

COAL CONVEYING MACHINERY

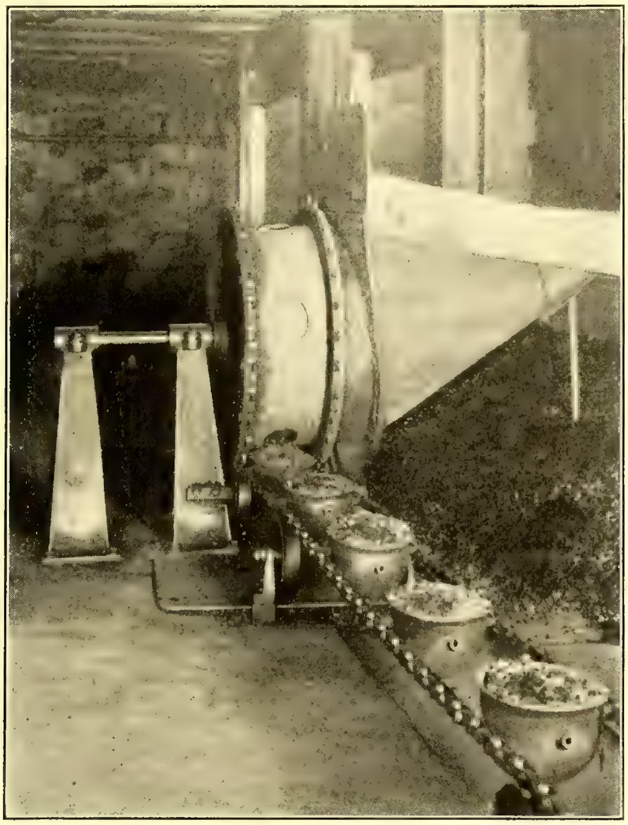
LINK BELT ENGINEERING COMPANY

Philadelphia, Jan. 25, 1904.

EDITORS STREET RAILWAY JOURNAL:

Some of your readers might be led to believe by Mr. Little's article on page 28 of your issue of Jan. 2, that some of the devices he describes were new and of English origin. As a

matter of fact, the drum feeder described by Mr. Little in the first conveying plant mentioned by him, has been used in this country for a number of years. The accompanying photograph shows one not made by us but built, and in use for a number of years at the Baldwin Locomotive Works, from designs of their mechanical engineer, Charles E. Wolle. It works very well on small coal, but if a stick or a piece of rope happens to be in the



DRUM FEEDER IN THE BALDWIN LOCOMOTIVE WORKS

coal there is trouble at once. The construction of the coal carrier described by Mr. Little is also not new. The same details of malleable iron bucket, steel bar link chains, bush joint, center pin for roller, and hollow roller have been used by us for a long time.

We also take exception, as engineers, to one feature of the coal handling arrangements of the Mersey Railway power house at Birkenhead. Two hoppers for feeding coal are installed, to avoid the risks (as Mr. Little says) of complete shutdown by reason of clogging of the coal in the feed chute; in other words, it seems to be taken for granted that the coal must clog and that a man must be there to clean it out. This problem was solved by American manufacturers of conveying machinery years ago, and there are on the market several devices which will feed from a hopper at a regular rate, without attendance and without danger of clogging, any coal from slack to run of mine.

F. V. HETZEL, Assistant Chief Engineer.

STREET RAILWAY COMPANIES AS PARK OPERATORS

544 La Salle Avenue, Chicago, Jan. 14, 1904.

EDITORS STREET RAILWAY JOURNAL:

Replying to the recent inquiry in your paper regarding the operation of parks by street railway companies, I have come to the very decided conclusion, after a number of years of experience in the management of companies controlling parks, that while a park is a very good thing for a company to own and control it is not a good thing for a company to operate. In my opinion, the only sound basis upon which to operate a park or pleasure resort is to lease it to some person who can give his entire attention to making the park in itself a financial success. If a street railway company attempts to operate a park on its own account the park is sure to be considered not as a revenue producer but simply as a means of producing traffic, and its income and expenditure accounts are not scrutinized with a view to profit and loss as they are by an individual who is running the resort for what he can get out of it. It is desirable that the company own, or in some way control the park, so that it can specify the kind of entertainments that are to be provided, and keep out objectionable features, but beyond that let the park business be taken care of by a specialist in that line. I know from experience that a large amount of money can be sunk in a park each season by a street railway company without half trying, and it takes a large amount of revenue from created traffic to pay the enormous expenses that easily run up in connection with park entertainment, where they are not conducted strictly on a business basis, as any other enterprise which must stand by itself. From my observation plenty of other street railway managers have come to the same conclusion.

Where a street railway company can obtain, say, $400 or $500 in yearly rentals for its park property, I have found it a good idea to use this revenue for additional attractions at the park on days that there are few or no attractions; for instance, some parks are so located that little or no amusement can be had on Sundays. At that time a sacred band concert at the park creates considerable traffic. Real estate for park purposes is generally located in the outskirts of the city or in the country, where land is cheap, and where the interest on the investment is small and can be generally covered by a portion of the rentals received from the lease of the park property to other parties.

C. E. FLYNN.

SPEED-TORQUE CHARACTERISTICS OF THE SINGLE-PHASE REPULSION MOTOR*

BY WALTER I. SLICHTER.

The single-phase commutator motor has attracted considerable attention of late, as there is quite a demand in railway work as well as in numerous other lines for an alternating-current motor that will start under a heavy load with a reasonable consumption of energy. At present it appears that a commutator motor is the only type that will fulfil these conditions.

For some months past the writer of this paper has been in charge of a series of experiments with various types of alternating-current commutator motors. During these experiments much attention was given to the repulsion motor. It is the purpose of this paper to place before the Institute some of the results obtained, and to point out some of the characteristics of the motor which give future promise of making it a very prominent factor in some lines of electric railroading.

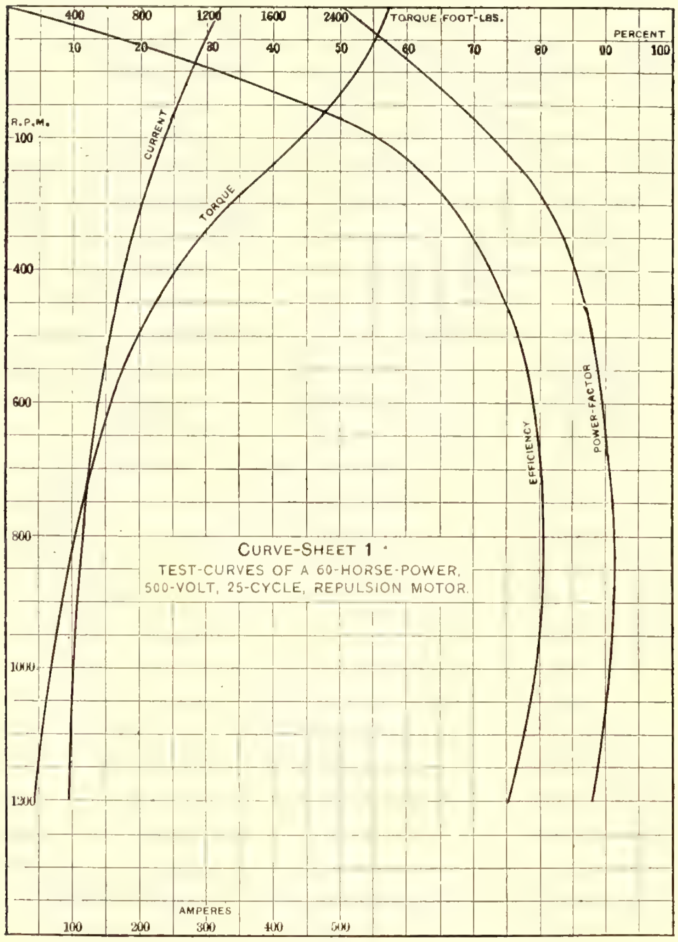
For the benefit of those not already familiar with this type of motor, it may be here stated that it is a single-phase commutating motor, resembling very much a regular direct-current armature in an induction-motor field. The resemblance to the induction motor is carried still further in that there is no electrical connection between the primary and secondary. This makes it possible to wind the primary for a high line voltage, while the voltage of the secondary winding is chosen at such a value as may be commutated satisfactorily, since it is short circuited on itself through its brushes.

The motor has the same characteristics as the direct-current series motor; namely, maximum torque at starting, increasing torque with increasing current and decreasing speed, and comparatively constant efficiency through a wide range of speed. The maximum speed of the motor is limited only by the load

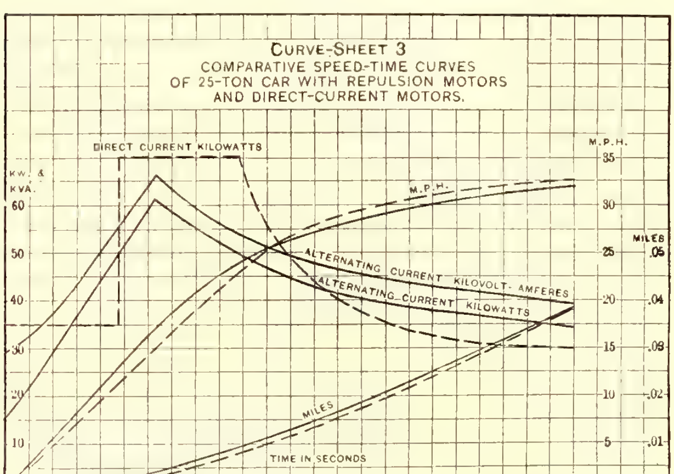
* A paper presented at meeting of the American Institute of Electrical Engineers, New York, Jan. 29, 1904. Copyright 1904, by A. I. E. E.

and impressed voltage and has no relation to the synchronous speed.

Due to the reactance of the motor circuits, the power factor at starting is low and will be with any alternating-current motor; but in the repulsion motor a low power factor does not mean small torque. On the contrary, the maximum torque occurs simultaneously with the lowest power factor; that is, at starting. The power factor of the repulsion motor rises very rapidly with the speed; it reaches a good value at one-third synchronous speed, and values near to 90 per cent are obtained over a considerable range of speed. For this reason a large number of poles is not necessary and frequencies of 25 cycles, 40 cycles, and even 60 cycles, may be employed.

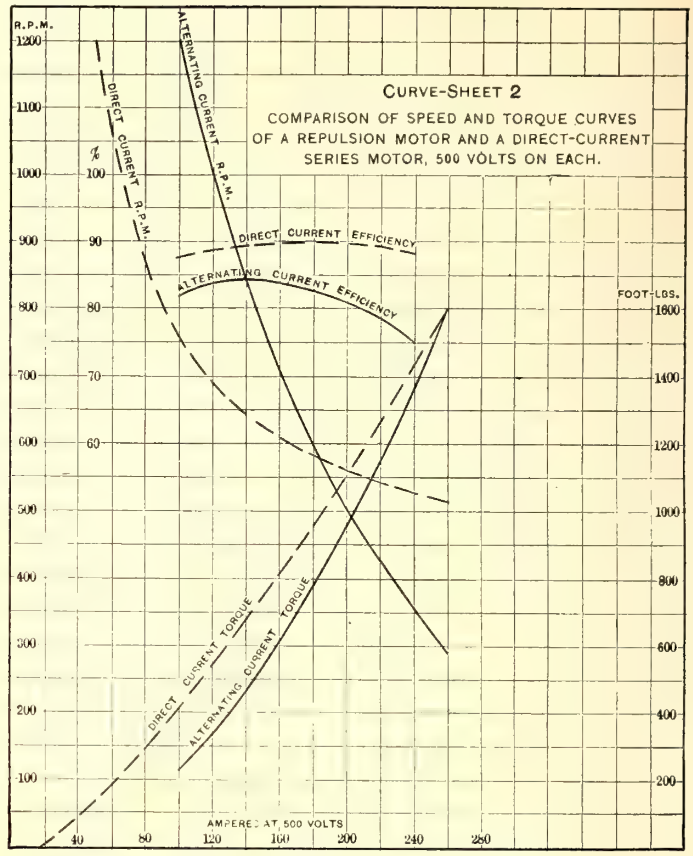


CURVE-SHEET 1
TEST-CURVES OF A 60-HORSE-POWER, 500-VOLT, 25-CYCLE, REPULSION MOTOR.

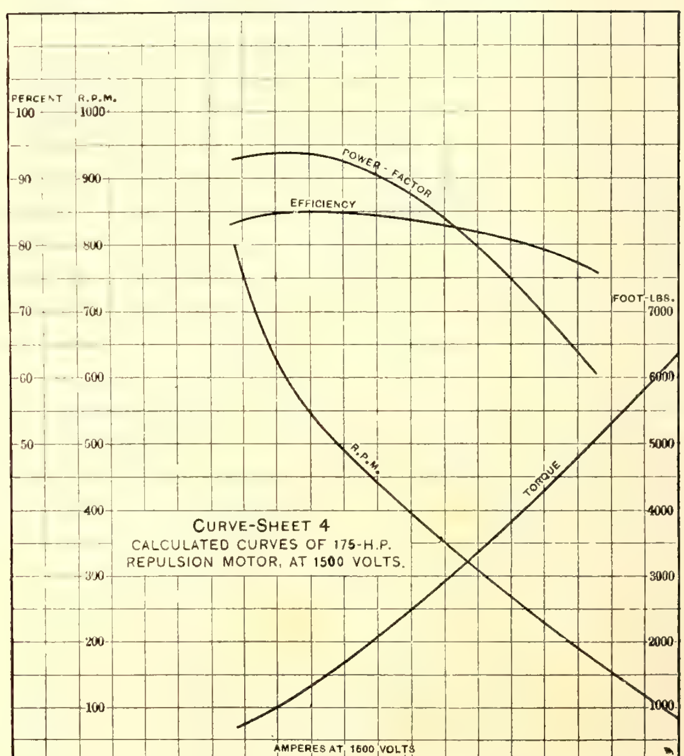


CURVE-SHEET 3
COMPARATIVE SPEED-TIME CURVES OF 25-TON CAR WITH REPULSION MOTORS AND DIRECT-CURRENT MOTORS.

The rotating conductors of the secondary cutting the primary flux, generate a leading electromotive force, which causes a leading current to flow therein and gives the high power factor of the motor. In the plain repulsion motor this leading current never reaches a value great enough to compensate entirely for the magnetizing and other wattless currents at available speeds, but the phenomenon is utilized to obtain unity power factor in the compensated type by the addition of a second circuit. The inherently good power factor of the repulsion motor makes it possible to use larger clearance between field and armature than is permitted in induction motors, thus greatly increasing its value in railway work where comparatively large air-gaps are necessary.



CURVE-SHEET 2
COMPARISON OF SPEED AND TORQUE CURVES OF A REPULSION MOTOR AND A DIRECT-CURRENT SERIES MOTOR, 500 VOLTS ON EACH.



CURVE-SHEET 4
CALCULATED CURVES OF 175-H.P. REPULSION MOTOR, AT 1500 VOLTS.

The curves given are partly from test and partly from calculation of motors having air gaps on a side of 1/8-in. and more. The air gap of corresponding stationary induction motors would be .040 in. and more.

The efficiency, while not so good as in a direct-current motor,

is yet very good, reaching values of from 80 to 85, including gear loss for sizes ranging from 50 hp to 200 hp.

Commutation at normal speeds is inherently good, due to the revolving field. As the speed decreases the current increases rapidly, producing a tendency to spark, but with the reduced voltage of starting the rush of current is limited to values within the range of good commutation, as in the direct-current motor. At higher speeds, ranging above one and one-half times synchronism, the frequency of commutation becomes high and sparking appears.

The motor of Curve Sheet 1 will start with 75 per cent of full voltage and twice full-load current with no trouble from sparking. As these curves are prepared upon a railway-motor basis and full-load current will produce a rise of 75 degs. C. after one hour's run, the ability of the repulsion motor successfully to commutate overloads is equal to that of the direct-current series motor; in fact, better, due to the short-circuited commutator which makes flashing-over impossible.

Curve Sheet 1 shows the characteristics of a repulsion motor plotted with revolutions per minute as a base. These curves are taken from tests on a 60-hp, 25-cycle, 500-volt motor; they show the rapidly rising efficiency and power factor and the large torque at starting. The starting torque is 2300 ft. lbs., with an input of 325 amps., and the normal torque during acceleration, 450 ft. lbs. at 750 revolutions and 125 amps. Thus the starting torque is five times normal and the starting current 2.6 times normal; or the torque per ampere at starting is 1.92 times what it is at normal speed, should occasion demand the full starting capacity of the motor.

This gives an idea of the steep speed characteristics of the motor, which are even better shown in Curve Sheet 2. The full lines refer to a later type of repulsion motor and the broken lines to a standard direct-current series railway motor; these curves are plotted in the usual way with current as a base. This shows that the torque increases more rapidly with increasing current in the repulsion motor than in the series; and conversely that the speed of the repulsion motor increases more rapidly with decreasing current than in the series motor. Efficiency, including gear loss, is given, and is 84.5 per cent at the maximum for the alternating-current motor. This motor was designed with the steep speed characteristics for acceleration work, while the motor of Curve Sheet 4 is designed for constant speed running and has not such steep curves but better constants at light loads.

The characteristics show the repulsion motor to be admirably adapted for acceleration work, the efficiency of acceleration being higher than in direct-current work, due to the possibility of obtaining fractional electromotive forces with alternating currents without introducing the dead resistance losses of the direct-current system of control.

This is shown in the curves on Curve Sheet 3, which gives the acceleration curves from tests of a 25-ton car equipped with two 60-hp repulsion motors. The full lines indicate the repulsion motor characteristics and the broken lines those calculated for a direct-current equipment. The gearing is chosen for the same free running speed, 33 m. p. h., the same average acceleration, and the same distance covered in 60 seconds. For the direct-current motor the curve of kilowatts input, miles per hour, and miles traveled, are given as calculated; and for the alternating-current motor the kilovolt-ampere input, kilowatt input, miles per hour and miles traveled from test.

The repulsion motor remains on the controller only 16 seconds, and the direct-current motor 25 seconds. The maximum power taken by the direct-current motor is 70 kw. and by the repulsion motor 61 kw. or 67 kilovolt-amperes. At the end of 25 seconds the total kilowatt-hour input in the two cases is .375 for the direct current and .30 for the alternating current. At the end of 60 seconds both cars have covered a distance of .039 mile, and have reached practically the same speed of 32.5 m. p. h., the kilowatt-hour input being .72 for the direct current and .685 for the alternating current.

By comparing the areas of the kilowatt curves in the two cases the gain, or rather the saving by the use of the alternating current, is readily seen. It is also worthy of note that the volt-ampere input of the alternating-current motor is least at starting; that is, the line current is least. As this is the time at which the power factor is lowest, it is seen that the effect of the low power factor on the regulation of the system is much modified by the small value of the current.

Curve Sheet 4 shows the calculated characteristics of a 175-hp railway repulsion motor having an air gap of .15 in. and wound for 1500 volts and 25 cycles. The efficiency, including gear loss, is 85 per cent at the maximum, and the power factor is 93. Such a motor is designed for heavy, slow-speed locomotive work, which is probably one of the most promising fields for the alternating-current motor. It is readily seen how well it is adapted for freight haulage by the fact that the efficiency of 85 per cent is attained at a speed as low as 500 revolutions, thus permitting a speed of 12 m. p. h. to 15 m. p. h., with a good gear reduction.

Thus the repulsion motor is well adapted for acceleration work as well as for efficient running at light loads, and having good constants at low speeds is well adapted for freight haulage at low speeds.

The curves given in this paper all refer to the simple repulsion motor, the theory of which is given in the paper by C. P. Steinmetz. There are many variations of the repulsion motor, more or less complicated, from which a better power factor and even a better efficiency have been obtained in test. However, a description of these various schemes with their characteristics would require sufficient space to warrant a distinct paper, and it is hoped to present such to the Institute at some future date.

THE ALTERNATING-CURRENT RAILWAY MOTOR*

BY CHARLES P. STEINMETZ.

For electric railroading a motor is required which maintains a high value of efficiency over a wide range of speed. That is, the torque per ampere input at constant impressed voltage must increase with decrease of speed, the speed increase with decrease of load.

In electric motors, torque is produced by the action of a magnetic field upon currents flowing in an armature movable with regard to the field. If then the field is constantly excited—shunt motor on constant potential—the torque is approximately proportional to the current, the speed approximately constant at all loads. If the field is excited by the main current of the motor—series motor on constant potential—the field strength and thereby the torque per ampere varies approximately proportional to the current, and thereby the load, the whole torque approximately proportional to the square of the current and the speed inversely proportional to the current, leaving saturation out of consideration. That is, the motor has the characteristic specified above for a railway motor.

Since the direction of rotation of the direct-current motor is independent of the direction of the impressed electromotive force, with laminated field the direct-current motor can be operated with alternating currents. By the use of alternating currents it becomes possible to transfer current from circuit to circuit by induction, and instead of passing the main-line current through the armature of the alternating-current motor, the armature circuit can be closed upon itself and the current induced therein as transformer secondary by a stationary primary coil in the main circuit surrounding the armature.

* Abstract of a paper presented at meeting of the American Institute of Electrical Engineers, New York, Jan. 29, 1904. Copyright 1904, by A. I. E. E.

Condition of operation of the direct-current motor type on alternating current is, however, that the current in field and armature reverses simultaneously. This is by necessity the case in the series motor. In the shunt motor, however, the armature current as energy current should be in phase with the impressed electromotive force, while the field current as magnetizing current lags nearly 90 degs. To bring it back into phase, W. Stanley tried condensers in series in the field circuit,

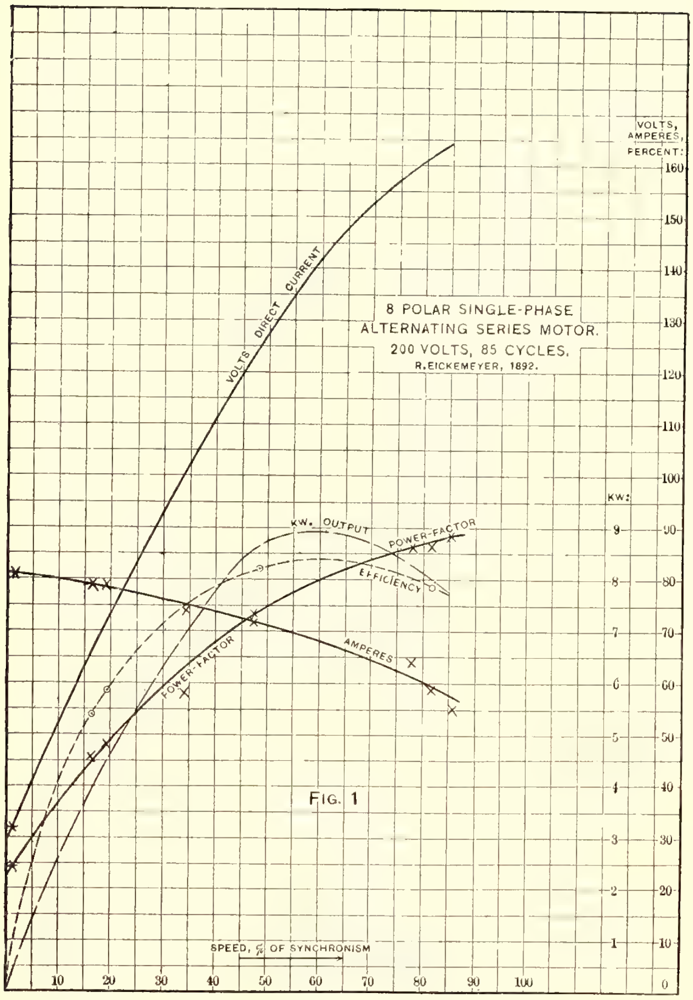


FIG. 1

but failed, due to the impossibility of neutralizing the self-induction of the field, which varies with the commutation and the frequency, by the negative self-induction of the condensers, which varies with the frequency in the opposite direction. The solution of the problem has been found by the use of polyphase systems, by utilizing for the field excitation the electromotive force in quadrature with the armature currents acted upon by the field magnetism. As I have shown elsewhere, the polyphase induction motor can be considered as a development of the direct-current shunt motor for alternating-current circuits, and, indeed, has all the shunt motor characteristics regarding speed, torque, etc. As a railway motor the induction motor has, therefore, not been exploited, although it has been strongly recommended in those very few cases where it appeared good engineering. Experimental work with polyphase induction motor railways has been carried on continuously since 1893.

While in the early days of alternating-current motor development all other engineers were industriously developing the type with shunt-motor characteristic, only Rudolph Eickemeyer, of Yonkers, was far-sighted enough to realize the absolute necessity of the series motor characteristic for railway work and undertake the development of the single-phase alternating-current series motor. I had the good fortune at that time to be associated with Mr. Eickemeyer.

As was pointed out by G. Kapp, I believe in 1888, the power factor of the alternating-current series motor is inherently low, since the same magnetic flux which induces, proportional to the frequency of rotation, the electromotive force of useful work in the armature conductors, induces in the field coils an electromotive force of self-induction, proportional to the fre-

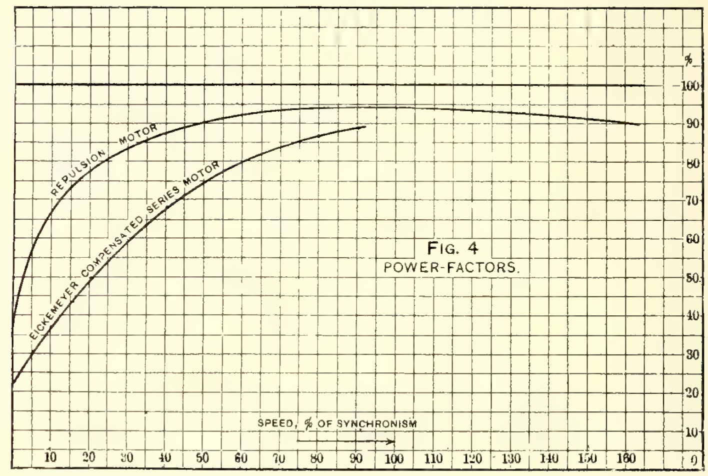


FIG. 4

quency of alternation, thereby giving the armature the same number of turns as the field (which is more than permissible in good practice, since good practice requires weak armature and strong field). Even at synchronous speed the electromotive force of rotation of the armature would still only be equal to the electromotive force of self-induction of the field; and the power factor, allowing for an additional self-induction of the armature, would be below 70 per cent. This probably deterred the other engineers from considering the alternating-current series motor.

Eickemeyer solved the difficulty by designing the armature with a number of turns several times greater than the field (24 to 7 in the first motor built) and neutralizing the armature self-induction and reaction by a stationary secondary circuit surrounding the armature at right angles electrically to the field circuit (the "cross-coil," as he called it), and either short-circuited upon itself or energized by the main current in opposite direction to the current in the armature.

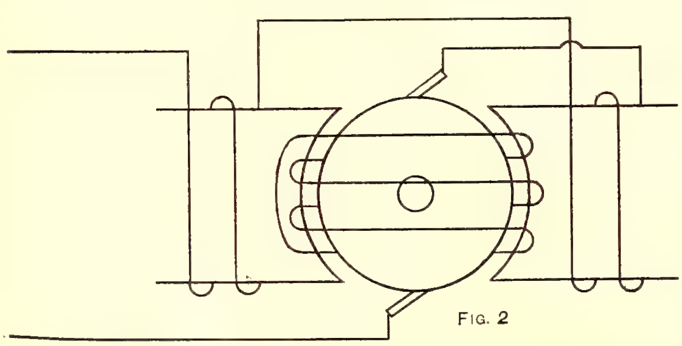


FIG. 2

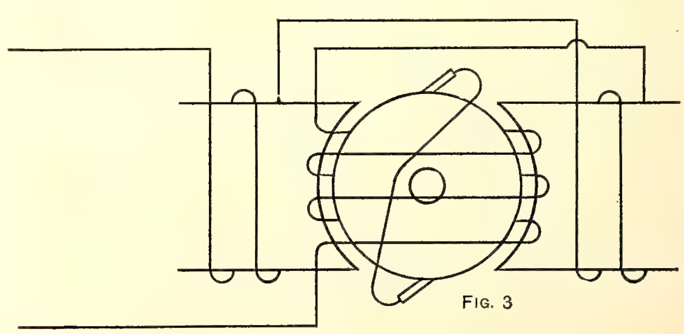


FIG. 3

In January, 1891, I tested the first motor of this type, a bipolar motor with the following constants:

Field, two coils of fourteen turns No. 10 B. S. wire, connected in parallel.

Armature, twenty-four coils of four turns each of No. 12 B. S. wire.

Secondary circuit, two coils of eighteen turns each of No. 10 B. S. wire connected in parallel.

At 100 cycles and 150 volts impressed electromotive force, this motor gave a three-fourths synchronous speed:

Current, 45 amps.

$I^2 R$, 400 watts.

Hysteresis and eddy currents, 900 watts.

Total output, including friction, 4000 watts.

Hence:

Efficiency, 75.5 per cent.

Power factor, 79 per cent.

The starting current of this motor at 150 volts was 70 amps.

With a bipolar motor and the very high frequency then used, the speed, 4500 revolutions at three-fourths synchronism, was undesirably high, so we immediately proceeded to build an eight-pole motor. In this, solid copper rings were used as secondary circuits surrounding the armature and neutralizing its self-induction, with an effective copper section more than four times that of the armature conductors. The ratio of armature series turns to field series turns was about four. This motor was tested in 1892. The record of tests is given in Fig. 1, the observed values being marked on the curves. For comparison on this sheet is also given the direct-current voltage required to operate this motor at the same speed and current.

As seen, when approaching synchronous speed, the power factor is nearly 90 per cent. The commutation was fair at 85 cycles, the highest frequency at which our factory engine was able to drive the alternator, and perfect at 33 cycles.

A number of railway motors of this type were designed. The great difficulty, however, was that during these early days 125 cycles to 133 cycles was the standard frequency in this country, 60 cycles hardly considered, and 25 cycles not yet proposed.

The efficiency of this alternating-current series motor is slightly lower than that of the same motor on direct-current circuit, due:

(1) To the hysteresis loss in the field.

(2) The hysteresis loss in the armature core, which is of full frequency up to synchronism and of still higher frequency, the frequency of rotation, beyond synchronism.

(3) The $I^2 R$ loss in the short-circuited secondary conductors surrounding the armature.

As seen, to make the alternating-current series motor practicable, the transformer feature must be introduced, by having its armature as primary circuit closely surrounded by a short circuited secondary circuit, as shown diagrammatically in Fig. 2.

Instead of closing the stationary circuit upon itself as secondary circuit and feeding the main current into the rotating armature as primary circuit, mechanically the same results would obviously be obtained by using the stationary circuit as primary, energized by the main current and closing the armature upon itself as secondary by short circuiting the brushes and thereby keeping the main current and the line potential away from the armature, as shown diagrammatically in Fig. 3. This introduces the great advantage of reversing the sign of the uncompensated part of the armature self-induction, so that it is subtractive, which results in an essential improvement of the power factor, especially at low speed.

This is shown in Fig. 4, where with the speed as abscissas, in per cent of synchronism, are plotted the power factor of the Eickemeyer compensated series motor of Fig. 1, of ratio armature to field $= 4$, and the power factor of one of the first railway repulsion motors, of ratio armature to field $= 3.5$.

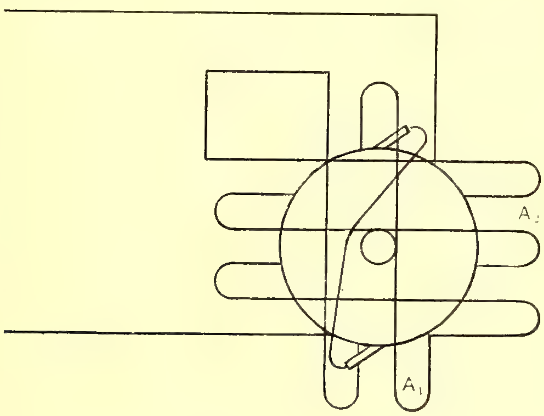
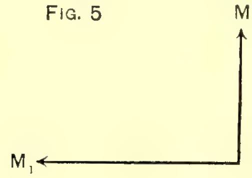


Fig. 5



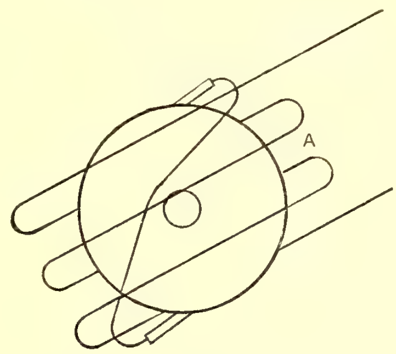
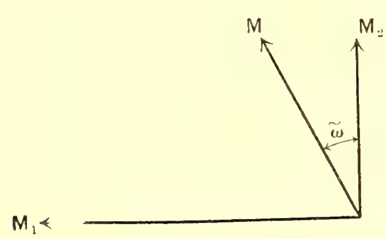


Fig. 6

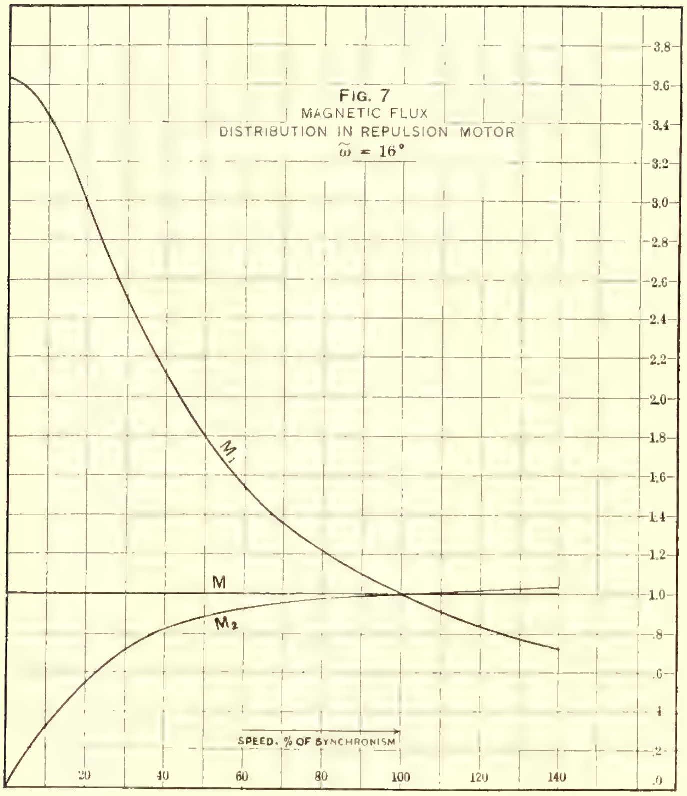


The compensation of the armature self-induction in Fig. 3 is based on the feature of the transformer that primary and secondary current are in opposition to each other. The secondary current of the transformer, however, lags slightly less than 180 degs. behind the primary current; that is, considering it in the reverse direction, is a leading current with regard to the primary current. The current in the armature in Fig. 3 is, therefore, a leading current with respect to the line current, and so not only does not add an additional lag but reduces the lag caused by the self-induction of the field-exciting coil.

This motor then consists of a short-circuited armature surrounded by two coils at right angles with each other and connected in series, as illustrated in Fig. 5; the one, A_2, parallel with the effective armature circuit, acting as primary of a transformer to induce the secondary armature current; the other, A_1, the field exciting coil. The ratio of turns of these coils, n_2 to n_1, is the ratio of effective armature series turns to field turns, as discussed before. Obviously, these two coils can be replaced by one coil at an angle with the position of brushes as shown in Fig. 6, and the cotangent of the angle of the axis of this coil with the position of the brushes is the above ratio; that is, the smaller this angle the greater is the ratio of armature to field turns; that is, the better the power-factor of the motor.

This motor, Fig. 6, is Professor Elihu Thomson's repulsion motor.

In the armature an electromotive force is induced by the alternation of the magnetic field, M_2, of coil A_2, proportional to M_2, and to the impressed frequency and in quadrature with M_2 and an electromotive force is induced by the rotation through the magnetic flux, M_1, of coil, A_1, proportional to M_1, and to the frequency of rotation and in phase with M_1. These two electromotive forces must be equal and opposite, since the armature is short circuited (neglecting the resistance and self-inductive reactance of the armature) and at synchronism. Therefore, M_1 and M_2 are equal and in quadrature with each other; that is, in the armature of the motor, Fig. 5, and, therefore, of the repulsion motor, Fig. 6. At synchronism a



uniform rotating field exists and the hysteresis loss in the armature core is, therefore, zero at synchronism and at other speeds proportional to the difference between speed and synchronism; that is, to the slip, just as in the polyphase induction motor, while in the motor, Fig. 2, the hysteresis loss in the armature core is proportional to the impressed frequency or the frequency of rotation, whichever is the higher frequency. The hysteresis loss of the repulsion motor is, therefore, lower than that of the same motor as compensated series motor.

Unlike the plain series motor, which can never return power into the line, the repulsion motor when reversed becomes a generator, consumes mechanical power as brake and returns electric power into the line, even at low speeds. Experiment verifies this feature.

CITY SCHEDULES IN ST. LOUIS

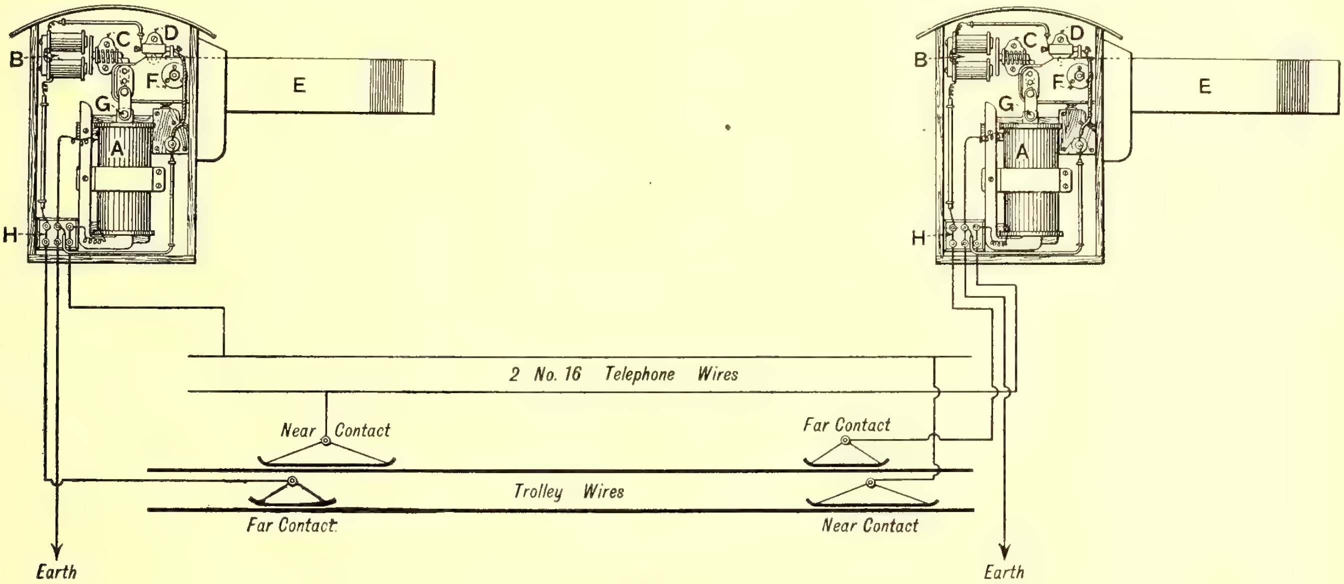
Important changes in the schedule speed of cars have been made on the lines of the St. Louis Transit Company since the management of the property was taken by A. B. Du Pont, now second vice-president of that company. The interest manifested among other street railway managers in these radical changes which have been taking place during the last three years in St. Louis, and Mr. Du Pont's well-known position as an advocate of fast schedule, led a representative of the STREET RAILWAY JOURNAL recently to ask Mr. Du Pont for a brief statement of the facts in the case. These inquiries resulted in bringing out some interesting facts regarding schedule speeds and number of trippers in St. Louis. Mr. Du Pont says that the average schedule speed of the cars in the city service on the lines of the St. Louis Transit Company is now a little over 10 m. p. h. The ordinary schedule during the middle of the day calls for 359 regular cars, to which 520 trippers are added during the rush hours, making a total of 879 cars during the rush hours. These figures alone demonstrate Mr. Du Pont's belief in fast schedules, and it is doubtful whether there is another city the size of St. Louis in the world where the average speed is as fast considering all the conditions; although, of course, there are cities with less congested streets where better time is made. It is also evident that the St. Louis Transit Company's rush hour schedule is most remarkable, as there is an increase of about 144 per cent over the regular schedule. Mr. Du Pont does not believe that a fast schedule increases accidents, but, on the other hand, that it tends to decrease them, as he maintains that the public will not take such chances in a city where fast schedules are common as in a city where schedules are slow and there is more temptation to take chances; in other words, the greater the risk the greater the care on the part of those exposed to it. He believes that fast schedules decrease the operating expenses, unless motors are too small for the schedule, in which case, of course, the saving in conductors' and motormen's wages by the fast schedule would be decreased by motor repairs. As to the great number of trippers, summing up the whole case briefly, Mr. Du Pont says, "I believe in going after the nickel; give people a chance to ride and seats, if possible, at the times when they want to ride the most." In his experience fast schedules tend to increase riding, especially during the noon lunch hour. Now many people ride home to lunch, where formerly they lunched downtown. The large number of trippers during the morning and evening rush hours tends to induce short distance riding, as people now ride who would otherwise walk in preference to taking crowded cars during the rush hours.

AUTOMATIC ELECTRIC TRAMWAY SIGNAL SYSTEM

An automatic electric tramway signal system, made by Estler Brothers, of London, England, has been in use for some considerable time on a large English corporation tramway, and is reported to be giving excellent satisfaction.

The construction details and wiring of this system are clearly shown in the accompanying illustration. The apparatus consists of a main solenoid (A), which receives current direct from the trolley wire by the special contact plates described below. The solenoid is wound with thin wire, having a total resistance of about 750 ohms, consequently only takes a very small current. In the core of the solenoid is a soft iron plunger (G), which is connected to the semaphore arm (E) by links. The semaphore arm is made of wood, and is free to swing about the pin (F). The normal position of the arm is down, indicating that the line is clear. As soon as a car passes the contact plate connection is made, and current passes through the solenoid, which pulls the signal to horizontal or danger position. It is held in this position by a catch (C) until the car passes the far contact-plate, when current is conducted to the solenoids (B), which release the catch (C), allowing the signal arm to fall. As soon as the signal arm falls the circuit breaker (D) is opened, so that current only flows through the solenoids (B) for a short period. All the necessary electrical connections are made from a small terminal block (H). The whole apparatus is contained in a weatherproof case, and owing to the small number of parts can be relied upon to act without any special attention. The connection between the signals consists of two No. 16 telephone wires supported on insulators.

The wiring connections shown are those used in the case of a single line of track having turnouts which are invisible from each other, but provided with double trolley wires; consequently two signals are necessary and four contact-plates. A car approaching from, say, left to right, would proceed if the signal on the left were down, and would on passing the near contact-plates set the signal on the right to danger. When the car passed the far contact it would release the signal on the right, indicating that line was again clear.



DETAILS OF AUTOMATIC ELECTRIC TRAMWAY SIGNAL SYSTEM

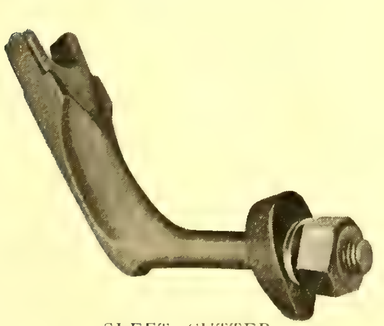
The contact-plates consist of flat plates suitably suspended above the trolley wire. A smooth contact is made between plate and trolley wire by the trolley wheel, as the plates are supported by means of springs.

The manufacturers state they have found it unnecessary, especially on town service, to provide lamps in the signal apparatus, as the lights on the car give ample illumination to see the semaphores at night.

AN EFFICIENT SLEET CUTTER

The accompanying cuts illustrate the O. K. sleet cutter, manufactured by Porter & Berg, of Chicago, which has met with very flattering success during the three years it has been on the market. The makers state that it is now used by almost all of the electric railways throughout the Middle West and in many other places where sleet is encountered.

The removal of sleet from the trolley wire is a matter of great importance to any operating road, and to accomplish this work expeditiously a device which may be attached directly to the harp, without disturbing the wheel, is of self-evident value.



SLEET CUTTER

SLEET CUTTER ON TROLLEY WHEEL

The sleet cutter illustrated consists of a malleable iron casting, the shank of which bolts securely into the harp and fitted with a lock washer to prevent it from working loose. The body of the device is made of malleable iron, and is practically indestructible. The brass which makes the contact is soft enough to take the brunt of the wear, thus saving the trolley wire, and when it is worn out it can be easily replaced at a small cost. This cutter fits snugly in the harp, and is so designed that it offers no obstruction which could catch on the span wire or overhead construction when the trolley leaves the wire.

If each car is equipped with one of these sleet cutters, the motorman can easily attach it to the harp, whenever the necessity for its use arises, without loss of time, thus enabling him to maintain his time schedule and avoid much annoyance.

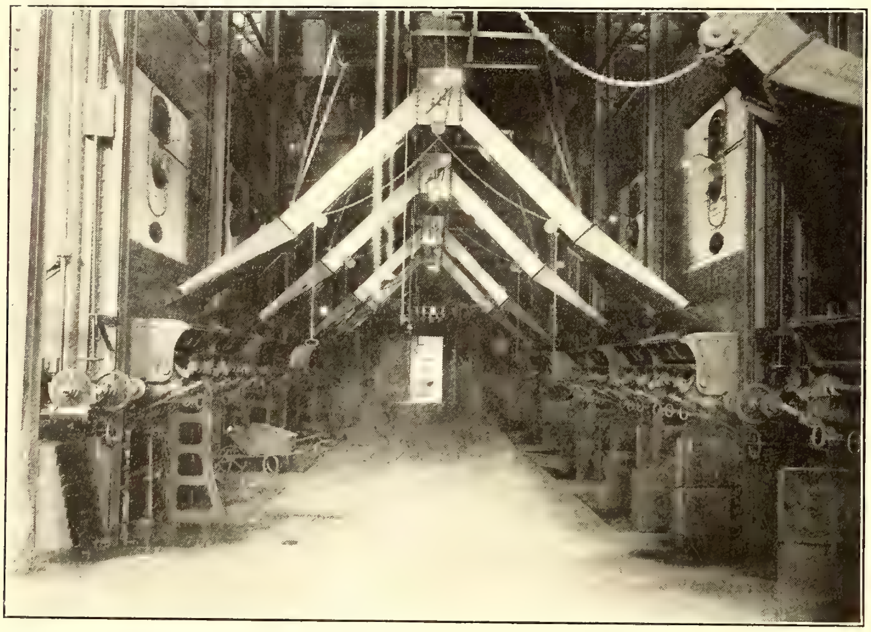
WATER-TUBE BOILERS IN ENGLISH TRAMWAY STATIONS

The increasing use of water-tube boilers in large power plants has been due not only to their greater safety over fire-tube boilers but also to the many improvements in their design made during recent years. The Stirling Boiler Company, Limited, of Edinburgh, has given much attention to this subject, and its water-tube boilers embody many excellent features. A large number has been adopted in important municipal undertakings; among these may be mentioned tramway stations for the London County Council, also Liverpool, Kirkaldy and Sheffield Corporations. The accompanying illustration shows nine Stirling boilers for the Mersey Railway. Each of these boilers is to develop 1500 hp, probably the largest units in England. A valuable testimony to the merits of the Stirling boiler is the number installed with leading engineering firms of wide knowledge and experience, such as Vickers Sons & Maxim, Siemens Brothers & Company, Limited, D. Colville & Company, Limited, Sir B. Samuelson & Company, Limited, and many others.

The Stirling boiler has three top and two bottom drums, connected by four banks of tubes. The tubes can be renewed individually, and as they are expanded direct into the drums the construction is very simple. There are no complicated headers and joints requiring elaborate machine work. The top drums are carried by a girder framework independent of the brickwork, and as the bottom drums are built clear at the ends they are free to move with any expansion or contraction of the tubes; thus strains due to this cause are completely avoided.

The three steam drums are all connected above the water level by tubes, and likewise the front and mid drum, below the water level. The main tubes are straight throughout the greater part of their length, but curve with easy bends toward each end, to enable them to enter the drum radially.

The combustion chamber has its three sides lined with fire-brick, the action of which assists to perfect the high-temperature combustion caused by the effective mixing of the furnace gases in the large combustion chamber before the gases give out their heat to the water-tubes of the boiler. The banks of tubes have fire-brick baffles arranged between them, which cause the hot gases from the furnace to take a devious course along and between them. The temperature of the outgoing gas is said to be reduced to such a minimum that no economizer is necessary.



BOILER DIVISION OF MERSEY RAILWAY POWER STATION

It will be evident also that the circulation of the water should be good. Every tube has a free outlet to the drums at each end, so that all steam formed has the full area of the tube for its passage to the steam space, and is not confined in narrow necks or headers. The bottom drums maintain a supply of water ready to take the place of the steam formed, so that there is no possibility of tubes being filled with steam only. The steam is made principally in the two front banks of tubes, and these tubes are inclined at a good angle for allowing the steam to pass freely to the steam space, while the circulation of water between the front and middle drums is very free through the numerous tubes which connect them below the water line. The water level is about the center of the top drum, so that the steam and water spaces are considerable, and fluctuations of the water level are not rapid. The feed-water is led into the top back drum and passes slowly down the back bank of tubes into the back bottom drum, where solid matter and impurities are deposited. The water then slowly passes into the front drum, where it joins the general circulation.

This arrangement of the admission of the feed into the back section is claimed to achieve the important result that deposition from the water takes place at the rear of the generator, where the temperature is not sufficient to cause injury through overheating. The Stirling boiler is stated to have a very high efficiency, mainly due to this cause and to the large fire-brick combustion chamber, which maintains a high initial temperature, and insures perfect combustion of the fuel. For this reason fuel of inferior quality can be used, and it is said this is now being done in a number of cases with remarkable economy in the cost of steam produced.

A feature of the Stirling boiler, in its improved form, is the ease with which it can be examined, as by removing a man-door (of the usual internal pressure type) on each drum, access is gained to the inside of every part of the drums, which being from 3 ft. to 3 ft. 6 ins. in diameter, are ample in size, and to the ends and interior of every tube. The easy bends of tubes can be readily cleaned, special provision being made for the thorough and easy cleaning of the tubes from the scale—whether soft or hard—and the tubes being vertical facilitate this. The boiler is also very simple to repair, being so designed that any single tube can readily be replaced without disturbing others in the event of a tube giving out. A temporary repair can be easily effected by plugging a tube and replacing it at a more convenient time.

From reports which have been made on the working of this boiler, and more particularly of tests made by Professor Ewing, it would appear that the steam produced is exceptionally dry, owing to the rapid circulation described above, and to the manner in which the steam outlet is arranged. It is stated to be impossible for any priming to take place, even when the boiler is forced to its utmost. From an actual test with a "Stirling" boiler worked by means of forced draft till it was evaporating 100 per cent more than the guaranteed amount, the percentage of moisture in the steam was less than one-tenth of 1 per cent.

The manufacturer of this boiler also makes mechanical stokers, superheaters and other accessories specially designed to suit boilers of this type.

AN INTERESTING ADDITION TO CONVERTIBLE CARS FOR THE WASHINGTON WATER POWER COMPANY

In the STREET RAILWAY JOURNAL of May 2, 1903, an article was published describing sixteen convertible cars built for the Washington Water Power Company, of Spokane, Wash., by the J. G. Brill Company. Attention was then called to the fact that the Washington Water Power Company bought the second Brill convertible car built, and after a thorough trial for determining its wearing qualities and capacity to retain warmth, purchased another car of larger dimensions, and later the sixteen cars referred to. The last lot was the first in which the builders' convertible and Narragansett types were combined.

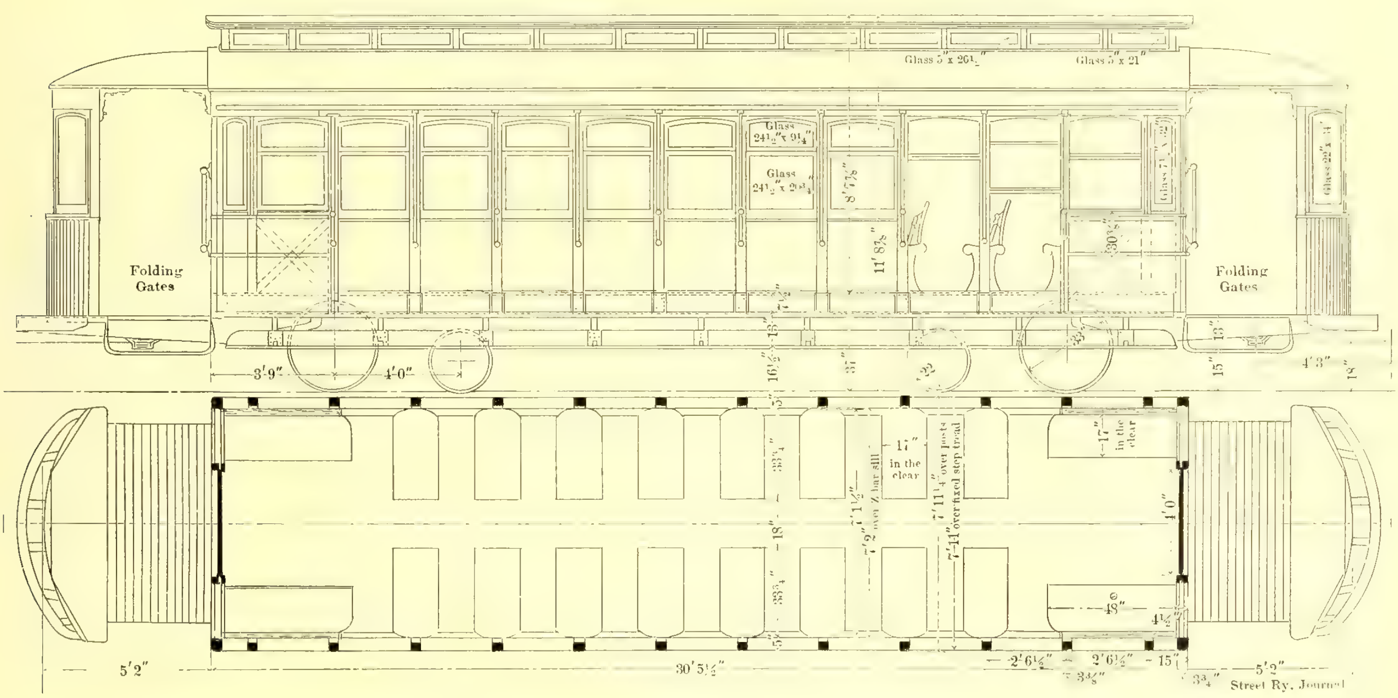
A few months ago the railway company ordered ten more convertible cars of practically the same dimensions as the former lot, and later increased the order to twelve. One of these cars is shown in the accompanying illustrations, and is especially interesting on account of its being the first of this type to have the section between the double corner posts and the first corner posts solidly paneled. The builders' practice in this type is to connect the double corner posts with solid panels, but to provide for longitudinal seats at the corners the additional solid panels have been included, and it is expected that in the future all double-truck convertible cars and many of the single-truck cars will comprehend this feature. Railway men generally are appreciating the value of extra space just inside the doors of their closed cars, to prevent crowding at this point and to facilitate egress and ingress. In the former arrangement of this car single seats were used at the corners; and, therefore, when the car was closed, the space between the doors and the entrances to the aisles was too limited. In the new arrangement the clear space between the longitudinal

corner seats is 4 ft., and from the door to the cross-seats 5 ft. 3 ins. One can readily see that there are no disadvantages with this arrangement. Passengers occupying the corner seats may enter and leave at the side entrances next to the seats or by the platforms. The longitudinal seats are 4 ft. long, giving generous space for three persons. There is, of course, additional strength in the longer solid paneling, obtained by the cross-bracing shown in the diagram, and also by the convex and the concave panels, the belt and the window rails. All spaces between the panels and the side linings not occupied by the bracing are solidly blocked in.

It will be noticed from the illustrations that side steps, or running boards, are practically as low as the platform steps, and that the steps on the outward-extending lower flange of the Narragansett type of Z-bar sills are practically on the same level with the platforms. Side entrance is, therefore, made as safe and as easy as by the platforms. The large double-sash windows of the solidly paneled sections are raised into the roof pockets on the same system as the rest of the windows. The runways which guide the metal trunnions at the sash corners are of metal for their full length, precluding all possibility of sticking. The distance from center to center of the side posts is 2 ft. 6½ ins., the posts are 3⅜ ins. thick, and the corner posts 3¾ ins. Other dimensions are shown on the accompanying diagram.

CONVERTIBLE CAR PARTLY OPEN

The movable panels are composed of two sheets of thin, flexible steel, held apart by horizontal slats, which are tapered at the ends to allow a slight compression at the edges of the outer metal sheet, thus making it water-tight. When the panels are raised into the roof pockets their position is directly behind the head linings. The cars are handsomely finished in ash, and have ceilings of decorated birch, giving a light and pleasant effect. Guard rails on either side are of a single piece, and held under the waterboard by patented gravity catches when not in use.



CONSTRUCTION DETAILS OF CONVERTIBLE CARS FOR WASHINGTON WATER POWER COMPANY

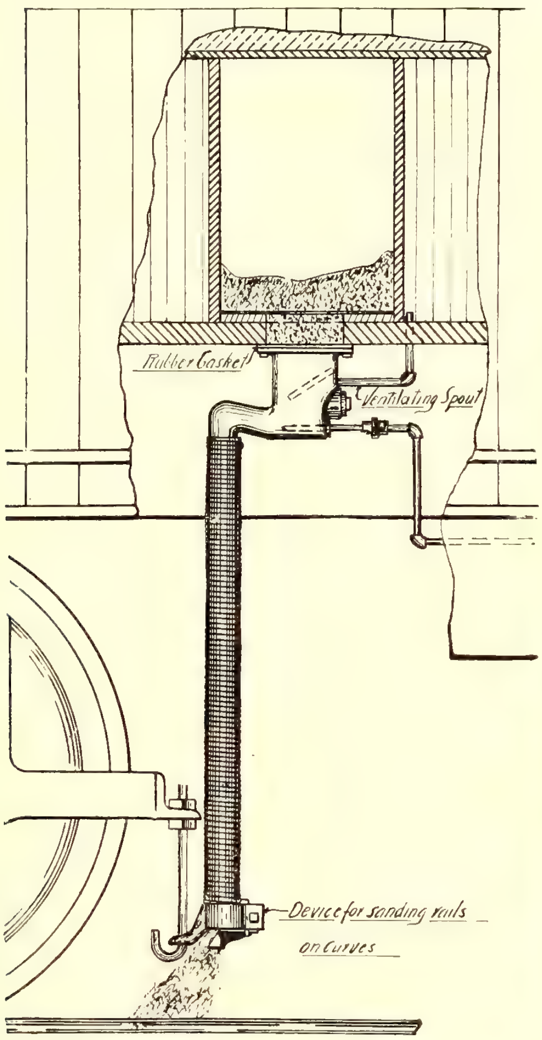
CONVERTIBLE CAR CLOSED

The cars are mounted on Brill "Eureka" maximum traction trucks, having solid forged side frames and a wheel base of 4 ft. The driving wheels are 33 ins. in diameter, and the pony wheels 22 ins.; the axles are 4 ins. The trucks are equipped with 38-hp motors. The sand-boxes, which are of the builder's make, have extra large hoppers, occupying all the available space under the corner seats. Among other specialties used on these cars are channel-iron radial draw-bars, "Dedenda" alarm gongs, angle-iron bumpers and folding gates.

PNEUMATIC RAIL SANDER

The accompanying cut shows some details of the Ham air sander, manufactured by the Ham Sand Box Company, of Troy, N. Y. This sander has been in use on many railways during the past two years, and is stated to be giving excellent service.

This sander possesses a number of special features, among these being the shelf for preventing sand from packing in the bottom of the box, the air space under the shelf and a vent pipe communicating with same for drawing off all moisture from condensation. The latter feature is a very desirable one, as moisture has been the cause of much trouble in sanders



PNEUMATIC RAIL SANDER

formerly used. The cut also shows this maker's special device for sanding rails on curves. This method is reported as having given satisfaction ever since its introduction two years ago.

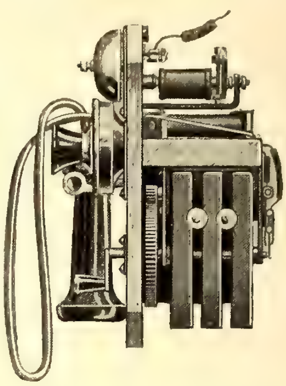
BOSTON & WORCESTER STREET RAILWAY COMPANY PLANNING FREIGHT LINES

The Boston & Worcester Street Railway Company is rapidly effecting plans so that freight may be carried over its lines under the privileges granted by the Commonwealth. The necessary rights to operate the express cars through the several towns have been granted by the authorities of Shrewsbury and Westboro, and arrangements have been been made for hearings in Southboro, Wellesley and Newton.

When the rights in the latter places are secured, the route will be completed for the entire run from Worcester to the tracks of the Boston Elevated Railway Company. The Boston & Worcester Street Railway Company hopes to do an immense business in bringing market garden produce into Boston.

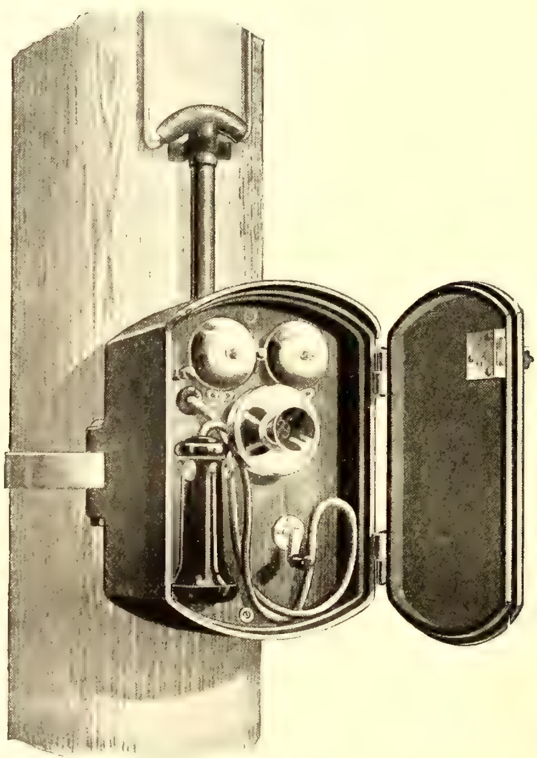
RAILWAY TELEPHONES

A new line of telephone apparatus especially adapted to meet the conditions existing on street railways and interurban lines, has been recently perfected and placed on the market by the Mayer & Englund Company, of Philadelphia. The accompanying illustrations represent two of the principal types of these telephones.

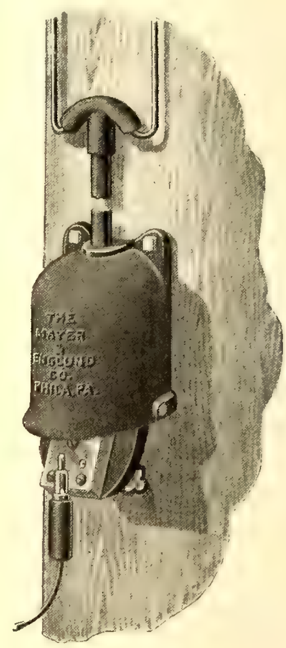


DETAILS ON BOARD

One illustration shows an iron box telephone to be attached to either iron or wood poles. The outer case is made of malleable iron with door equipped with a Yale lock, the whole apparatus being entirely weatherproof. All of the working parts of this telephone, including batteries for the local circuit, are attached to one back board, which is held in place in the iron box by two screws. This greatly facilitates the work of inspection and



POLE TELEPHONE



JACK BOX

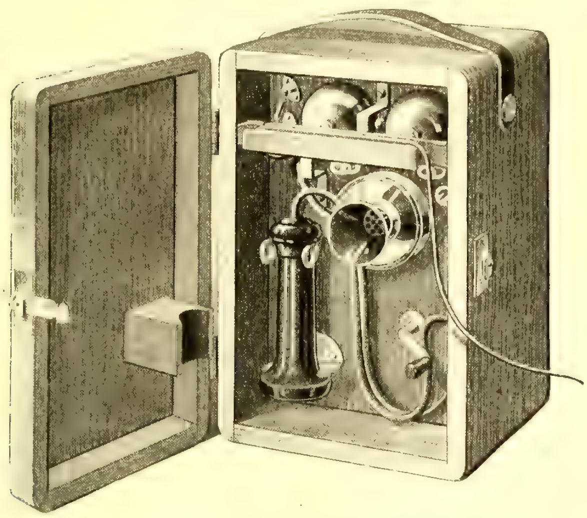
repairs, as by removal of the two screws the entire mechanism can be taken out, leaving the empty iron case on the pole. As all the inside parts of the telephone are interchangeable, the entire telephone system can easily be kept in good condition by having one or more extra sets of parts on hand mounted on the board.

Another illustration shows a portable car telephone. The inside arrangement of the details of this instrument, which are all mounted on one board, as well as the operating parts themselves, are precisely the same as in the pole telephone, the only difference being that this outfit is installed in an oak box with leather carrying strap.

This instrument is equipped with 10 ft. to 20 ft. of cord, at the end of which is attached a plug inserted in the specially designed jack box, shown in the accompanying cut. These jack boxes are made of malleable iron, are entirely weatherproof, and under all ordinary conditions are also tamper-proof. Jack boxes may be installed on poles along the line about every half mile, and communication had with the central office by plugging

in at these points. The length of the cord will allow the motorman to leave the instrument in the vestibule of the car, so that the instrument need not be exposed while in use, the vestibule being virtually a telephone booth.

All of these instruments are made with standard long-distance transmitters, bipolar receivers and full-size hooks, with ample contact surfaces. Although both of the instruments illustrated are compact, they do not contain any miniature



PORTABLE CAR TELEPHONE

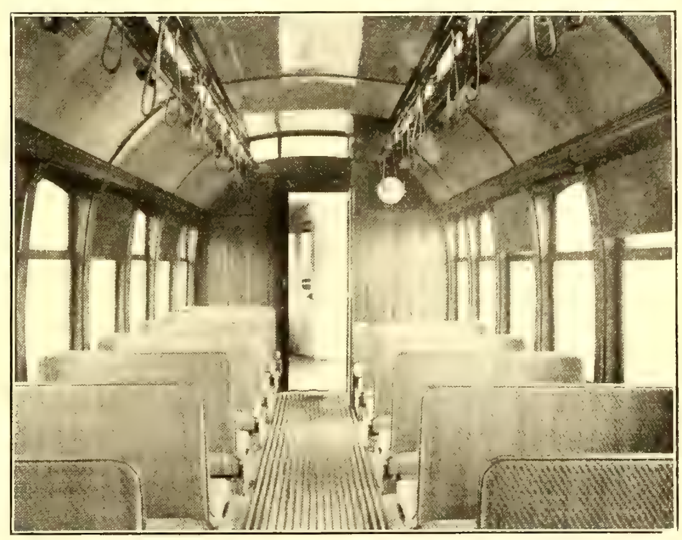
parts, everything being full standard size, and, therefore, conveniently and quickly renewed. The generators are ordinarily wound for 40,000 ohms, and the ringers for 1600 ohms.

The Mayer & Englund Company has already sold a large number of these instruments, which are said to be giving perfect satisfaction. The company announces in this connection that it will soon issue a complete descriptive catalogue of these telephones as well as standard wall and portable telephones.

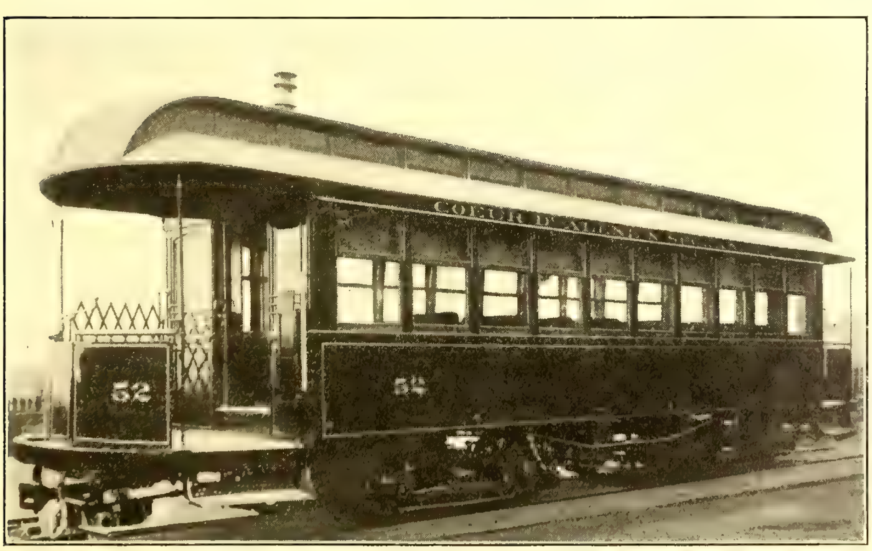
CARS FOR THE NEW COEUR D'ALENE-SPOKANE LINE

The Coeur D'Alene & Spokane Railway, which has recently been put in operation, is the second electric system in Idaho. It extends from Coeur D'Alene, which is situated on the lake of the same name, in the northern part of the State, to the city of Spokane, Wash., distant about 35 miles. The road traverses the valley of the Spokane River, which has its source in the Coeur D'Alene Lake. The richest mining district in the State is in the vicinity of Coeur D'Alene, and as Spokane is the nearest large commercial center the new road will undoubtedly do a flourishing business.

INTERIOR OF PASSENGER CAR ON COEUR D'ALENE & SPOKANE RAILWAY



INTERIOR OF COMBINATION PASSENGER AND BAGGAGE CAR ON COEUR D'ALENE & SPOKANE RAILWAY

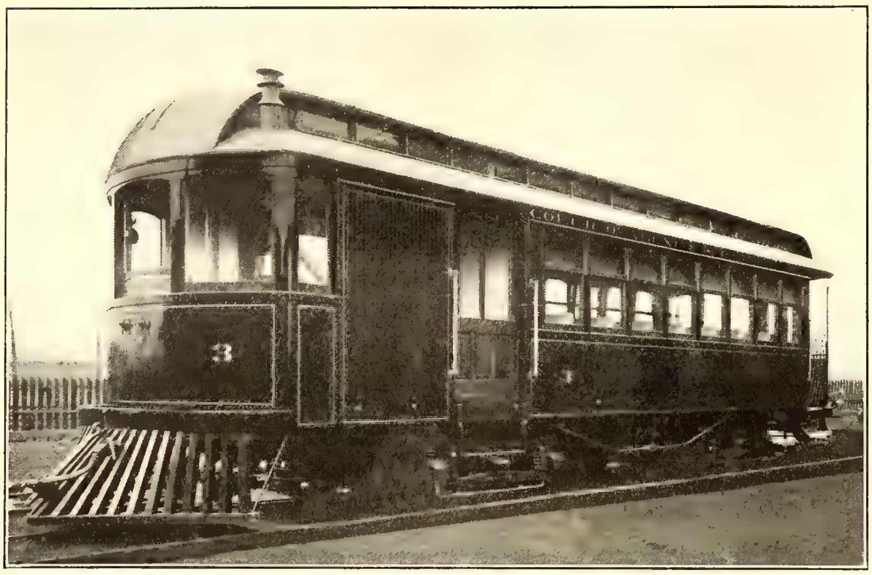


PASSENGER CAR FOR THE COEUR D'ALENE & SPOKANE RAILWAY

The American Car Company has delivered to the railway three semi-convertibles with 28-ft. bodies, three combination passenger and baggage semi-convertibles with 34-ft. 4-in. bodies, and two baggage and express cars with 40-ft. bodies. The cars are mounted on Brill 27-E-1 trucks, capable of a speed that will rival the steam road which parallels the line. The trucks have solid forged side frames, a wheel base of 6 ft., and 33-in. wheels.

The straight passenger semi-convertible cars are 38 ft. long over crown pieces, and from end panels over crown panels are 5 ft.; width of cars over sheathing, 8 ft. 4 ins.; the side sills are 4 ins. x 7¾ ins., and end sills, 5¼ ins. x 7¾ ins. Besides upper and under trusses, 12-in. x ⅜-in. sill plates are included. The interiors are finished in cherry with birch ceilings. The seats are upholstered in plush, are 36 ins. long, and the aisles 23½ ins. wide. These cars are seated for thirty-eight passengers. At one end there are twin doors, and at the other a single door, which is offset to give

ample space for the toilet room in the corner. Provision is made for passing from one car to another (when operated in trains, which is the intention) by removing panels from the centers of the dashers. Single steps are used, their height being 17⅞ ins. from the rail head, and 14 ins. from step to platform.



COMBINATION PASSENGER AND BAGGAGE CAR ON COEUR D'ALENE & SPOKANE RAILWAY

The combination passenger and baggage cars are 39 ft. 4 ins. over crown pieces, and are intended to run in one direction. They are equipped with cow-catchers of standard type. The baggage compartment at the forward end includes the motorman's cab. These cars are of the same width as the straight passenger cars, and their sills are of the same dimensions. The passenger compartment seats thirty passengers, and folding seats are placed against the sides of the baggage compartment for the use of smokers. The toilet room is located in the passenger compartment next the partition. These and the straight passenger cars are of the Brill patented semi-convertible type.

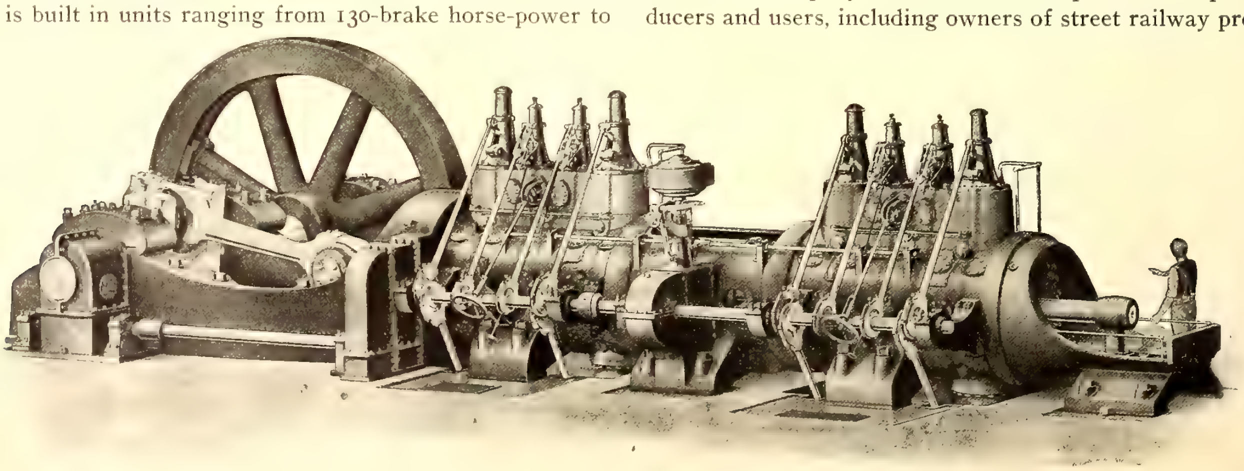
The baggage and express cars are very strongly constructed, as they are expected to carry heavy loads. The side sills are 5¼ ins. x 7⅞ ins., and are substantially trussed. The trucks are Brill No. 27-E-1, with 6-ft. 6-in. wheel base. Five-foot sliding bars are provided at either side, and 36-in. swinging trusses at diagonally opposite corners.

THE ALLIS-CHALMERS NURNBERG GAS ENGINE

The Allis-Chalmers Company has acquired sole rights for and is now building in the Edward P. Allis Works at Milwaukee, the Nurnberg gas engine illustrated herewith. This engine is built in units ranging from 130-brake horse-power to 6000-brake horse-power, to operate with all classes of gaseous fuel, and is adapted to all work that can be performed by a stationary steam engine, including the driving of alternating-current generators for light and power purposes. It is of the 4-cycle double-acting type. Like a modern steam engine, it will develop the same power with a cylinder of one-half the cubic contents required by the older type, while an equal number of Nurnberg cylinders will give to the crank shaft a double number of impulses. In its standard construction, with two cylinders placed in tandem and a single set of transmitting parts, the Nurnberg gas engine utilizes these parts to their full extent, instead of only 25 per cent, as is the case in the ordinary single cylinder, single-acting gas engine; and it accomplishes this without increasing the maximum stresses to which the moving parts are subjected. The valves are operated by means of eccentrics in place of noisy and short-lived old-time cams. The pistons are positively supported by outside crossheads running on cool slides, so that the cylinder walls are not called upon to bear any weight, and their efficient lubrication and permanent tightness are assured. The inlet and governing valves and their gearing are readily accessible and always in sight, while the exhaust valves are located at the lowest point of the cylinder, to ensure the expulsion of such solid matter as may be carried into the cylinder by the gas, or result from carbonization of the lubricant. The cylinder heads can be removed and replaced without the disconnection or deranging of any part of the valve gearing, and, likewise, the pistons may be withdrawn from their cylinders, examined and fitted with new rings, without disturbing any valve mechanism, or even the metallic packing of the piston rods. In a similar manner access to the inside of the cylinder and valve chambers is rendered easy and quick. All parts of one cylinder are interchangeable with any corresponding parts of all other cylinders of the engine. Regulation is attained by the use of an ordinary, high grade, fly-ball governor. The crank-shaft is journaled in bearings of special construction, giving firm support without undesirable rigidity.

Care has been exercised to allow all parts of the engine full freedom to expand and contract without endangering its perfect alignment. Extensive and carefully distributed water-cooling is provided for, and important moving parts are automatically lubricated under pressure by special oil pumps.

The Nurnberg gas engine has been thoroughly developed, perfected and proved by its original designers and builders in Germany, and its introduction into this country by the Allis-Chalmers Company is an event of importance to power producers and users, including owners of street railway properties.



THE NURNBERG GAS ENGINE

LEGAL DEPARTMENT

CONDUCTED BY WILBUR LARREMORE OF THE NEW YORK BAR.

DEFECTIVE TRANSFER TICKETS

In Indianapolis Street Ry. Co. vs. Wilson, decided by the Supreme Court of Indiana in March, 1903 (66 N. E., 950), it was held that where a passenger is aboard a street car without the proper transfer ticket, which is due to the mistake or fault of the conductor of the car from which he was transferred, and not to the fault of the passenger, the conductor in charge of the car must accept the reasonable explanations of the passenger in regard to the transfer in dispute.

It was further held, that under the facts disclosed in that case, an action for the forcible expulsion of the passenger from one of the defendant's cars would lie, as the conductor's action because of defects in the transfer ticket was unjustifiable. The Indiana court cites and analyzes a large number of authorities in the courts of the different States of the Union in support of its conclusion.

In Jacobs vs. the Third Ave R. R. Co., impleaded with the Dry Dock, East Broadway & Battery R. R. Co. (71 App. Div., 199), the Appellate Division of the New York Supreme Court, First Department, rendered a decision which is in accord with, and even tends to extend the scope of the conclusion reached by the Indiana Court. It was held that where two street railroad companies, for a valuable consideration, agree to accept transfer tickets issued by each other, the conductor of one of the companies, in issuing a transfer ticket entitling the holder to ride upon the cars of the other company, acts as the agent of the latter company. It was further held, that under such circumstances the status of a person riding upon a transfer ticket is the same as if he had paid a cash fare; and where, owing to a mistake of the conductor who issued the transfer ticket, in punching thereon the time it was issued (which mistake the passenger was unable to discover owing to his ignorance of the meaning of the numbers upon the transfer ticket), a conductor, employed by the second company, refuses to accept the ticket, ejects the holder from the car and causes his arrest and imprisonment, the latter company is liable in damages, notwithstanding that the conductor acted in good faith, without malice and with a desire to protect the property of the company. It was also decided that the company cannot shield itself from liability to the passenger under a rule adopted by it respecting the recognition of transfer tickets.

The discussion in the New York case turned entirely upon the possible division of responsibility, and, therefore, of liability, between two distinct but co-operating companies, and it was held that there was a sufficient common interest in the fares received, under the provisions of the traffic agreement, to render the company upon which a transfer pass had been issued liable for the illegal expulsion of a passenger in like manner as if it had been the original company.

In view of the reasoning of the Indiana Court, and the many authorities cited by it, and also in view of the New York decision, applying the principles in question even as to separate but co-operating companies, there seems little doubt that the doctrine of liability upon the issue of transfers must be generally accepted.

It is true that the New York Court of Appeals has recently held, in Monnier vs. N. Y. C. & H. R. R. R. Co. (175 N. Y., 281), that the fact that a railroad passenger, by reason of the absence of the ticket agent, is unable to procure a ticket before entering the train is no justification for his forcible resistance to an ejection therefrom, when, having refused to pay the additional fare required of passengers without tickets, by a rule of the company, made under express statutory authority, the conductor, without undue force, ejects him; and neither the company nor the conductor is liable for damages in an action for an assault and battery brought by the passenger. The court takes the ground that under such circumstances it is the duty of the passenger to pay the additional fare or submit to an ejection, and then resort to his remedy for the negligence or mistake of the ticket agent. This decision is by a bare majority of the New York Court, and rests upon peculiar considerations of public expediency and convenience. There are, however, decisions to the same effect in the courts of other States.

In Townsend vs. N. Y., C. & H. R. R. R. Co. (56 N. Y., 295) it was held that a regulation of a railroad company requiring passengers either to present evidence to the conductor of a right to a seat, when reasonably required so to do, or to pay fare, is reasonable, and for non-compliance therewith a passenger may lawfully be put off the train; that the wrongful taking of the passenger's ticket by the conductor of a previous train, in which the former has performed part of his journey, does not exonerate from compliance with this regulation; that for the wrongful act of the former conductor the company is liable, but that this does not justify the passenger in violating the company's lawful regulations upon another train. The recent decision of the Supreme Court of Maryland in W. M. R. Co. vs. Schaun (55 Atl., 701), is to the same substantial effect as Townsend vs. R. Co., though there are many cases the other way, and the weight of authority would seem to be against the New York and Maryland doctrine.

Undoubtedly, these decisions by the New York Court of Appeals, involving inability to procure a ticket at the ticket office and cases of defective tickets, are somewhat allied in principle to cases of defective passes issued by street railway companies. In the steam railroad cases cited it is conceded that an action for breach of contract will lie, but the right of the passenger to resist expulsion from the train and to sue for damages as for a wrongful expulsion, is denied. It is possible, though it can hardly be deemed probable, that a similar view will be taken by the New York Court of Appeals as to defective street car transfers if the question be taken to that tribunal. Meantime, the law of New York, as laid down by the Appellate Division of the Supreme Court, and the overwhelming weight of authority outside of New York, are that a passenger on a street car, without a proper transfer ticket, the defect of which is due to the fault of the conductor ot the car from which he was transferred, may resist ejection and sue for wrongful ejection.

The practical suggestion to street railroad companies is to accept such legal policy as authoritative, and to frame practical rules that shall, as far as possible, promote the detection of fraudulent or irregular attempts to use transfers, while discouraging ejections, if conductors have reasonable ground to believe that a passenger speaks the truth and that irregularity in a transfer presented is due to the fault of another employee.

LIABILITY FOR NEGLIGENCE

KANSAS.—Street Railroads—Accident at Crossing—Care Required—Contributory Negligence.

1. In an action for personal injuries, based on the negligence of a defendant, the burden of proof is on the latter to show contributory negligence on the part of the plaintiff, unless the evidence introduced by the plaintiff to sustain his case tends to show that his want of care contributed to the injury.

2. A traveler on a city street, who is about to cross the tracks of an electric street car company, must exercise his faculties of sight and hearing, and under special circumstances must use other careful and prudent means to ascertain whether a car is approaching.

3. The prevailing rule respecting the care required of a traveler over steam railway tracks applied to one crossing a street railway.

4. The reciprocal rights of the traveler and a street car company considered.—(Burns vs. Metropolitan St. Ry. Co., 71 Pacific Rep., 244.)

KANSAS.—Trial—Submission of Issues—Instructions.

1. The trial court should fairly, fully, and specifically state to the jury all issues of fact made by the pleadings and evidence. An issue made, however, by the pleadings, but not supported by the evidence, should not be submitted to the jury by instructions.

2. In an action to recover damages for personal injuries, the trial court should not particularize acts, and inform the jury that a nonperformance thereof by the plaintiff would defeat a recovery. It is better and more in harmony with our system of practice to instruct the jury generally in the law of negligence applicable to the facts. Held, however, that no error was committed in this case by the instruction given.—(Honick vs. Metropolitan St. Ry. Co., 71 Pacific Rep., 265.)

KANSAS.—Street Railways—Negligence—Injury to Person Driving in Street—Contributory Negligence—Instructions.

1. In an action for damages for injury occasioned by a collision between a street car and plaintiff's buggy while he was driving on or dangerously near the street car track, an instruction to the jury to the effect that the rights of the plaintiff as a traveler upon that portion of the street occupied by the railway track and the rights of the street car company were equal, should have been qualified so as to include the duty of the traveler to turn aside to permit an approaching car to pass.

2. In such an action, an instruction that, even if the jury should find from the evidence that the plaintiff was negligent in having his buggy on or near the track of the defendant, so that it was struck by a car, still plaintiff would be entitled to recover if they should further find that the injury was caused entirely by the negligence of the defendant in failing to provide a headlight sufficient to enable the motorman to discover an obstruction in time to stop the car and prevent injury, and that the injury to the plaintiff would not have happened, notwithstanding the negligence of plaintiff, if such headlight had been on the car, is self-contradictory, and therefore erroneous, in that it postulates negligence in the plaintiff proximately causative of and directly contributive to the collision and injury, in the presence of which no negligent act of the defendant could be a sole or entire cause.

3. The instruction mentioned in paragraph 2, above, was further erroneous in that it permitted the jury to disregard negligence on the part of the plaintiff proximately causative of and directly contributive to his injury. Such negligence is sufficient to defeat recovery.—(Metropolitan St. Ry. Co. vs. Rouch, 71 Pacific Rep., 257.)

KANSAS.—Appeal—Review—Street Railroads—Injury to Person on Track—Proximate Cause.

1. If a judgment entered on a general verdict finds support in the evidence upon any theory of the law embraced within the issues made by the pleadings, it will not be reversed because entirely unsupported by the testimony.

2. In an action against a street railway company for damages in wrongfully causing the death of one on a public street, not a trespasser, although the evidence may show the negligence of deceased in coming upon the track in a position of danger, in the first instance, contributed toward the collision, yet if there is evidence tending to show the motorman in control of the car which caused the death saw deceased in the position of danger, or, by the exercise of reasonable diligence should have seen him, in time to have stopped the car and avoided the death, the proximate cause of the death is one of fact for the jury.—(Metropolitan St. Ry. Co. vs. Arnold, 72 Pacific Rep., 857.

KENTUCKY.—Carriers—Injury to Passengers—Permanent Injuries—Evidence—Damages—Excessiveness.

1. Where a passenger on a street car, who was injured by the premature starting of the car while she was attempting to alight, testified that her ankle had never recovered its strength, and that she walked with difficulty, was unable to go up and down the steps as she had done before, and still suffered pain from the injury, the court was justified in submitting the question of permanent injury to the jury.

2. Where a passenger on a street car was injured by the premature starting of the car while she was attempting to alight, wrenching spraining her ankle, which had not recovered at the time of the trial, a verdict of $1,000 in her favor was not excessive.—(Louisville Ry. Co. vs. Casey, 71 S. W. Rep., 876.)

KENTUCKY.—Street Railroads—Injuries to Pedestrians—Crossing Tracks—Care Required.

1. In an action for injuries to a pedestrian on a street railway track, an instruction that it was plaintiff's duty, when she started to cross the street, to exercise ordinary care, and that if she failed to exercise such care, and by reason thereof helped to cause the injury, she could not recover, was not objectionable for failure to state that it was plaintiff's duty to look and listen for approaching cars before going on the track.—(Louisville Ry. C. vs. Poe, 72 S. W. Rep., 6.)

KENTUCKY.—Railroads—Expulsion of Passenger—False Imprisonment—Arrest of Passenger—Breach of Contract—Action—Complaint.

1. A complaint against a street railway company alleged that, by contract between the carrier and two certain towns, the carrier was bound to transport passengers from a certain city to either of such towns for one five-cent fare, and that, plaintiff having taken passage on a car of defendant's, the conductor refused to accept the five-cent fare offered for a continuous ride from the city to one of the towns. Held, that the allegation did not amount to a statement that defendant refused to carry plaintiff.

2. In an action against a railway company, the complaint alleged that defendant, by an agent, called the police to arrest plaintiff, and that the police illegally placed plaintiff under arrest, and wrongfully held him as a prisoner. Held, that, in the absence of an allegation that it was done maliciously and without probable cause, the complaint stated no cause of action for false imprisonment.

3. A complaint against a railway company alleged that, by contract between the carrier and two certain towns, the carrier was bound to transport passengers from a certain city to either of such towns for one five-cent fare, and that, plaintiff having taken passage on a car of defendants' the conductor refused to accept the five-cent fare offered for a continuous ride from the city to one of the towns, and that defendant, by an agent, called on the police to arrest plaintiff, and that they illegally placed plaintiff under arrest, and wrongfully held him as a prisoner. Held, that the complaint did not state a cause of action for false arrest and imprisonment.

4. If plaintiff intended to endeavor to recover for violation of contract, and also for illegal arrest, the complaint stated two separate and distinct causes of action.—(Dierig vs. South Covington & C. St. Ry. Co., 72 S. W. Rep., 355.)

KENTUCKY.—Carriers—Street Railroads—Injuries to Passengers—Operation of Car on Curve—Negligence—Evidence—Exclusion—Avowal—Review.

1. Plaintiff was thrown from the front platform of a crowded trolley car as it was rounding a curve, and partially fell across the gate, when his head was struck by an iron trolley pole. There was no proof that the car was operated negligently, or was running at an unusual rate of speed, and plaintiff's fall was the result, of the inevitable swing of the car as it responded to the curve in the track. Held, that such facts were insufficient to establish negligence of the railway company.

2. In an action for injuries to a passenger by being struck by a trolley pole near the track, error, if any, in sustaining an objection to measurements made by a witness subsequent to the accident, on the ground that it was not shown that the pole was in the same position as it was at the time of the accident, could not be reviewed, in the absence of an avowal of the answer expected from the witness.—(Moser vs. South Covington & C. St. Ry. Co., 74 S. W. Rep., 1090.)

KENTUCKY. — Street Railways — Negligence — Passenger Alighting from Car—Care Required.

1. In an action against a street railway for injuries owing to the starting of a car while plaintiff was alighting therefrom, the court instructed that, if plaintiff was injured because of the starting of the car before she could leave it in safety by the exercise of ordinary care, the law was for the plaintiff, and the jury should so find. Held, that the instruction was not erroneous on the ground that the court should have defined the degree of care which the law imposed on the carrier.—(Henning vs. Louisville Ry. Co., 74 S. W. Rep., 209.)

KENTUCKY.—Street Railroads—Injury to Trespasser—Negligence of Motorman—Discovery of Peril—Contributory Negligence—Granting of New Trial—Discretion of Court.

1. The Court of Appeals is slow to disturb the action of the circuit court in granting or refusing new trials where the grounds are in the discretion of the court; especially so where it grants a new trial.

2. If an injury to a trespasser was caused by the negligence of the motorman in failing to exercise ordinary care to know of his presence on the track and of his danger, the company was liable, unless the motorman did not discover his presence in time to have avoided injuring him, and he, by his own negligence, so contributed to case his injury that, but for such negligence, it would not have happened.

3. If the motorman discovered plaintiff's danger in time to have prevented the injury, but failed to exercise such care as was necessary and at his command, the company was liable without regard to his contributory negligence.—(Floyd vs. Paducah Ry. & Light Co., 73 S. W. Rep., 1122.)

KENTUCKY.—Street Railways—Personal Injuries—Drawing Jury—New Trial—Grounds—Qualifications of Jurors—Conflict of Evidence.

1. Ky. St. 1899, section 2265, reads: "The clerk shall write the names of the jurors entered of record on separate slips of paper, as near the same size and appearance as may be, and when a jury is wanted the same shall be drawn from a box after the papers shall have been deposited therein and well mixed. The clerk shall provide and keep for that purpose a suitable box with a sliding lid." An affidavit made by the deputy clerk who selected the jurors recited "that he wrote the names of the jurors entered of record on separate slips of paper of as near the same size and appearance as may be, and that the same were placed in the drawer and well mixed; that for the purpose of the trial he drew from the drawer the names of eighteen of the jurors as required

by law; that this method was uniformly used in drawing jurors in the court; that the drawer was exclusively used and suitable for this purpose." Held, to show substantial compliance with the statute, and that plaintiff was not prejudiced.

2. In an action for personal injuries against a street railway, one of defendant's attorneys asked one of plaintiff's witnesses, a physician, as to the extent of plaintiff's injuries, and as to the fee which had been paid him for his services. Held, not improper, or ground for a new trial.

3. The fact that the physician did not testify as strongly for plaintiff as the latter's attorneys had been led to believe was not ground for a new trial.

4. In an action against a street railway it appeared that the daughter of one of the jurors married the half-nephew of the president of defendant company, but that he died several years before the trial. Held, that the juror was not disqualified.

5. The fact that one of the jurors was in the employ of an express company, and that some of the attorneys employed by the defendant were also attorneys for the express company, was not ground for a challenge.

6. In an action against a street railway for personal injuries, where plaintiff testified that he was attempting to alight from a car it suddenly started forward throwing him to the ground, and there was testimony partially corroborating him, and defendant's witnesses testified that the conductor of the car assisted plaintiff to alight, and that after he had alighted he staggered and fell, and there was other testimony that he used morphine and whiskey, etc., it was the province of the jury to determine which theory as to how the accident occurred was true.—(Miller vs. South Covington & C. St. Ry. Co., 74 S. W. Rep., 747.)

LOUISIANA.—Street Railroads—Collision with Wagon—Petition.

1. A personal injury suit, in which an exception of no cause of action was sustained in the district court. The judgment is reversed as erroneous, and the cause remanded for trial on the merits.—(Welty vs. St. Charles St. Ry. Co., 33 Southern Rep., 730.)

LOUISIANA.—Res Judicata—Several Defendants—Liabilities Inter Se.

1. Where, in an action against four railroad companies for violation of a contract of carriage, plaintiff has obtained a judgment in solido against the four defendants, this judgment, though res judicata between plaintiff and the defendants, does not conclude the latter as to matters between themselves, where they have severed in their defense and their prayer is purely defensive, asking that plaintiff's demand be rejected. If three of the defendants, having paid the judgment, seek contribution from the fourth, the latter has the right to a judgment in its favor, on showing that the violation of the contract was due entirely to their fault.

2. Where a judgment has been rendered against four defendants in solido, who are equally at fault, they are liable inter se according to their interest in the subject-matter of the contract. Civ. Codé, art. 2106.—(Smith Bros. & Co., Limited vs. New Orleans & N. E. Ry. Co. et al., 33 Southern Rep., 769.)

LOUISIANA.—Street Railroad—Injury to Traveler—Contributory Negligence.

1. The danger resulting from emerging rapidly from a cross-street and attempting to traverse a double-track railway immediately behind a passing car, without pausing to consider that it may mask a car moving in the opposite direction upon the further track, is understood by those who are at all accustomed to street car travel, and is a danger from which, in the main, the individual wayfarer must be his own protector, since in such case, he appears so suddenly, and affords so little notice of his coming, that the efforts of the motorman to avoid the collision are likely to be of little avail.

2. In the instant case, an intelligent boy, in his thirteenth year, employed as a newspaper carrier, and making his rounds on horseback, rode at a brisk pace out of a cross-street into an avenue upon which there is a double-track electric railway, and, without stopping, traversed the near track, immediately behind a moving car, and then, still without stopping or looking around, attempted to traverse the far track a few feet in front of a car heavily loaded and rapidly moving in the opposite direction from the first. It does not appear that the motorman was negligent in failing to see the boy or divine his purpose, or in attempting to stop the car, and no damages can be recovered for injuries to the boy resulting from the collision which followed.—(Schutt et al. vs. Shreeveport Belt Ry. Co. et al., 33 Southern Rep., 577.)

LOUISIANA.—Intervention—Injunction—Bond.

1. A plaintiff in intervention, who unites with the defendant in resisting the demand of the plaintiff in the suit, does not thereby become a defendant in the suit, nor can that status be conferred upon him by the court, since a person bringing in his individual capacity has the right to determine for himself whom he will sue, and cannot be compelled to sue another against his will.

2. An order authorizing the filing of an intervention, and designating the intervener as a defendant, followed by a judgment on a rule nisi, directing a writ of injunction to issue upon the plaintiff's furnishing bond in favor of the original defendant and of the intervener, is unauthorized in so far as it requires a bond in favor of the intervener, and the latter has no right of action on the bond so given.—(St. Charles St. Ry. Co. vs. Fidelity & Deposit Co. of Maryland,Ltd., et al, 33 Southern Rep., 574.)

LOUISIANA.—Injury to Servant—Contributory Negligence—Electric Wires—Care of Master—Inspection.

1. It is not of itself contributory negligence to engage in a dangerous occupation.

2. Where a person is employed in the presence of a known danger, to constitute contributory negligence it must be shown that he voluntarily and unnecessarily exposed himself to the danger.

3. A company maintaining electrical wires, over which a high voltage of electricity is conveyed, rendering them highly dangerous, is under the duty of using the necessary care and prudence at places where others may have the right to go, to prevent injury. It must see to it that its wires are perfectly insulated, and kept so, or else it must provide adequate guard wires or other sufficient safety appliances, as means of protection against the dangerous wires.

4. The fact that frequent inspections of the line were made to ascertain the condition of the wires and remedy defective insulation, does not relieve the company of liability. If the span wire had become dangerously charged with the electrical current, the company's inspection should have been thorough enough to have detected it. It is the company's business to know the dangerous defects in or along its lines, and, knowing, to safeguard the same.—(Potts vs. Shreveport Belt Ry. Co., 34 Southern Rep., 104.)

LOUISIANA.—Carriers—Injury to Passenger—Defective Station—Liabilities.

1. Parties embarking on or alighting from railway trains upon the invitation, express or implied, of its officials, are justified in acting upon the assumption that the officials have taken proper precautions to insure their safety.

2. Where an accident happens to a passenger by the breaking of one of the railway company's appliances, the burden is upon it to show affirmatively a condition of things which would exonerate it from liability. A railroad company is bound to know of the effect of time and weather upon its appliances. It should, by proper inspection, and timely changes and renewals, keep them safe.

3. Even should a railway company be under no direct obligation to repair or keep in good condition the bridges or streets along its line of way, it should avoid stopping its cars at places where it is not safe for passengers to embark or alight. It should either stop its cars short, or pass them beyond the danger points.

4. A railway company which uses as a station for embarking or disembarking its passengers a pavilion constructed upon a street, is liable to a passenger for injuries received from the breaking of a rotten plank in the steps leading to the cars, whether the station was constructed by it or not. It is liable as a licensee.—(Leverett et al. vs. Shreveport Belt Ry. Co., 34 Southern Rep., 579.)

LOUISIANA.—Street Railroads—Injury to Pedestrian—Proximate Cause—Negligence.

1. Action sounding in damages for personal injuries incurred. Facts and circumstances make out a case of contributory negligence barring plaintiff's recovery.

On Rehearing.

2. Finding himself between two street cars upon a crossing, plaintiff held his ground. A curve in the car tracks began where he stood. On entering the curve, the car in front of him developed a lateral motion, and squeezed him against the other car. Although he had lived in New Orleans all his life, and presumably was as familiar as anybody with this crossing, he did not know of this lateral movement, and did not guard against it, which he could easily have done, and had ample opportunity to do, as the cars at one moment were stationary, the one taking on passengers and the other letting a wagon go by. Under these circumstances, held, that this unexpected lateral movement of the car and the act of plaintiff in remaining between the cars were the proximate causes of the accident.

3. The car behind plaintiff would have passed on, and would not have been there to act as a wall for plaintiff to be pressed against, if it had not made an emergency stop to avoid striking plaintiff, who had negligently passed too close ahead of it. Held, this negligence of plaintiff in passing too close ahead of this car was not a proximate cause of the accident, it being disconnected

judicially from the accident by the deliberate act of the plaintiff himself in choosing to remain between the cars and the deliberate act of the car company in so running its cars upon the crossing as to create a danger by which pedestrians upon the crossing might be overtaken unawares.

4. The act of the car company in creating upon one of the most frequented crossings of the city of New Orleans an insidious danger, when it could have avoided doing so by not permitting the cars to pass each other upon the crossing, is held to constitute actionable negligence.—(Schwartz vs. New Orleans & C. Ry. Co., 34 Southern Rep., 667.)

LOUISIANA.—Street Railways—Injury to Person on Track—Negligence—Evidence.

1. It is negligence, on the part of an electric railway company whose line traverses a city, to have one of its cars in the charge of a young man only eighteen years old, whose experience in the handling of an electric car dates only twenty days back.

2. For the shortcomings of such a motorman, in a case where the death of a human being has ensued, the car company will be held to the strictest accountability; and doubt as to whether the life of the deceased might not have been spared had the car been in the hands of a more experienced and more competent motorman will be construed against the car company.

3. The situation having been that the street was one thoroughfare, with continuous pavement from curb to curb, the car track being in the center, the rails laid flush with the surface, and nothing setting them off from the rest of the street, and that as the car ran the deceased was riding on horseback somewhat ahead of the car, close enough to the track for his proximity to challenge attention (not so close, however, as to be within the line of danger), and that the car was gaining upon him, and that the street was somewhat crowded—held, first, it was not negligence under the circumstances not to have ckecked the speed of the car before the actual emergency had arisen; secondly, it was incumbent on the motorman, under the circumstances, to prepare for emergencies by turning off his current and winding the slack out of his brake, and the failure to do the latter was negligence.

4. From the fact that the car was not stopped within the space within which it was possible to stop it, there arises an inference that the motorman was not as prompt or as energetic as it was possible for a motorman to be, and this inference overcomes the statement of witnesses that the motorman did all that was possible to stop the car.—(Crisman et al. vs, Shreveport Belt Ry. Co. et al., 34 Southern Rep., 718.)

LOUISIANA.—Carriers—Injury to Passenger—Punitive Damages.

1. Plaintiff sues for damages for personal injuries sustained whilst a passenger in a street car, which, through the negligence of its servants, was collided with by a car belonging to the defendant. The plaintiff and the medical experts sworn on his behalf testify that the injuries so received have resulted in partial paralysis. Upon the other hand, medical experts called on behalf of the defendant, whilst conceding that the plaintiff is not responsible for his condition, and also conceding the possibility that such a condition may have resulted from the causes to which the plaintiff attributes it, propound the theory that he is suffering from "railway spine"; that is, that he is the victim of his imagination, and believes that he is paralyzed, whereas he is, in fact, affected by no physical ailment. As it does not appear that he is any more likely to get well in the one case than in the other, and as, in neither case, is he responsible for his condition, it is not clear that it would make any difference, for the purposes of the present claim, whether he is really paralyzed or is merely laboring under a fixed belief to that effect. Considering the whole evidence, however, the conclusion is reached that the defendant's theory is not sustained.

2. The actual wrongdoers, i. e., those in charge of the colliding car, having been prosecuted criminally, and, no doubt, punished if they deserved it, there is no sufficient reason for awarding punitory damages against the defendant, who is only consequentially liable, as the principal is liable for the acts of his agent.—(Patterson vs. New Orleans & C. Ry. Light & Power Co. et al., 34 Southern Rep., 782.)

MARYLAND.—Electric Railway—Tracks in Open Country—Crossings—Negligence—Contributory Negligence—Evidence—Sufficiency.

1. Though an electric railway is negligent in running a car at a higher rate of speed than allowable, and in failing to give signals, its negligence does not excuse that of one who, seeing a car approaching, drives across the track without again looking, relying on his own estimate that he can make the crossing in safety.

2. One about to cross the tracks of an electric railway in the nighttime, and in the open country, saw a car rapidly approaching from one-half to two or three blocks distant, and drove across the track without again looking. His vehicle was struck by the car, and he was killed. There was, at the time he looked, a signal at the nearest crossing, which, if obeyed by the operators of the car, would have required it to stop there, but there was no evidence that deceased saw the light, or knew what it meant. Held, that he was guilty of contributory negligence.—(State, to Use of Meidling et al. vs. United Rys. & Electric Co. of Baltimore, 54 Atlantic Rep., 612.)

MARYLAND.—Street Railways—Transfers—Time Limit—Passenger—Refusal to Pay Fare—Expulsion.

1. Acts 1900, p. 463, c. 313, requiring the street car company of Baltimore City to give, on request, each passenger paying a cash fare a transfer for a "continuous" ride, does not prohibit the company from limiting the time within which a transfer can be used.

2. When the time limit of a transfer issued by a street railway has expired, the transfer is void on its face, and a conductor is justified in refusing to honor it and demanding a fare.

3. When a conductor of a street railway has given a passenger a reasonable time and opportunity to pay his fare, and the passenger has refused, and the conductor has commenced the process of ejecting the passenger, the ejection may be completed, even though a fare be tendered, as the passenger has forfeited his rights as such.—(Garrison vs. United Railways & Electric Co. of Baltimore, 55 Atlantic Rep.)

MARYLAND.—Street Railroads—Injuries to Passenger—Negligence—Warning to Passengers—Construction—Contributory Negligence—Duty of Conductor.

1. Testimony of plaintiff which showed that she was a passenger on defendant's street car and had received from the conductor a transfer to another line, that the conductor notified the passengers to change for that line, that the car stopped, and, while she attempted to alight, started and threw her to the ground, established a prima facie case of negligence on defendant's part.

2. A notice posted in a street car, which states that "cars stop to take on and let off passengers at near side of cross streets," and that those violating the notice do so at their own risk, not meaning that cars will stop only at such places, does not preclude a passenger getting on or off at any other place from recovering for injuries sustained by reason of the company's negligence.

3. A passenger on a street car had received a transfer to another line. As the car approached the transfer point the conductor called out the place, and directed the passengers to transfer to that line. The car came to a stop, and the passenger attempted to alight, but, while so doing, the car started and threw her to the ground. The car stopped because of a wagon in front of it, and when the wagon moved the car started up. The passenger received no notice to delay the transfer. The rear of the car, when it stopped, was from 50 ft. to 100 ft. from the street crossing where it usually stopped. Held, that the passenger was not guilty of contributory negligence, as a matter of law, in attempting to alight.

4. Where, after a conductor of a street car had given directions to transfer to another line, the car stopped, but not for the purpose of enabling the passengers desiring to transfer to alight, it was the duty of the conductor to warn the passengers to keep their seats till he should give further directions.—(United Rys. & Electric Co. of Baltimore vs. Woodbridge, 55 Atlantic Rep., 444.)

MARYLAND.—Carriers—Personal Injuries—Passenger Alighting from Street Car—Evidence.

1. Alleged error in excluding a written instrument cannot be reviewed where the writing is not incorporated in the record.

2. In an action against a street car company for personal injuries from the starting of a car as plaintiff was getting off, in which defendant claimed that plaintiff attempted to get off the car before it reached its regular stopping place at a corner, evidence of a regulation of defendant company requiring motormen to stop at a certain schoolhouse located near the corner, at which plaintiff desired to get off, was not admissible to show a reason for stopping before reaching the corner, it not appearing that plaintiff was aware of the regulation or of any custom to stop at that place.

3. A notice on a street car that "no one is permitted to get off or on when the car is in motion," and that "cars stop to take on and let off passengers at near sides of cross streets," is not sufficient to constitute a notice that the car stopped only at near sides of cross streets so as to render it negligent per se for a passenger to attempt to get off elsewhere.

4. Where a passenger on a street car signaled the conductor to stop, and the car stopped not further than 50 ft. from a crossing at which the passenger desired to alight, it was negligent to start the car while the passenger was in the act of alighting.—(United Railways & Electric Co. of Baltimore City vs. Hertel, 55 Atlantic Rep., 428.)

MARYLAND.—Assignments for Creditors—Construction—Record—Filing Bond.

1. An assignment of a claim for personal injuries to the assignor's attorney, in trust, in case a recovery was had, to pay himself one-half of the amount recovered, to pay a physician's bill for services, and, if sufficient remained, to pay the balance to such persons as the assignor should direct, was not an assignment for the payment of the assignor's debts generally, within Code Pub. Gen. Laws, art. 16, section 205, requiring every trustee for the benefit of creditors to file with the clerk of the court in which the instrument creating the trust is to be recorded a bond, etc., and providing that no title shall pass to the trustee until such bond is filed; and hence such assignment was valid, in the absence of fraud, without record or the filing of a bond by the trustee.—(United Rys. & Electric Co. vs. Rowe et al., 55 Atlantic Rep., 703.)

MASSACHUSETTS.—Street Railroads—Injury to Passengers Standing on Front Platform—Assumption of Risk.

1. Plaintiff boarded the front platform of a crowded street car, on which six or seven other passenges were standing, and was injured by being thrown from the platform by a sharp jerk of the car as it rounded a curve. There was a sign on the car, of which plaintiff was aware, that "Passengers riding on the front platform do so at their own risk." Held, that such rule was reasonable, and precluded a recovery for plaintiff's injuries.

2. It was not negligence for a street car company to take plaintiff on as a passenger, because the car was crowded.

3. The fact that there were passengers on the platform of a street car when plaintiff entered thereon did not show that the rule that passengers riding there assumed the risk of any injury had been waived by the street car company or was not in force.—(Burns vs. Boston El. Ry. Co., 66 N. E. Rep., 418.)

MASSACHUSETTS.—Carriers—Elevated Railroad—Injuries to Passengers—Falling Objects—Res Ipsa Loquitur.

1. Where a passenger was injured by sawdust blowing in her eye from an elevated railroad structure adjoining defendant's depot, and plaintiff testified that she did not know whether the sawdust was thrown or blew down, it being proved that there was a wind blowing at the time from 14 miles to 22 miles per hour, plaintiff was not entitled to recover under the doctrine of res ipsa loquitur.

2. The mere presence of sawdust and shavings and a piece of wood on an elevated railroad structure, by the falling of which a person is injured, is not of itself evidence of negligence.—(Wadsworth vs. Boston El. Ry. Co., 66 N. E. Rep., 421.)

MASSACHUSETTS.—Carriers—Injuries to Passengers—Gross Negligence—Evidence.

1. Plaintiff's intestate boarded an open street car, and took a seat at the extreme left end. There were other unoccupied seats in the car. The conductor approached deceased for his fare, when he arose, put his hand in his trousers pocket, and, while doing so, leaned to the left and backwards, and fell from the car, receiving a fatal injury. The car was running at a speed of about 16 miles per hour, but there was no evidence of any jolt or jar. Held, that the speed at which the car was running, and the failure of the conductor to tell the deceased to sit down, or to warn him of the danger of standing so near the edge of the car, was not such gross negligence as would entitle plaintiff to recover for decedent's death.—(Witherington vs. Lynn & B. R. Co., 66 N. E. Rep., 206.)

MASSACHUSETTS.—Carriers—Elevated Railways—Injuries to Passenger—Negligence.

1. For the rapid handling of the throngs of passengers on an elevated road, the cars were so arranged that the side doors for the exit of the passengers were opened by guards on the platforms at the stations. A passenger who had his hand on one of the doors was injured by the guard's opening it before the train came to a full stop. The guard had no knowledge of the position of the passenger's hand, and the train was so nearly stopped that the opening of the door was the occasion of no danger. Held, that the guard was not guilty of negligence.—(Hannon vs. Boston Elevated Ry. Co., 65 N. E. Rep., 809.)

MASSACHUSETTS.—Street Car Passenger—Injuries While Alighting from Car—Negligence—Evidence.

1. Plaintiff was injured while alighting from a street car by reason of the slippery condition of the steps. The accident occurred during a storm of snow and sleet. The route of the car was about five minutes each way. Before the car started on its trip during which the accident occurred, it had waited at least fifteen minutes. By the rules of the company, it was the duty of the conductor, in case of a storm, to sprinkle sand on the platform and steps. The conductor testified that there was a sand pail at each end of the car. Held, to warrant a finding that defendant had undertaken to prevent, and could have prevented, the steps from being slippery.

2. This evidence, with the testimony of the conductor that about half an hour before the accident he had put a quart of sand on the step while the car was waiting, and the testimony of plaintiff's witnesses that there was no sand on the step when the accident happened, and that there was no sand pail on the platform, was sufficient to warrant the jury in finding that defendant was negligent.

3. Plaintiff testified that she knew that she had to look out for herself, because it was slippery, and so held the handle of the car dasher. Held, that the jury were warranted in finding that she knew that the step was slippery, and exercised due care in view of that knowledge.—(Foster vs. Old Colony St. Ry. Co., 65 N. E. Rep., 795.)

MASSACHUSETTS.—Street Railways—Death by Wrongful Act—Due Care of Deceased—Burden of Proof—Evidence—Sufficiency.

1. In an action against a street railway company for negligent death, the burden of proof was upon plaintiff, administrator, to show that deceased was in the exercise of due diligence when he was killed.

2. In an action against a street railway company for negligent death, where there was no evidence as to what deceased did for several minutes intervening between the time when he was seen walking along the north side of the street and the time when he was seen lying face downward across the track immediately in front of the car and on the south side of the street, whether he tried to pass before an approaching car and fell or stood too near the car, or was seized with vertigo, there was not sufficient proof that deceased was in the exercise of due care to justify a recovery.—(Cox vs. South Shore & B. St. Ry. Co., 65 N. E. Rep., 824.)

MASSACHUSETTS. — Witnesses — Cross-Examination — Admission of Evidence—Exceptions.

1. Whether questions asked on cross-examination in respect to points irrelevant to the matter in issue should be answered or excluded rests wholly within the discretion of the trial judge, and his rulings thereon are not subject to exception.

2. Under Superior Court rule 48, providing that all requests for instructions shall be made in writing before the closing arguments unless special leave is given to present further requests later, a request for a ruling is too late when it is not called to the attention of the court until after the instructions have been given.

3. On the cross-examination of a surgeon who had testified as to his conclusion in regard to the disease plaintiff was suffering from, the trial court properly excluded a question as to whether other surgeons might not arrive at a different conclusion.

4. After a medical witness for defendant in an action for negligent injuries had been requested to state how far he required a patient to disclose the history and symptoms of a disease, he was further asked whether he disclosed the information thus obtained to other persons, to which he replied that it depended on the individual, and the purpose for which the information was desired. Held, that as the question was within the limits of a reasonable cross-examination, and defendant's case was not prejudiced by the answer, the court properly permitted the question.

5. It cannot be said, as a matter of law, that, if a party to an action has testified falsely to a material question, the presumption is that all her testimony is false.—(Root vs. Boston Elevated Ry. Co., 67 N. E. Rep., 365.)

MASSACHUSETTS.—Electric Railroads—Injuries to Pedestrians—Contributory Negligence—Failure to Look.

1. Where plaintiff, before leaving a pathway and going onto a bridge, if he had looked could not have failed to have seen that the motorman in charge of an electric car was about to start the car and run the same over the bridge, and that the car would take up all the room between the sides of the bridge, but he failed to look, and proceeded onto the bridge, and was struck, he was guilty of contributory negligence.—(Judge vs. Elkins et al., 66 N. E. Rep., 708.)

MASSACHUSETTS.—Carriers—Injuries to Passengers—Negligence—Sufficiency of Evidence.

1. In an action against a street railway company for injuries to a passenger, evidence showing that plaintiff, who was standing near the edge of the rear platform without holding onto anything, was pitched off by a sudden jerk in the car, caused by a sudden stop, without showing that there was any defect in the car or rails, or that the apparently sudden stop was not justifiable, fails to show any negligence on the part of defendant.—(Timms vs. Old Colony St. Ry., 66 N. E. Rep., 797.)

MASSACHUSETTS.—Street Railways—Personal Injuries—Collision with Vehicle on Track.

1. In an action against a street railway company for injuries caused by a collision with plaintiff's vehicle, in which it was alleged that the brake of the car was defective, an instruction that, even if the brake was not working properly, yet if the plaintiff crossed the track so near the car that if it had been in the best possible condition it could not have been stopped, then the

plaintiff was not entitled to recover, was properly refused, because separately stating but one fact bearing upon defendant's negligence.

2. The instruction was incorrect, since the car might have been proceeding at a speed so rapid that, even if the brake had been in good condition, the car could not have been stopped in time to prevent a collision, in which case the excessive speed might have been negligence.

3. The instruction was not sufficient as a statement of the principle that a defect in the brake should not be considered unless such defect contributed to the injury.—(Silva vs. Boston Elevated Ry. Co., 66 N. E. Rep., 808.)

MASSACHUSETTS.—Carriers—Electric Cars—Injuries to Passenger—Burning of Fuse—Negligence—Evidence—Res Ipsa Loquitur—Waiver.

1. The ordinary burning out of a fuse used to prevent an excessive amount of electricity to enter the motors of electric street cars is not prima facie evidence of negligence in an action for injuries to a passenger alleged to have been caused thereby.

2. In an action for injuries to a passenger on an electric street car by fire alleged to have been caused by the burning out of a fuse, the expert evidence on both sides showed that the report, flash, and vapor-like puff attendant on the burning out of a fuse in proper condition was instantaneous and harmless. Other evidence established that the fuse on the car in question was located directly under plaintiff's seat, and that the burning thereof was attended with a flame lasting a few seconds, which partly enveloped plaintiff, and burned her face and clothing; while other witnesses testied that they noticed only the smoke, and no flame. Held, that a verdict finding that the flame was not the instantaneous and harmless flame which results from the ordinary burning out of a fuse in proper condition; that the fuse was therefore defective, and that the company was guilty of negligence in placing the fuse where it was, was not contrary to the evidence.

3. Where, in an action for injuries to a passenger on a street car from the burning out of a fuse, there was evidence which would have warranted the conclusion that the duration and intensity of the flame produced by the explosion was greatly in excess of that which would have been the result if the fuse had been in proper condition, and that the improper condition of the fuse could have been discovered by the use of reasonable care, an instruction that the doctrine of res ipsa loquitur did not apply was properly refused, since how far negligence could be inferred from the accident itself under such circumstances was for the jury.

4. In an action for injuries to a passenger on an electric car by the burning out of a fuse, plaintiff's unsuccessful attempt to prove by direct evidence the precise cause of the burning out of the fuse did not estop her from relying on the doctrine of res ipsa loquitur. —(Cassady vs. Old Colony St. Ry. Co., 68 N. E. Rep., 10.)

MICHIGAN.—Negligence — Street Car Company—Passenger Alighting—Starting Car—Evidence—Findings.

1. Where the only question in dispute was as to whether or not a street car was in motion when a passenger attempted to alight, and plaintiff's testimony that the car stopped and as she was stepping off it started was corroborated by other evidence, while the conductor and six passengers testified that the car was in rapid motion when she attempted to get off, and finding that the car had stopped, and started as plaintiff was getting off, was not against the clear weight of the evidence.

2. Where plaintiff in an action against a street car company testified that as she was holding the hand rail of the car with her left hand, with her foot out to step on the ground, she heard the bell ring, became insensible, and when she regained consciousness found her left arm pulled out of its socket, the jury were warranted in inferring that the car started as she was alighting.—(Bartle vs. Houghton County St. Ry. Co., 93 N. W. Rep., 620.)

MICHIGAN.—Master and Servant—Servant's Injuries—Fellow Servant—Assumption of Risk.

1. An employee of an electric railway company, who was injured while returning from work on one of its cars, which was running on time, at the ordinary rate of speed, and within orders, by the wrecking of the car on a switch thrown open by one not in the company's employ, was not precluded from recovery by the fact that the car was in charge of a fellow servant, where the negligence alleged and proved, if any, was not that of such fellow servant.

2. An employee of an electric railway company, who was furnished with transportation on the company's cars in going to and returning from work, did not assume the risk of defective appliances in connection with the track over which he rode, as his work was performed at a distance therefrom, and he had no duty calling his attention thereto.—(Noe vs. Rapid Ry. Co., 94 N. W. Rep., 743.)

MICHIGAN.—Master and Servant—Street Railroads—Injuries to Motorman—Negligence—Collision—Proximate Cause—Rules—Establishment—Caution Against Accidents—Signal Lights — Telephones—Acts of Conductor—Incompetency—Knowledge of Master.

1. Where plaintiff, a street railway motorman, was injured by a collision with a car which was being backed on the same track on which his car was being operated, for the purpose of obtaining relief for a car which had been derailed by reason of a defect in the track some distance ahead, the defect in the track was not the proximate cause of the injury.

2. Where a street railway company had promulgated a rule requiring that cars shall not be started backward before the motorman receives three bells from the conductor, who must remain on the rear platform while the car is moving backward, the failure of the company to promulgate other rules regulating the running of cars backward was not negligence justifying a recovery for injuries to a motorman in collision with a backing car; it not appearing that other or different rules were in use on other roads, regulating such operation of cars.

3. Where a street railway motorman knew that cars were operated backward on some occasions without red lanterns being carried on the rear thereof, and that the company had not established telephone connections to warn following cars of a car being operated backward, he assumed the risk of the operation of such cars without such precautions.

4. Where a street railway car was being run backward, and just before a collision with a following car the conductor signaled the motorman to stop the car, and then jumped, his act in jumping did not constitute negligence on which a liability for injuries to the motorman of the following car could be predicated.

5. In an action for injuries from the negligence of a street railway conductor, witnesses testified that he was slow in ringing bells, and was liable to get excited and give wrong signals. Other witnesses testified that he was not a good conductor, and that he was short, and had to stand on tiptoes to reach the bell cord, which made him slow in emergencies; but none of such witnesses testified that the conductor's incompetency had ever been reported to the company or the union. Held, that such evidence failed to raise a presumption that the company knew or ought to have known of his incompetency, so as to charge it with negligence in failing to remove him.—(Seccombe vs. Detroit Electric Ry., 94 N. W. Rep., 747.)

MICHIGAN.—Error to State Court—Federal Question—Constitutional Law—Due Process of Law—Equal Protection of Law—Validity of Order Requiring Safety Appliances at Grade Grossings.

1. A decision of a State court refusing a petition for a writ of mandamus, in which relator claimed and set up a right under the Constitution of the United States, is tantamount to the denial of that right, and is therefore reviewable in the Supreme Court of the United States.

2. Neither due process of law nor the equal protection of the laws is denied a street railway company by an order of the commissioner of railroads made and issued under Mich. Pub. Acts 1893, act No. 171, section 5, requiring such street railway to pay one-half of the expense of constructing and maintaining safety appliances at a grade crossing of a steam railroad which was not built until after the street railway had been constructed.

3. An objection that a State statute violates the Federal Constitution because it does not provide for notice to those who may be affected by it is not available to a party who was in fact given notice, and who at the hearing objected to the action proposed to be taken under such statute.—(Detroit, Fort Wayne & Belle Isle Railway, Plff. in Err., vs. Chase S. Osborn, Commissioner of Railroads, 23 Supreme Court Rep., 540.)

MICHIGAN.—Street Railroads—Repair of Railway Tracks—Injury to Pedestrian—Negligence—Instructions—Remarks of Court.

1. While plaintiff was walking on a street across defendant's railway tracks, which were being repaired, a rail handled by defendant's employees rolled on her foot and injured her. Her testimony tended to prove that no barriers were placed where the repairs were made. On passing over the track shortly before the accident, she had noticed that some of the planks and rails were taken up. On her return she observed nothing to indicate danger, and was not warned until the very instant she was injured. Defendant's evidence tended to show that the place was guarded by barriers, and that the workmen handling the rail which injured plaintiff did not observe her until too late. The accident occurred about noon. Held, insufficient to justify a finding of actionable negligence notwithstanding plaintiff's contributory negligence.

2. An instruction that, if plaintiff saw evidence of repairs, she was bound to observe whether they interfered with the passage

of persons, and if she saw workmen moving a rail along the walk it was her duty to avoid a danger apparent to a person of ordinary prudence, and if she saw the workmen or might have seen them by the exercise of ordinary caution she was bound to pay heed to what was being done, and if she failed to do so, and was injured, when a person of ordinary care would have avoided the injury, she could not recover, was not erroneous, as directing a verdict for defendant.

3. It was not error to charge that, if barriers were placed across the walk as claimed by defendant, and plaintiff stepped over them and was injured, she could not recover, though the mere fact that barriers are erected will not always preclude a recovery where the evidence in the case was not such as would warrant the jury in finding for plaintiff if the barriers existed.

4. It was not error to charge that the question whether a danger existed in the street should be determined solely from the evidence in the case, and not from a consideration of what other persons had done.

5. Remark of the trial court in denying a motion to direct a verdict for defendant to the effect that the record may show that the court considers this one of the close cases which should go to the jury, and that different minds might draw different conclusions from the evidence, was not prejudicial to plaintiff.—(Sosnofski vs. Lake Shore & M. S. Ry. Co., 95 N. W. Rep., 1077.)

MICHIGAN.—Street Railways—Injury to Animals—Contributory Negligence—Negligence—Failure to Carry Headlight—Evidence—Declarations of Motorman—Res Gestæ.

1. In an action against an electric railroad for death of a cow, evidence of plaintiff considered, and held, not to show that he was guilty of contributory negligence in law.

2. In an action against an electric railroad for death of a cow, testimony of a passenger that, when the car struck the cow, the motorman, while alighting, said: "There, that is running without a headlight," was properly admitted as part of the res gestæ.

3. In an action against an electric railroad for death of a cow, an instruction that defendant's liability under its franchise requiring its cars to be properly lighted, and under the law of negligence, was not materially different; that defendant was obliged to have such a light as would give plaintiff fair notice of its approach; that it was for the jury to say whether the lights were reasonable on the night of the accident, and whether failure to carry a headlight was negligence under the circumstances—fairly presented the law.—(Ensley et al. vs. Detroit United Ry., 96 N. W. Rep., 34.)

MICHIGAN.—Street Railroads—Collision—Negligence—Questions for Jury—Impeaching Witness.

1. Where plaintiff's own testimony shows he was using due diligence to get off the track of an approaching car, and a witness for him states he went right on the track, the question of his negligence is for the jury.

2. A party cannot impeach his own witness by showing contradictory statements made by him because his testimony on cross-examination was not such as he expected.

3. Where negligence charged against a street car company is the failure to reasonably check and control the speed of the car, and the evidence shows the car was heavily loaded and approaching plaintiff on a down grade, the question of negligence is for the jury.—(Westphal vs. St. Joseph & B. H. St. Ry. Co., 96 N. W. Rep., 19.)

MINNESOTA.—Street Railways—Injuries to Passenger—Evidence—Damages.

1. Where a street car stops for passengers to alight, and the servants in charge invite them to leave, such servants have no right to jerk or move the car while such invitation is being acted upon, and it is negligence to do so.

2. It is proper to allow a physician to give the result of information derived by him in the treatment of a patient, when being examined as an expert.

3. A verdict of $4,000 held to be excessive, and reduced to $2,500.—(Skelton vs. St. Paul City Ry. Co., 92 N. W. Rep., 960.)

MINNESOTA.—Street Railroads—Injury to Passenger—Evidence—Excessive Damages.

1. Held, that the evidence in a personal injury case as to the manner in which the accident occurred was not so inherently unreasonable and improbable as to require the court below to grant a new trial upon hearing an alternative motion made by defendant's counsel after a verdict in plaintiff's favor.

2. The jurors were justified in finding from the evidence that both the hearing and eyesight of a child ten years of age were permanently injured and impaired by the accident, and that other injuries were received by her at the same time. Held, that a verdict in her favor in the sum of $6,000 was not excessive, under such circumstances.—(Hunt vs. St. Paul City Ry. Co. (two cases), 95 N. W. Rep., 312.)

MINNESOTA.—Street Railroads—Injury to Pedestrian—Appealable Order.

1. In an action for damages for personal injuries alleged to have been caused by the negligence of defendant, the evidence is examined, and held, sufficient to sustain the verdict for plaintiff.

2. An order directing judgment notiwthstanding a verdict, based upon an alternative motion for judgment or a new trial, is appealable. Bank vs. Graham, 69 N. W., 1077; 67 Minn., 318, followed.—(Peterson vs. Minneapolis St. Ry. Co., 95 N. W. Rep., 751.)

MINNESOTA.—Street Railroads—Injury to Pedestrian—Contributory Negligence—Willful Negligence.

1. In an action for injuries to plaintiff's intestate, who was run upon by one of defendant's electric cars while he was passing over an urban street midway between crossings, held, that the evidence shows that intestate failed to exercise reasonable precautions for his protection and contributed to his own injury.

2. Held, further, that the evidence does not tend to disclose such willful negligence on the part of defendant's motorman, after the discovery of intestate's peril, as to require a summission of that issue to the jury.—(Baly vs. St. Paul City Ry. Co., 95 N. W. Rep., 757.)

MISSOURI.—Carriers—Street Railway—Negligence.

1. Where a street car conductor stopped his car for two ladies to get off, and after one got off, but before the other had done so, some one not in the employ of the railway company, nor with the authority or knowledge of the conductor, gave the motorman the signal to start, and he did so, throwing the second lady to the ground, there was no negligence on the part of the railway company, and such passenger could not recover from the company for the injury so sustained.—(Krone vs. Southwest Missour Electric Ry. Co., 71 S. W. Rep., 712.)

MISSOURI.—Street Railway—Injury to Conductor—Negligence—Contributory Negligence—Instructions—Fellow Servants.

1. In an action by a conductor against a street railway company for injuries sustained by being run into by another car while he was trying to open the gate to the vestibule of his car after changing his trolley for the purpose of crossing to the car sheds, the answer alleged as contributory negligence that he, without looking or listening, allowed himself to be brought into such close proximity to the car as to be struck by it. The court charged that it was immaterial on which side of the car plaintiff walked back to the gate after changing the trolley. Held, not error, as the negligence, if any, did not consist in the walking back, but in the position assumed afterwards.

2. If, after the conductor changed his trolley, he looked in the direction the car which struck him came, and saw no car approaching, and immediately signaled the motorman to go ahead, and attempted to get on his car through the gate to the vestibule, he was not guilty of negligence in failing to continue to look and listen for an approaching car.

3. An instruction, in an action for injuries to a street car conductor by being struck by another car, that it was the motorman's duty to have stopped his car under certain circumstances, was not erroneous for want of evidence as to the ability of the motorman to have stopped the car, though there was no direct evidence as to the time or space within which it could have been stopped, it appearing that as a matter of fact it was stopped within 1½ car lengths after the accident, and it being a matter of common knowledge that cars running at ordinary speed can be stopped in less than 100 ft.

4. Where one is discovered by a motorman of a street car standing in a place of peril, and it is apparent, if he does not move out of it, he will be struck and injured, the motorman must check or stop his car, and has no right to assume that the person will move out of danger.

5. A street railway is a railroad within the meaning of Rev. St. 1899, section 2873, providing "that every railroad corporation, owning and operating a railroad in this State, shall be liable for all damages sustained by any servant thereof while engaged in the work of operating such railroad, by reason of the negligence of any other servant thereof," subject to the defense of contributory negligence.—(Stocks vs. St. Louis Transit Co., 71 S. W. Rep., 730.)

MISSOURI.—Street Railway—Negligence—Crossing Track—Ordinary Care—Instructions—Evidence.

1. In an action against a street railway company for damages resulting from a collision of a car with a team crossing the track, an instruction in general terms that, if the driver was exercising ordinary care, the verdict should be for plaintiff, without specifically stating the care the driver was bound to exercise, was error.

2. Where, in another instruction, the court specifically stated the care the driver was bound to exercise, the error in the first instruction was cured.

3. Where, in an action against a street railway company for damages from a collision of a car with a team crossing the track, the driver testified that as he approached the crossing he looked to see if a car was approaching, but his view was obstructed by a standing car, and as it moved away he looked again, but did not see the approaching car, and could not hear it because of the noise made by the departing car and by his wagon, and other witnesses testified that, had he looked, he could have seen the approaching car, the question as to whether he looked when he should was for the jury.—(Sanitary Dairy Co. of Missouri vs. St. Louis Transit Co., 71 S. W. Rep., 726.)

MISSOURI.—Street Railroads — Negligence — Cities — Police Power—"Vigilant Watch Ordinance"—Instructions—Evidence—Sufficiency—Conductor—Duties.

1. McQuillin's Ann. Mun. Code (page 797, section 1760), providing that the person in charge of a street car shall keep a vigilant watch for all vehicles and persons on foot, and, on the first appearance of danger to such persons or vehicles, the car shall be stopped in the shortest time and space possible, is a police regulation conferring a right of action on a party injured in consequence of a violation of it, without any allegation or proof that the ordinance has been accepted by the street car company.

2. Inasmuch as the meaning of the phrase "shortest time and space possible" is uncertain, the incorporation of the ordinance bodily in an instruction in a personal injury action against a street railroad company is misleading.

3. A petition in an action for personal injuries which joined in the same count a cause of action for common-law negligence and one for negligence under the provisions of a city ordinance is not objectionable for misjoinder of causes of action.

4. Where plaintiff, injured by a street car at a crossing, testified that he could not see the car on account of an obstruction, and that he did not hear it, it was proper to submit the issue of contributory negligence to the jury, though other witnesses, similarly or not so advantageously situated, testified that they saw the car 150 ft. away.

5. The conductor of a street car is not required to keep a lookout and avoid accidents at crossings.—(Gebhardt vs. St. Louis Transit Co., 71 S. W. Rep., 448.)

MISSOURI.—Malicious Prosecution—Street Car Company—Arrest of Passenger—Authority of Conductor—Probable Cause—Malice—Sufficiency of Evidence—Tender of Fare—Defaced Coin—Elements of Damage—Admissibility of Evidence—Punitive Damages—Excessive Verdict.

1. Where the rules of a street car company direct its conductors to call a policeman in case of trouble on a car, a conductor is thereby authorized to cause the arrest of a passenger, and prefer a charge of disturbing the peace against him, so as to render the company liable in an action for malicious prosecution.

2. A street car passenger tendered a defaced nickel, which was all the money he had. The conductor refused to receive it, and proceeded to eject the passenger. On reaching the car door the passenger offered resistance, and succeeded in preventing his removal. The scuffle caused the lady passengers to scream. There was no fighting, or offer to fight, and the passenger used no violent language. The conductor called a policeman, and effected the passenger's arrest. A city ordinance punished any person who should disturb the peace. Held, in an action for malicious prosecution, that there was no probable cause for the arrest.

3. After the arrest the passenger was taken by the officer and conductor to the conductor's boss, and the facts related to the latter. The boss had a telephone communication with some one, and then ordered a charge of disturbing the peace to be made against the passenger. On a trial for malicious prosecution, the conductor swore that he had no malice against the passenger. Held, that the evidence was sufficient to take the issue of malice to the jury.

4. Where a passenger on a street car tenders the exact amount of his fare, in legal-tender coin, the conductor has no right to refuse to accept it, and eject the passenger, though the coin was so worn as to lead the conductor to honestly believe that it was not a good one.

5. Compensation may be recovered for every injury caused by a malicious prosecution, including loss of time, attorneys' fees paid to procure acquittal or release, and injuries to the feelings and reputation.

6. The refusal of an instruction that an acquittal in the original prosecution does not raise a presumption of malice and want of prabable cause is not prejudicial error, where the evidence of both parties shows that there was no probable cause.

7. The evidence warranted an instruction that, if the jury found express malice, they might award punitive damages.

8. Where a teller in the United States sub-treasury was permitted to testify as to the appearance, etc., of a coin tendered as car fare, defendant's objection that the evidence was irrelevant and immaterial was too general to require consideration.

9. A party waives an objection to evidence by introducing the same character of evidence himself.

10. In an action for malicious prosecution, it appeared that the only expense occasioned plaintiff was $10 attorney's fee and $3.50 for bond. Plaintiff was a business man and lost half a day's time. There was no direct evidence that he suffered any pain of mind, or that his reputation was damaged. He submitted to arrest rather than be forcibly ejected from defendant street car company's car. The occasion of plaintiff's ejection was the tender of a coin so worn that the conductor, in good faith, refused it, but which was all the money plaintiff had. Held, that a verdict awarding $1,000 actual and $1,000 punitive damages was excessive, and should be reduced to $1,000.—(Ruth vs. St. Louis Transit Co., 71 S. W. Rep., 1055.

MISSOURI.—Personal Injuries—Claim for Damages—Evidence—Nurse Hire—Quotient Verdict.

1. Where the petition in an action against a street car company for personal injuries alleged that, on account of the injuries, plaintiff was compelled to hire nurses to wait upon him, and prayed judgment for a lump sum, evidence of the amount paid out by plaintiff as nurse hire was admissible, through there was no specific sum claimed therefor.

2. The jury in a personal injury case voted ten for plaintiff and two for defendant, and thereafter each juryman put down on paper the amount each considered the plaintiff ought to recover, and divided the total by 12, the quotient being $467. The verdict returned, however, was a majority verdict for $500, ten agreeing thereto. Held, that it did not appear that the verdict was arrived at improperly.—(Moore vs. Southwest Missouri Electric Ry. Co., 75 S. W. Rep., 176.)

MISSOURI.—Street Railroads—Regulation—Municipal Ordinances—Speed—Vigilant Watch—Collision with Vehicle—Complaint—Common-Law and Statutory Negligence—Joinder—Violation of Ordinance—Negligence Per Se—Last Clear Chance—Contributory Negligence—Question for Jury.

1. A city ordinance providing that operatives of street railway cars shall keep a vigilant lookout for obstructions on the track is a police regulation binding on all street railways operating cars in the city limits, whether accepted by such railways or not.

2. In an action for injuries to the driver of a vehicle by collision with a street car, plaintiff is entitled to join in the same count or cause of action negligence arising from a breach of defendant's common-law duty to use due care and negligence arising from defendant's breach of a city ordinance requiring a vigilant lookout.

3. Where at the time of a collision between a street car and a vehicle, the motorman was running the car at a rate of speed prohibited by a city ordinance, defendant was guilty of negligence per se.

4. Where a motorman operating a street car, after having seen plaintiff on the track, attempting to move a balky horse, continued to run his car at a rate of speed prohibited by a city ordinance, and made no effort to stop or check the car, which came into collision with the vehicle, he was guilty of both common-law negligence and of a violation of an ordinance requiring motormen to keep a vigilant watch for obstructions.

5. When plaintiff drove into a street on which a street railway line was operated, he saw a car coming toward him at a distance of 150 ft. to 200 ft. He would have had sufficient time to have crossed the track in front of the car, but when his horse got partly over the track he balked and would not proceed. At the time the horse stopped, the car was from 100 ft. to 125 ft. distant, and could have been checked in time to avoid a collision, but the motorman made no effort to do so. Plaintiff knew that his horse was balky, and might have escaped injury by jumping from the wagon before the collision. Held, that the motorman had the last clear chance of avoiding the injury, and plaintiff's contributory negligence, if any, was no bar to a recovery.

6. Whether plaintiff, by remaining in his wagon, was guilty of contributory negligence, which continued down to the injury, and directly contributed thereto, was a question for the jury.—(Meyers vs. St. Louis Transit Co., 73 S. W. Rep., 379.)

MISSOURI.—Rewards for Arrest and Conviction—Right of Officer.

1. Defendant offered a reward for the arrest and conviction of any person doing a certain act. Plaintiff was a member of the sheriff's posse when he made an arrest, so that he could not claim a reward for this, but he was discharged from the posse, and defendant then renewed the promise, and he then secured the conviction. Held, that he was entitled to the reward.—(Cornwell vs. St. Louis Transit Co., 73 S. W. Rep., 305.)

LONDON LETTER

[*From Our Regular Correspondent.*]

There is an old agreement between the Great Western Railway and the Metropolitan Railway under which half of the train service between Hammersmith and Aldgate is worked by the former company, so that the new system of electricity initiated by the Metropolitan Company necessitated an alteration in the agreement. An arrangement has therefore been concluded between the two companies by which Edgware Road Station has been selected as a central point, and the Great Western Railway will provide the power from Hammersmith to this station, and is making preparations for a central power station for furnishing the necessary current at Park Royal. The new power station will also supply the current for lighting Paddington Station, hitherto furnished by the company's generating station at Westbourne Park, which is the oldest in London. The company also has a large quantity of capstans, cranes and machinery, which in future will be worked by electricity. An important feature of the new power station will lie in its capacity of extension when the time arrives for more ambitious schemes of electrification. The contract for engines, three-phase generators, condensing and auxiliary plant, aggregating about 10,000 hp for this important station, has been secured by the Electric Construction Company, Limited, of Wolverhampton and London, and will consist of eight 750-kw steam-driven generators, each having a normal full load in each phase of 250 kw. These generators have to be so wound that the full output of 750 kw can be obtained at any voltage between 6300 and 6600 on a non-inductive load. Further, there are to be four 150-kw three-phase generators, one to be driven direct by a continuous-current motor, and another by a high-tension 6500-volt three-phase induction motor, and the remaining two by compound high-speed engines.

The London County Council has decided that English-made rails are to be laid on its new tramways. Tenders were received from twenty-six firms, the successful firms being Bolckow, Vaughan & Coy, Middlesbrough, and the Frodingham Iron & Steel Company, Limited, Doncaster. Tenders were received from Belgium and America, and, although they were lower than the accepted tenders, they were for various reasons passed over. The total to be spent is over £80,000. The committee's recommendation in favor of English rails was enthusiastically welcomed by the Council.

The electrification has now been completed of a further section of the London County Council's southern tramways—namely, the lines extending from the Elephant and Castle to New-Cross and Greenwich. These embrace about 10 miles of double track. The conversion to electric traction of the cable line between Kennington and Streatham is about to be proceeded with, and also of the short connecting line between Kennington Park-Road and the cable line and of some further short lengths, principally in the Southwark and Bermondsey districts. On the completion of this work all the lines which formerly made up the undertaking of the London Tramways Company south of the Thames will have been reconstructed for electric traction, together with short sections of line formerly belonging to the South London Tramways Company. Some new lines are also to be laid, one of which will have a terminus at Southwark Bridge. The underground conduit system of electric traction has been adopted by the London County Council for all the above-mentioned lines. The work of conversion of the Greenwich lines was divided between two firms of contractors, Messrs. Dick, Kerr & Company and Messrs. J. G. White & Company, who acted under the supervision of Mr. Fitzmaurice, the County Council's chief engineer, as regards the track work, and of J. H. Rider, the Council's electrical engineer, as regards the electrical equipment.

Birmingham has initiated its first section of the municipal tramways, the line from Birmingham to Aston Brook, on which there will be a two-minute service.

Having pushed its tramways up to Hampton Court last year, and so invaded the confines of the Thames Valley, the London United Tramways Company now contemplates further operations in the same region. Finding the extension to Hampton Court successful and popular, it purposes seeking Parliamentary authority to carry its lines onward to Taplow and Maidenhead. The scheme is to lay down a tramway from Hounslow on to Colnbrook and Slough, and thence to Skindle's Hotel, at the Taplow end of Maidenhead Bridge. Another and a similar, but much shorter, extension projected is from Hounslow to Staines, and that likewise will tempt many people to journey to the river-side by road rather than by rail. All these developments are calculated to confer a much-needed benefit on the various Thames side towns.

The Wakefield & District Light Railway Company, whose light railways are now being constructed, will shortly be opened for public traffic, deposited a bill in Parliament for next session seeking power to construct tramways in Wakefield, Pontefract, Normanton, Whitwood, Castleford, Featherstone and Knottingley, of a total length of over 25 miles, at an estimated cost of £183,918. The company seek powers to raise £165,000 additional capital, with the right to borrow a further sum of £55,000, but the bill expressly provides that the company shall not create debenture stock. As regards the purchase of the tramways by local authorities, it is proposed that the tramways in Wakefield and the urban districts of Methley Stanley and Altofts shall not be purchased for twenty-five years; in the other districts the period proposed to be fixed is forty-two years.

Shareholders in the Birmingham & Midland Tramways, Limited, have authorized their directors to make a provisional agreement to acquire the whole of the local tramways rights which the British Electric Traction Company has been steadily accumulating these last eight years. The interests of the Dudley, Stourbridge & District Electric Traction Company, the South Staffordshire Tramways (lessee) Company, the Wolverhampton District Electric Tramways, Limited, and the City of Birmingham Tramways Company are all included in the compact. The present authorized capital of the company is £500,000, and this is to be increased to £1,050,000.

The Bath Tramway system was recently opened to the public. The British Westinghouse Company, which has the contract for the equipment of the generating station and rolling stock, has just completed the erection of the former, as well as of the car-shed buildings, in the record time of seven and one-half months. The opening passed off most satisfactorily, every car carrying practically its full complement of passengers. When in full running there will be forty cars at work. The gradients at Bath are excessive, the maximum being 1 in 12. The Bath cars are fitted with the Westinghouse magnetic brake, one of the numerous good features of which is that it will automatically bring the car to rest on the severest gradient, even should the trolley leave the wire. This, as well as its other good points, were repeatedly demonstrated on the opening day, the trolleys being purposely removed from the line when the cars were on a gradient of 1 in 12, and the cars were brought to a stop in a few yards, all the passengers alighting without mishap. This brake has received the approval of the Board of Trade, with the most favorable comments.

In the Street Railway Journal of Jan. 30 will be found a full description of the electrification of the Liverpool to Southport branch line of the Lancashire & Yorkshire Railway, but as successful trials have recently been made on this installation, it is shortly referred to here. Several schemes of this kind are at present near completion, but it would seem that after all this particular electric railway will be the first to be put in actual service, and the contractors, Messrs. Dick, Kerr & Company, Limited, are certainly to be congratulated on the successful completion of this most important pioneer work.

Successful trials have been made on the new London tube, viz., the Great Northern & City Railway. It will, perhaps, be remembered that the Street Railway Journal published a full description of this undertaking some two years ago, and further articles on the subject will appear in the near future. At this time it will be sufficient to state that press representatives were invited to travel through this tube on a recent date. The total length is about 3½ miles, and the tube extends from Finsbury Park Station, on the Great Northern Railway to Moorgate Street, although extensions are at present being made to Lothbury. This tube is different from all others, either in operation or in course of construction in London, in so far that it has been made large enough to admit the ordinary rolling stock of the Great Northern Railway. It will be remembered that the contractors for the whole work were S. Pearson & Sons, Limited, under the immediate charge of E. W. Moir. The principal sub-contractors for the electrical part of the work was the British Thomson-Houston Company, which has supplied the whole of the generating plant, and the electrical equipment of the rolling stock. The British Thomson-Houston multiple-unit system has been adopted. The carriages were built by the Electric Railway & Tramway Carriage Works, of Preston, and the Brush Electrical Engineering Company, of Loughborough. It is expected that the formal opening of the line will take place in the course of a week or two.

Out of seventy applications for the position vacated by the resignation of A. L. C. Fell, now the general manager of the London County Council Tramways, the successful applicant is A. R. Fearnley, who has for several years been the general manager of the Birkenhead Corporation Tramways.

Joseph Chamberlain, who is at present busily engaged in an attempt to revise the fiscal policy of Great Britain, has recently appointed a tariff commission for the purpose of a thorough in

vestigation into the various branches of manufacture and trade which are naturally influenced by the import of manufactured articles from other countries. Mr. Chamberlain has succeeded in putting on this commission representatives of most of the manufacturing trades in this country, and readers of the STREET RAILWAY JOURNAL will be interested to know that only a few days ago George Flett, the managing director of Dick, Kerr & Company, Limited, chiefly through whose influence this company has made such a phen menal success in the few years of its career as electrical engineers and manufacturers, has been appointed to the commission. It was thought by the other members of the commission that it would be well to have a member representing the very important and growing industry of the manufacture of electrical apparatus. Mr. Flett was selected to fill this position, which, after due consultation with his board, he decided to accept. There is no question that Mr. Flett will bring to bear upon this subject the whole of his large business experience. There is probably no one else in Great Britain who has a more complete and masterful grasp of the whole electrical situation from a business point of view than Mr. Flett, and he will undoubtedly fill his position in the commission with entire success and credit, not only to himself, but to the commission and the electrical industry as a whole. A. C. S.

PARIS LETTER

(From Our Regular Correspondent.)

The accident which occurred on the Paris Metropolitan Railway in the month of August last is now definitely attributed to the use of salt on the third rail. The temporary substitution of wooden blocks for the present insulators, which latter are, as already reported of exceptionally small insulating thickness, has not yet been carried out. The expenses arising from this accident amount to about f. 2,000,000, which will affect the net receipts for the past year. The Metropolitan situation, however, appears to be very satisfactory from a financial standpoint, and a dividend of f. 15 was decided upon at the last meeting of the company. At the same meeting the results of competition from the proposed North-South line, of which a map was published in the last issue, was discussed. The Metropolitan Company does not anticipate any great falling off of receipts in consequence of the opening of this new road, and is about to issue obligations amounting to f. 50,000,000, and perhaps f. 75,000,000, to cover the equipment of new lines.

Some statistics are now available. The Municipal "Bulletin" has just made up a report of detailed receipts of the Metropolitan traffic during the nine first months of 1903 as follows:

	1902	1903	Increase
Return tickets	6,720,280	12,996,681	6,276,398
First class	5,657,472	9,297,741	3,640,269
Second class	29,027,585	51,292,248	22,264,563
Passes	6,970	7,853	883
Total passengers carried	41,412,410	73,594,523	32,182,113
Gross receipts, francs	7,148,772	12,707,969	5,559,197
Franchise payment, francs	2,372,046	4,191,463	1,810,416

The length of line in actual service was as follows:

On Oct. 7, 1902, 13.329 km; from Oct. 7 to Jan. 30, 1903, 17.335 km; from Jan. 30 to April 1, 1903, 22.912 km; since April 2, 1903, 24.11 km.

The greatest change in operating practice during the past few months is the substitution of seven-car trains for the usual eight-car trains. The composition of these trains is also different, there being two motor cars ahead, instead of one leading and one in the center of the train, or one at each end, as before. The train line is thus reduced to a minimum. Petroleum lamps have been added in the stations, and the backs of the benches have been removed, it having been recognized that they formed an obstacle to free exit from the stations in an emergency. The demand for smoking cars has not gained much headway, mostly on account of the opposition of hygienic societies. Mr. Levy has reported on the sanitary and hygienic conditions of the Metropolitan, which are pretty fair.

Among the plans for new construction which are being discussed before the Municipal Council, M. Pugliesi-Conti is calling attention to proposed line No. 8. According to the plan now being considered, the city would not do the actual construction work of the tunnel, but would lease it together with the operation for a certain number of years, after which the line would become municipal property. Line No. 8 constitutes what is known as the Inner Circle, and embraces the Opera, the principal boulevards, the Bastille, Boulevard Henri IV., Boulevard St. Germain and Les Invalides, and terminates at the starting point, the Opera.

The Municipal Council has been requested by one of its members to take up the question of a reorganization of the tramway system, and this plan is now being discussed by the mixed commission recently appointed by the Minister of Public Works and composed mostly of members of the Council and a few engineers and officials. The object in view is to consider the question of omnibus and tramway service in Paris and the Department de la Seine. Two plans are being discussed. One is for the city to lease the concession for tramways and omnibuses within the city limits to one or more operating companies for a short term of years and for the Seine Department to do the same in its territory. The other plan is to divide Paris into a certain number of segments and give a monopoly in each to the suburban tramway company, which enters the city at that side, the same companies also to operate the omnibuses. The concessions for outside lines would then be awarded by the Department of the Seine. It will be noticed that this commission does not encourage the plans of the Cie Generale des Omnibus, which have been mentioned in previous letters. The matter will not, however, be decided upon very quickly, and the outcome of the question will be mentioned in future letters.

Meanwhile the tramway companies are not being allowed to remain idle. The municipality has requested them to equip their cars with illuminating signs and make other improvements.

The Cie de l'Est Parisien has followed the example of the Cie Generale des Omnibus, which has made propositions to the Council of the Seine Department for remodeling its system. The Est Parisien, it will be remembered, has franchises for quite a number of lines which for the most part connect the center of Paris with the suburbs. The Diatto and trolley systems are in use. The proposition is now under the consideration of the Departmental Council, and is worth a short analysis. The company proposes to raise the fares to a uniform 10 centimes and 15 centimes, in place of the zone system now in use, to install the trolley system as far as the Bastille and the Place de la Republique, and also along the left bank of the Seine within the city, also the equipment of a new line consisting of trolley up to the Boulevard Magenta, and thence to the Parc Monceau by the conduit system. The further terminus of the line would be the suburb of Bondy. After inquiry of the various arrondissements of Paris and its environments, the commission threw out these propositions, and agreed only to the principle that the Est Parisien lines would be improved by a reorganization. Further plans are therefore being formulated, and the results will be reported later. It is worthy of note, however, that the changes in fares and the use of the trolley system proposed by the company have been rejected in entirety.

We have referred above to the general rapid transit scheme in Paris, part of which has already been carried out by the Metropolitan Company, with the co-operation of the city. The lines proposed by the city for future operation have a greater length than those already in operation. A few figures of the actual status may be of interest. The total cost of construction of the existing lines will exceed f. 295,000,000, and the length of lines in operation is 42 km. The amount actually spent on construction by the city is f. 130,000,000. A new loan has been voted amounting to f. 170,000,000 at 3½ per cent, repayable in seventy-five years. There are eight lines either in operation or projected, as follows:

Line No. 1, Vincennes-Porte Maillot, the first line to be put into operation, and running east to west through the city.

Line No. 2, the Circular line, running around the city on the outer boulevards. This road is for the most part in operation, and a small portion only remains to be completed.

Line No. 3, Courcelles-Menilmontant, is almost completed, and is now being equipped. Several months will yet elapse before the line will be ready for public service.

Line No. 4, or transversal line. This has been called the backbone of the whole Metropolitan system. It cuts the circular line No. 2 at about its middle in the North and South. This line has been delayed owing to the question of the passage over the Seine and the passage around the Institute of France.

Line No. 5 has also been delayed by reason of a modification of the route.

Line No. 6, Place d'Italie-Cours de Vincennes. This line is being pushed, and the serious tunnelling work will be commenced in the spring.

Line No. 7, Place du Danube-Palais Royal. This has not yet been commenced, nor has—

Line No. 8, Auteuil-Opera. This is the last line at present decided upon, and will not be commenced for a year or two, depending upon the progress of the other lines.

The Massachusetts Railroad Commission has refused to grant a petition to compel the Worcester & Connecticut Eastern Railway Company to lower its fares between Oxford and Worcester.

ANNUAL MEETING AND BANQUET OF THE NEW ENGLAND STREET RAILWAY CLUB

The annual meeting and banquet of the New England Street Railway Club was held this year at the Hotel Brunswick, Boston, on the evening of Jan. 28. The banquet, which was scheduled for 7 o'clock, was preceded by an informal reception in the parlors of the hotel, lasting about an hour. When the attendants gathered in the dining hall of the hotel, it was found that about 400 were present. Among the guests at the head table were members of the State Railroad Commissions from practically all the New England States.

As the banquet was coincident with the annual meeting of the club, President Farrington, after the repast was finished, announced as the first order of business the election of officers for the coming year. The following were unanimously elected:

J. H. NEAL

J. J. LANE

President, J. H. Neal, chief of department of accounts, Boston Elevated Railway, Boston.

Vice-Presidents:

Maine—I. L. Meloon, superintendent Sanford & Cape Porpoise Railway, Sanford.

New Hampshire—H. A. Albin, superintendent Concord Street Railway and Concord & Manchester Street Railway, Concord.

Vermont—C. K. Jones, manager Brattleboro Street Railway, Brattleboro.

Massachusetts—John T. Conway, superintendent Division 1, Old Colony Street Railway, Quincy.

Rhode Island—D. F. Sherman, treasurer Providence & Danielson Railway, Providence.

Connecticut—J. K. Punderford, general manager Fair Haven & Westville Railway, New Haven.

Secretary— John J. Lane, editor Street Railway Bulletin, Boston.

Treasurer—Nathan L. Wood, with the Frank Ridlon Company, Boston.

Executive Committee—H. E. Farrington, master mechanic, Boston & Northern Street Railway, Chelsea, Mass.; C. F. Baker, superintendent motive power and machinery, Boston Elevated Railway, Boston; W. D. Wright, superintendent of equipment, the Rhode Island Company, Providence; E. A. Sturgis, superintendent motive power and machinery, Worcester Consolidated Street Railway, Worcester; Louis Pfingst, street railway supplies, Boston; R. W. Conant, street railway supplies, Cambridge; D. E. Manson, assistant manager the Westinghouse Electric & Manufacturing Company, Boston.

Finance Committee—J. H. Neal, president; James F. Wattles, secretary, Rand Avery Supply Company, Boston; Fred. F. Stockwell, Barbour-Stockwell Company, Cambridgeport.

After the election of officers Mr. Neal was installed as president and introduced the toastmaster of the evening, Hon. Russel A. Sears, counsel of the Boston Elevated Railway Company. The following speakers were then called upon in turn by the toastmaster; Henry M. Whitney, Gen. William A. Bancroft, president Boston Elevated Railway Company; George W. Bishop, of the Massachusetts Railroad Commission; George G. Crocker, of the Boston Rapid Transit Commission; Luther C. Smith, of the Vermont Railroad Commission; H. M. Putney, of the New Hampshire Railroad Commission; Edward C. Spring, manager Dayton, Covington & Piqua Traction Company, and Representative Guy W. Ham, of Boston.

J. H. Neal, president of the New England Street Railway Club, although a young man, has for over fifteen years been identified with the street railways in Boston, and at the present time fills the responsible position of chief of department of accounts for the Boston Elevated Railway Company. He has always taken great interest in his work, and has reached a most enviable position as an expert accountant. He started in the business as a clerk, and has been advanced several times, until he assumed his present responsible position. Mr. Neal has invented several railway appliances, which have attained prominence in the street railway world. He is a very active member of the New England Street Railway Club, and has been its secretary and treasurer during the past two years.

John J. Lane, the newly elected secretary of the New England Street Railway Club, has been engaged in the newspaper business, as proprietor, publisher, editor or special correspondent for twenty-eight years, and during the last two years has been editor of the Club's official publication, "The Street Railway Bulletin." He was, for many years, special correspondent for the Boston Globe and Boston Herald, with headuarters at Laconia, N. H., and during that time established and managed several daily and weekly newspapers. About nine years ago, he came to Boston to accept an editorial position with the Associated Press, and remained with that organization until he resigned to become editor of the official publication of the New England Street Railway Club.

Y. M. C. A. IN MEMPHIS

The Memphis Street Railway Company, of Memphis, Tenn., has donated $1,000 toward establishing a railroad branch of the local Y. M. C. A., and will furnish the organization with club rooms. These rooms will be fitted up with athletic paraphernalia for developing the physical man, while suitable reading matter will be kept on file and social entertainment provided properly to administer to the mental man. The Y. M. C. A. of Memphis will co-operate with the railway company in establishing the new organization.

THE NEW YORK TO PORT CHESTER ELECTRIC RAILWAY PLANS

The New York, Westchester & Boston Railway Company, the rival of the New York & Port Chester Electric Railway, for the construction of a four-track, third-rail electric railway from New York to Port Chester, was given a hearing before the Railroad Committee of the Board of Aldermen of New York on Jan. 25, on its application for a franchise to cross the streets and avenues on its proposed route in the Borough of the Bronx. Counsel for the company stated that the road, as projected, is to be a four-track line of high speed and frequent service, two tracks for express and two for local traffic, having a main line running from the Borough of the Bronx to Port Chester, and a branch from Pelham to White Plains, midway between the New Haven and the Harlem railroads, and also one to Throgg's Neck, via Clason's Point, a total of 32 miles. The route covered is substantially that of the New York & Port Chester, which recently applied to the Board of Aldermen for a similar franchise, which has not yet been granted.

An opinion by John G. Johnson and Geo. S. Graham, of Philadelphia, and William B. Hornblower and Charles E. Hughes, of New York, was read, holding that the company now is "a valid and subsisting corporation," and has the right to construct and maintain its proposed road; also a letter from Dick & Robinson, bankers of New York, saying that they have agreed (subject to the assent of the city) to provide $13,125,000 to purchase rights of way and construct the road, having associated with them other financial interests in New York and Philadelphia.

The checkered career of the company has already caused doubt in many minds as to the sincerity of its latest move. Organization was perfected in 1872, and in 1875 the company was placed in the hands of William T. Tomlinson as receiver. By a recent order of the Supreme Court Mr. Tomlinson transferred the assets of the company to George T. Forster, of New York, representing the new banking interests. The claim is made that under chapters 62[illegible] and 627, of the Laws of 1903, which exempts the time during which the road is in receiver's hands from the ten years in which a railroad company is required to complete its road, the company has fully seven years more to build its line; also that having been incorporated before such requirement became a law, it may construct its road without obtaining the consent of the city authorities.

The persistent refusal of the New York Aldermen to act on the petition of the New York & Port Chester Company has resulted in the introduction in the Legislature, in the interest of that company, of a bill vesting the right to grant franchises to cross streets in New York in the authorities of the immediate borough involved. A public hearing on this bill is to be held Feb. 10.

An instance of the policy of the Aldermen toward the company is shown by the questioning of the financial resources of the company by one of the members of that body, after the company has demonstrated its ability to build the road to the satisfaction of the State Railroad Commission and the Supreme Court.

ANNUAL MEETING OF THE SOUTH SIDE ELEVATED RAILROAD COMPANY, CHICAGO

The South Side Elevated Railroad Company held its annual stockholders' meeting at Chicago, Jan. 28. The following financial report was made:

RECEIPTS		
Dec. 31—	1902	1903
Receipts	$1,433,828	$1,629,360
Other earnings	48,477	49,477
Miscellaneous receipts	1,538	473
Totals	$1,483,843	$1,679,310
EXPENSES		
Maintenance way and structure	$57,443	$64,325
Maintenance equipment	107,145	132,847
Conducting transportation	364,736	422,857
General expenses	*149,957	158,160
Loop rental	183,057	216,183
Totals	$862,338	$994,375
Net earnings	621,505	684,934
Bond interest	33,750	33,750
Balance	$587,755	651,184
Dividends	409,124	409,133
Surplus for year	$178,631	$242,051
BALANCE SHEET		
Assets		
Cost of property	$12,006,657	$12,350,880
Stock in treasury	92,390	92,400
Material and supplies	24,931	41,416
Current assets	25,726	49,446
Due from companies and agents	......	11,283
Cash on hand	8,814	7,720
Totals	$12,158,522	$12,553,146
Liabilities		
Capital stock	$10,323,800	$10,323,800
Funded debt	750,000	750,000
Current liabilities	†183,814	‡386,387
Profit and loss	850,908	1,027,959
Depreciation	50,000	65,000
Totals	$12,158,522	$12,553,146

* Includes taxes. † Includes reserve for taxes: ‡ The items are:

Operating expenses for December	$74,697
Reserve for taxes, due in April	73,975
Construction expenses for new lines	237,715
Total	$386,387

The item of construction and expenses for new lines will be ultimately paid out of the construction fund when the plans for providing money for the new lines are carried out.

The gross receipts during the year were 13.1 per cent above the previous year. The Chicago City Railway strike in November, which lasted two weeks, swelled the gross receipts for the year above the normal increase. During this strike the daily average of passengers carried suddenly rose from 85,788 to 206,000.

President Leslie Carter, in his report, outlined the plans which the company has for extensions and the improvement of the service, and also for the raising of $7,000,000 necessary to make these extensions. In regard to extensions, he said:

"In March last the privilege was granted by the City Council to your company to operate lines until 1938 to the Union Stock Yards and packing houses; Forty-Second Street, near Lake Michigan; Englewood, westward to a point between Center and Ashland Avenues; Englewood, southward to a point between Sixty-Eighth and Seventy-Second Streets; to build a third track from Twelfth Street to Forty-Third Street. To do these things will require the building of 3.8 miles of single track and 6.8 miles of double track, practically doubling your mileage. This work must all be completed by March 16, 1907.

"The addition of your lines will extend your service into as well or better populated territories than are now reached. The distances between terminals are no longer than on the present line. There will be new crosstown lines, affording entirely new business in the rush hours, which will not come on the northern and more crowded part of the road.

"The third track from Twelfth Street to Forty-Third Street will enable the company to establish an express service, reduce the running time of such trains ten minutes, and attract business from a wider territory.

"Reliable estimates of the traffic to be derived have been made, and justify the belief that the completed system will be as profitable as the present line, with increased probabilities of growth, and an increased certainty of holding business acquired.

"The advantages to the public, among others, are:

"A comprehensive service to all parts of the South Side, which have a population justifying the expense of constructing and operating an elevated railroad.

"On express trains a reduction of ten minutes in time from all districts served south of Thirty-Ninth Street.

"An improved service in rush hours to points north of Thirty-Ninth Street.

"Crosstown service from Englewood to the south parks.

"Crosstown service to the Union Stock Yards and packing houses.

"The line to the Union Stock Yards and to Lake Michigan will be leased to your company perpetually, with twenty years' privilege of purchase, at cost. The Englewood lines will be consolidated with your present lines, under the statute relating to railroad consolidations.

"The new Fortieth Street line will be financed by the Chicago Junction Railway Company, by an issue of bonds not to exceed $2,240,000, bearing interest at 4 per cent, secured on that company's property, the contracts for the work to be subject to the supervision of the officers of your company. The rest of the work must be financed by ourselves.

"The directors have always unanimously favored plans to accomplish this with stock and not by mortgage. In this they have been promptly supported by the assent of a majority of those stockholders with whom they have been able to communicate personally, and to such an amount of stock that they have substantial reasons to believe that it will be supported by a large proportion of all stockholders. As the amount, $7,000,000, is large, and as it is not certain that all the stockholders will take and complete the payment for the new stock, it is necessary to arrange for an underwriters' agreement, wherein it will be provided that each stockholder who takes and pays for his new stock shall receive back from the underwriters all the commission which the underwriters are entitled to under this agreement on such stock so taken by stockholders. Such commission will be not less than $7 a share. That is to say, each stockholder will be asked whether he will agree to take new stock to the extent of 70 per cent of his holdings, payment to be made, say one-third April 30, 1904, one-third April 30, 1905, one-third April 30, 1906, each stockholder to receive through the underwriters' agreement a credit equal to their commission on such stockholders' amount of stock, but not less than $7 per share.

"For all stock payments negotiable receipts will be issued, bearing interest at the rate of 4 per cent per annum. Full paid stock will be issued in exchange for receipts on making the final payment. A circular letter containing this plan will be addressed to all stockholders, asking each one whether he is willing to subscribe for the respective proportion of stock falling to him. If this plan meets with the same general approval of those whom we cannot personally see that it has with those whom it has been our good fortune to meet, the financing of the property will be accomplished at the least possible expense to the company."

W. B. Walker, W. R. Linn and Leslie Carter were re-elected directors for four-year terms. Officers were elected after the meeting of shareholders. On account of ill health, John H. Glade, who has been secretary of the company, resigned, much to the regret of the board. He was succeeded by Horace F. Hardy, auditor of the company. The officers and directors now are as follows:

President—Leslie Carter.

Vice-President—T. J. Lefens.

General manager—Marcellus Hopkins.

Secretary and Treasurer—Horace F. Hardy.

Directors—Byron L. Smith, William B. Walker, C. H. Wacker, Joseph Leiter, George E. Adams, C. J. Blair, T. J. Lefens, William R. Linn, Leslie Carter.

REPORT OF THE TORONTO RAILWAY COMPANY FOR YEAR ENDING DEC. 31, 1903

The report of the Toronto Railway Company for the year ending Dec. 31, 1903, shows gross earnings of $2,172,088, an increase of $337,179 over the same period of 1902. The net earnings were 18½ per cent more than the net of 1902. Out of the net profits there were declared four quarterly dividends of 1¼ per cent each, amounting to $326,548. After deducting pavement charges paid

to the city, and transferring $50,000 to the contingent account, there remained a surplus of $180,629. There was expended for general purposes and charged to capital account the sum of $379,-615. This expenditure includes extensive alterations and additions at the power house, new motor equipments, additional track and overhead construction, new rolling stock and buildings necessary for the increased business. The boilers of No. 1 power house are being replaced by boilers of much larger capacity and two additional direct-connected engines of 1600-hp capacity each, and generators are being erected, which it is anticipated will be sufficient to take care of all increases in business until the company is receiving power from Niagara. As an additional safeguard, a storage battery having a capacity of 3000 amp.-hours is now rapidly approaching completion. The city of Toronto received from the company under the terms of the franchise the sum of $298,839, as compared with $255,551 the previous year.

The results for four years past and the balance sheet of Dec. 31 follow:

	1903	1902	1901	1900
Gross earnings	$2,172,088	$1,834,908	$1,661,017	$1,501,001
Operating expenses	1,200,823	1,015,361	857,612	775,981
Net earnings	$971,265	$819,547	$803,405	$725,020
Fixed charges	342,101	313,105	292,679	321,818
Dividends paid (5 %)	326,548	302,439	270,000	240,000
Cost of paving	71,986	70,275	68,000	64,000
Contingent account	50,000	......	......	......
Total	$790,635	$685,819	$630,679	$625,818
Surplus	180,630	133,728	172,726	99,202
Passengers carried	53,055,322	44,437,678	39,848,087	36,061,667
Transfers	18,654,344	15,974,220	13,750,038	12,570,704

BALANCE SHEET, DEC. 31

Assets	1903	1902
Road and equipment	$11,184,499	$10,835,767
Stores on hand	139,459	108,555
Accounts receivable	623,102	362,304
Cash in bank	11,388	97,152
Cash in hand	162,274	22,167
Total	$12,120,723	$11,425,946

Liabilities	1903	1902
Capital	$6,600,000	$6,268,414
Bonds outstanding	3,473,373	3,473,373
Mortgages	70,000	70,000
Loan on bonds	100,000	......
Accrued interest	64,029	61,577
Accounts and wages	166,140	113,710
Unredeemed tickets	18,936	12,925
Injuries fund	8,319	......
Dividends	82,113	77,438
Contingent account	83,675	75,000
Profit and loss	1,454,136	1,273,507
Total	$12,120,723	$11,425,946

ANNUAL MEETING IN WASHINGTON

The Washington Railway & Electric Company and its subsidiary street railway and electric lighting companies held their annual meetings a few days ago. It had been expected that the annual reports of the companies would be ready for the stockholders, but with the exception of the City & Suburban Company the figures had not been compiled. It is expected that they will be ready in a few days, however, when they will be sent to Congress.

The City & Suburban Railway report shows the company to be paying operating expenses and fixed charges and a small surplus in addition. The company went into the hands of a receiver some time ago because of its inability to pay its fixed charges, in the shape of 5 per cent interest on the issue of $1,750,000 City & Suburban bonds. President Allan McDermott, of the Washington Railway & Electric Company, which owns the controlling interest in the City & Suburban, was appointed receiver. In the first year after the appointment of the receiver the company continued its failure to meet its fixed charges. In the year 1903, for the first time, a surplus over fixed charges of $6,000 was earned.

The total receipts of the company from passenger traffic rentals and other sources were $301,000. The expenses of operation were $207,500, and the interest on the City & Suburban bonds was $87,-500, making a total of expenditures of $295,000.

The following figures, though not official, are believed to closely approximate in round numbers the earnings of the entire Washington Railway & Electric system. The exact figures, as has been stated, are not yet available:

Gross receipts	$1,400,000
Operating expenses	750,000
Net earnings	$650,000
Fixed charges	350,000
Surplus	$300,000

The gross earnings of the allied companies increased for the year, and the operating ratio was reduced from 56 per cent to a trifle over 53 per cent. The fixed charges were 4 per cent on about $8,750,000 bonds, or $350,000. The surplus for the year increased nearly $100,000, the surplus for the preceding year having been $201,000. It will be seen that the surplus of $300,000 is equal to 3.5 per cent on the $8,500,000 preferred stock of the company.

The directors elected for the coming year are as follows: For the Washington Railway & Electric Company, George Truesdell, George W. Young, George H. Harries, James B. Lackey, S. L. Shober, Jr., A. L. McDermott and R. T. W. Duke, Jr. The directors of the subsidiary companies were the same, except that of W. F. Ham and H. W. Fuller were added. The officers of the main company and of the subsidiary companies are as follows: Alan L. McDermott, president; George H. Harries, vice-president; W. F. Ham, treasurer; James B. Lackey, secretary.

ANNUAL MEETING AND REPORT OF THE DETROIT UNITED RAILWAY

The annual meeting of the Detroit United Railways Company was held in that city a few days ago. The detailed operating report was presented and directors were re-elected as follows: Henry A. Everett, E. W. Moore, R. A. Harman and H. R. Newcomb, of Cleveland; R. B. Van Cortland, of New York; Arthur Pack, of Pontiac and Detroit; H. S. Holt, of Montreal, Que., and J. C. Hutchins, of Detroit. At a subsequent meeting of the board of directors these officers were re-elected: H. A. Everett, chairman board of directors; J. C. Hutchins, president; Arthur Pack, vice-president; Geo. H. Russel, of Detroit, treasurer; Edwin Henderson, of New York, secretary, and A. E. Peters, of Detroit, assistant secretary.

The report shows that the gross earnings for the year amounted to $4,386,974, an increase over 1902 of $425,572, while the net earnings for 1903 were $1,772,997, as against $1,700,616 for 1902. The surplus amounted to $311,860, as against $282,961 in 1902. The falling off in net earnings is accounted for by the increased cost of coal, labor and materials. The interest on the funded and floating debt for the year amounted to an even $1,000,000, as against $948,902 in 1902. An expenditure of $870,070 for additions and betterments was provided for by proceeds from the sale of bonds. During the year there were retired $16,000 of 5 per cent bonds, the balance of the issue of $275,000 of the Detroit Suburban Railway, and $200,000 of 6 per cent bonds of the Wyandotte & Detroit River Railway. To provide for these bonds there were taken out of escrow $216,000 of the Detroit United Railway 4½ per cent bonds.

A synopsis of the annual report is given below:

On Jan. 1, 1903 the number of miles of street railway operated was 513.9. There has since been added 19.9 miles, making a total of 533.858 miles.

DETROIT UNITED

Gross earnings		$3,842,868
Operating expenses, including taxes		2,246,947
Net earnings from operation		$1,595,921
Income from other sources		22,076
Gross income from all sources		$1,617,997
Deductions—		
Interest on funded and floating debt	$868,113	
Dividends	500,000	
		$1,368,113
Surplus income		$249,884

RAPID RAILWAY SYSTEM

Gross earnings	$454,946
Operating expenses, including taxes	310,049
Net earnings from operation	$144,897
Income from other sources	4,669
Gross income from all sources	$149,566

Deductions—	
Interest on funded debt	$125,050
Surplus income	$24,516

SANDWICH, WINDSOR & AMHERSTBURG RAILWAY

Gross earnings	$89,160
Operating expenses, including taxes	56,980
Net earnings from operation	$32,180
Income from other sources	12,117
Gross income from all sources	$44,297
Deductions—	
Interest on funded debt	$6,837
Surplus income	$37,459

DETROIT UNITED RAILWAY, RAPID RAILWAY SYSTEM AND SANDWICH, WINDSOR & AMHERSTBURG RAILWAY

	1903	1902	1901
Gross earnings	$4,386,974	$3,961,402	$2,919,171
Operating expenses, including taxes	2,613,976	2,260,786	1,596,765
Net earnings from operation	$1,772,997	$1,700,616	$1,322,405
Income from other sources	38,863	31,247	23,066
Gross income from all sources	$1,811,860	$1,731,864	$1,345,472
Deductions—			
Interest on funded and floating debt	$1,000,000	$948,902	$675,343
Dividends	500,000	500,000	500,000
	$1,500,000	$1,448,902	$1,175,343
Surplus income	$311,860	$282,961	$170,129

The total number of passengers carried on all lines during the period was 110,100,650, as against 98,378,427 in 1902. The average revenue from each passenger paying fare was 4.9 cents, but the transfers and deadheads brought the average for all passengers carried down to 3.8 cents.

The car mileage for the year was 21,730,898, and the net earnings per car-mile, .0816.

The tracks, rolling stock and other property have been efficiently maintained during the past year.

There has been charged out on the balance sheets under the head of "Additions and Betterments" as follows:

Organization expenditures	$5,000
Tracks	218,059
Electric-line construction Additional feed-wires.	59,261
Cars Fifty modern double-truck closed cars; the assembling of 200 motors and additions to 20 open cars.	240,976
Miscellaneous equipment Two concrete mixers, additional snow-plows and stone crushers.	5,693
Motor equipment Two hundred new 40-hp motors.	129,823
Air-brakes and compressors The instalment of ninety-five air-brake equipments and four air-compressing stations.	32,293
Power stations The completion of one 1500-kw and two 1000-kw generators, and one Filer & Stowell compound engine, also complete coal and ash-handling machinery in Station B.	104,214
Monroe Avenue shops Additions to this company's general shops.	59,545
Car houses Additions to the Jefferson Avenue, Woodward Avenue and Michigan Avenue car houses, and the building of a new car house and yard on Gratiot Avenue.	29,769
Harper Avenue property Additional buildings for the track department.	16,792
Michigan Avenue crossings Separation of grades of the Michigan Central and Grand Trunk Railways.	6,845
Wyandotte Division Extensions to car houses and additional feed-wire.	13,388
Orchard Lake Division Track work in Pontiac.	4,103
Pontiac Division Side tracks.	2,466
Flint Division New car house and track work in the city of Flint.	41,842
	$870,070

In addition to the above, there has been expended on the Rapid Railway system and on the Sandwich, Windsor & Amherstburg Railway as follows:

Rapid Railway system The building of 3.227 miles of main and side tracks; the addition of six modern double-truck cars with air-brake equipment, including compressor station; additional feed and trolley wire, and extensions to several car houses.	$140,723
Sandwich, Windsor & Amherstburg Railway The completion of 13.132 miles of track (Amherstburg extension); standardizing of tracks on London Street, Windsor; two new double-track cars, and extensions to lighting plant in city of Windsor.	315,267

NORTHWESTERN ELEVATED REPORT, CHICAGO

The report of the Northwestern Elevated Railroad Company, of Chicago, for the year 1903 shows that property to be prospering, although a raise in wages twice during the year and an increase in taxes has reduced the net income below what the natural increase would make it. The figures in detail are as follows:

	1903	1902
Passenger earnings	$1,246,473	$1,167,529
Other earnings (including loop net earnings)	295,566	243,469
Total earnings	$1,542,039	$1,410,998
OPERATING EXPENSES		
Maintenance of way and structure	$56,427	*$58,063
*Maintenance of equipment	66,415	51,261
Conducting transportation	370,366	306,143
General expenses	52,037	48,934
Net earnings	$996,792	$946,597
CHARGES		
Loop account, 1½ cent per passenger carried	$124,666	$116,774
Taxes	109,591	86,309
Interest on bonds	560,000	554,091
Surplus for year	$202,534	$189,432
Previous surplus	471,729	282,297
Surplus forwarded	$674,263	$471,729

STATISTICS

Ratio of operating expenses, including maintenance reserve, to earnings	42.59 %
Ratio of operating expenses, including maintenance reserve, loop account and taxes, to earnings	60.76 %
Daily average of passengers carried in 1900	47,594
Daily average of passengers carried in 1901	55,690
Daily average of passengers carried in 1902	63,986
Daily average of passengers carried in 1903	68,310

Increase in 1903 over 1902, 6.76 per cent.

* Includes $36,000 charged into operating expenses and set aside for future needs.

ANNUAL REPORT OF THE CROCKER-WHEELER COMPANY

The annual report of the Crocker-Wheeler Company, Ampere, N. J., for the year ending December 31, 1903, shows a decided gain over the preceding year. The results of the year's operation must be highly gratifying to the officers and stockholders, and it is certainly an encouraging showing for all interested in electrical development. While this company is widely known as one of the leading manufacturers of large generators and power motors, it will come as a surprise to those who have not followed closely the course of electrical development to learn that last year its gross business amounted to more than $2,000,000; in other words, it turned its capital over twice in twelve months. The gross profit for the year's operations was $519,781, and, after paying fixed charges, dividends, reserves, etc., a balance was carried to surplus of $167,994, making the total surplus to date $408,868. At the time of the report orders amounting to more than a half million dollars were passing through the works, which, though recently enlarged, are now crowded to their capacity. President Wheeler, under whose able management this institution has grown up, is to be congratulated on this evidence of stability and prosperity.

FAVORABLE DECISION FOR THE COMPANY IN THE NEW YORK TRANSFER CASE

On Friday, Jan. 29, the Court of Appeals dismissed the appeal of James S. Lenmaier from a decision of the lower courts denying him a mandamus to compel the Interurban Street Railway Company, of New York, to give free transfers at Eighth Avenue and One Hundred and Twenty-Fifth Street.

Justice O'Brien, writing the opinion, declares that this is not the proper remedy, and suggests that the statute provides a penalty of $50 in favor of any individual who has been refused a transfer where one should legally be issued, and that in addition he may institute an action for damages, to which he may have been subjected in consequence. In addition, Justice O'Brien says, the Attorney-General is authorized to bring action to vacate the charter of any railroad company that violates the law, and a refusal to give transfers in certain cases would doubtless bring a corporation within the scope of that statute.

Provision is also made, it is added, by the law for the investigation by the Railroad Commissioners of complaints of neglect of duty by railroad corporations, and their recommendation is enforceable by mandamus. A mandamus, it is held, is not the proper remedy until after action by the commissioners. The case of Mr. Lehmaier, representing the Transit Reform Committee of One Hundred, was passed upon by Justice O'Gorman, of the Supreme Court, and came up in the Appellate Division on June 19, last.

A RADICAL BILL IN MASSACHUSETTS

A radical bill has been introduced into the Massachusetts Legislature by Dr. Julius Garst, one of the representatives from Worcester. The bill provides that the selectmen of a town, or the aldermen of a city shall, in granting a franchise for a street railway company, include the payment of such sum as they deem proper by the grantee; that all existing locations expire July 1, 1924, and that all grants of locations shall be for a period of not more than twenty years. It is provided that the city or town may take over the property of the street railway on the payment of the cost of duplication, less depreciation, of the property. In case of a disagreement the price shall be fixed by the Railroad Commission. A two-thirds vote of the citizens at an election is required before a city or town may purchase a street railway. Provision is also made for a new grant of a location after the twenty years limit has expired, either to the original grantee or to a new party. In case a new grantee comes in he shall take over the property of the original grantee at the cost of duplication, less the depreciation. There is also provision for approval by popular vote of any grant, provided it is requested by 5 per cent of the citizens of the city or town.

Dr. Garst has introduced a similar bill relative to gas and electric light companies. He represents one of the most intelligent constituencies in Worcester, but his propositions have never been given the approval of his constituents.

THE FAMOUS CROSSING CASE IN NEW JERSEY

The famous Yardville crossing case is expected to be settled at an early date. The Mercer County Traction Company (a subsidiary company to the Trenton Street Railway, of Trenton, N. J.), having won again in the Court of Chancery, it is believed that there will not be any great delay in the higher courts. Once the case is finally decided in favor of the Traction Company, the local cars can run to Crosswicks and Allentown, and it is possible that the line would be continued toward the seashore. The fight, which has been reviewed at length in the Street Railway Journal, has been a lesser rival of the famous Croydon entanglement, the scenes of which were laid a dozen miles away in Pennsylvania. In both cases the Pennsylvania Railroad Company has been the opponent, and the fight has been bitterly contested. The Croydon fight included a dozen railroad charters, a dozen legal battles and several personal encounters. It was finally settled, after seven years, by a shrewd move upon the part of Wilbur F. Sadler, Jr., who came into control of the Philadelphia, Bristol & Trenton Street Railway. The Yardville fight has been devoid of personal encounters, but it has bristled with legal technicalities. Owing to an oversight in not accepting an ordinance in the earlier days of construction the Trenton Street Railway Company has been deterred from crossing the Pennsylvania's single track at Yardville, and three times the case has been fought through all the courts of the State. The Traction Company always won in the lower courts, and lost in the higher. It is believed that every loophole has been closed, and that the end is in sight. In the vicinity of the proposed crossing public sympathy has been unanimously with the Traction Company.

COMPLIMENTS FOR LAKE STREET ELEVATED MANAGEMENT

The motormen and conductors of the Lake Street Elevated Railroad at Chicago, at a recent meeting, decided not to reopen the matter of wages this year, and incidentally said some very complimentary things about the fair and considerate treatment they are receiving from the management of that road and Superintendent C. A. Gage in particular.

A THIRD-RAIL LINE TO COMPETE WITH NORTHERN SECURITIES ROADS

Prominent interests in the West are arranging for the organization of a company to build a third-rail electric railway between Duluth and Minneapolis. The plans of the promoters have progressed so far that the statement has been made that the Minnesota Central Railway Company has been selected as the title of the new company. As at present outlined, the road will be standard gage, 135 miles long, or 17 miles shorter than the Great Northern or Northern Pacific lines, between the points named. The new line, with its shorter haul between the cities and the advantages that will accrue to it from the use of electricity, is expected to be a formidable competitor of both of the steam lines mentioned. Among those reported to be interested in the company are: John J. Allen, J. Inist, of Minneapolis, and F. B. Rossom, of Virginia, prominent in iron land matters on the Mezaba.

RECEIVER FOR CHICAGO & SOUTH SHORE

The Royal Trust Company, of Chicago, and A. G. Ambler, as trustee, have made an application in the Federal Court for the appointment of a receiver for the Chicago & South Shore Railroad Company. This company operates the interurban line between La Porte and Michigan City, Ind. Application is also made for the foreclosure of a mortgage securing an issue of bonds for $282,000. Judge Anderson at La Porte issued a temporary restraining order forbidding the officers of the company from disposing of the property, pending the hearing of the receivership application Feb. 4.

AN IMPORTANT NEW COMPANY IN OHIO

The incorporation at Columbus, Ohio, on Jan. 28 of the Ohio Union Traction Company is thought to presage an important impending electric railway deal. The capital stock of the company is for the present only $10,000. The incorporators are: Richard Emory, W. A. Morgan, Otto F. Ebring, George E. Thomas and Harry L. Doud. Mr. Emory is superintendent of the Appleyard lines at Columbus. He said the company had already organized with A. E. Appleyard, of Boston, as president; Richard Emory, vice-president; C. F. Coaney, of Philadelphia, secretary; W. L. Pomerene, of Coshocton, Ohio, assistant secretary; G. B. Appleton, of Boston, treasurer. These officers and J. S. Harshman and C. A. Alderman, of Springfield, compose the board of directors.

The purpose of the company as set forth in the articles is to acquire or build and operate an electric railway from Cincinnati to Toledo, with a branch to Columbus and Cleveland. The main line will run from Cincinnati to Toledo, passing through Hamilton, Warren, Montgomery, Clarke, Champaign, Logan, Hardin, Hancock, Wood and Lucas Counties. The other line is to pass through Warren, Montgomery, Clarke, Madison, Franklin, Licking, Muskingum, Coshocton, Tuscarawas, Stark, Summit and Cuyahoga Counties.

There is an electric railway now operating between Cleveland and New Philadelphia, and it is proposed to build from the latter city to Zanesville, there to connect with the Columbus, Buckeye Lake & Newark line, now almost completed to Zanesville. The Appleyard line from Columbus through London to Springfield is now in operation to Dayton. From Dayton to Cincinnati the Cincinnati, Lebanon & Dayton line will be used. It is completed and in operation between Cincinnati and Lebanon. All told, it will be necessary to construct about 75 miles of additional track to make a continuous line from Cincinnati through Columbus to Cleveland.

The line from Cincinnati to Toledo may be completed for less money. The Findlay, Toledo & Bowling Green Road, connecting Toledo and Findlay, is in operation, and the Urbana, Bellefontaine & Northern runs from Dayton to Bellefontaine, so that a gap of only about 40 miles of road needs to be filled in.

ROCHESTER COMPANY TO INCREASE STOCK

A special meeting of the stockholders of the Rochester Railway Company, of Rochester, N. Y., is to be held Feb. 10 for the purpose of considering and authorizing an increase in the capital stock of the company from $5,000,000 to $5,500,000, and for the purpose of making such part of the issue of such increase of stock, preferred stock, and such part common stock as the stockholders may determine, and to transact such other business as may properly come before the meeting. The money will be used in continuing the improvements started some time ago. It is the purpose of the company to place the road in the best condition possible. A rumor has been current that the company is planning to absorb the Rochester & Eastern Company, and eventually to purchase the Rochester Gas & Electric Company.

BIDS FOR NEW SUBWAY IN NEW YORK

Formal application was renewed last week in a communication sent to the Rapid Transit Commission by August Belmont, embracing a report made by John B. McDonald, the subway contractor, for permission to build various extensions to the subway system in Manhattan and the Bronx. Again permission is asked to construct what is called the Broadway extension. Mr. McDonald says that he is not in favor of abandoning this line from Forty-Second Street to the Battery.

In Mr. McDonald's report, which, Mr. Belmont writes, meets with his entire approval, it is pointed out that this extension would make it possible to build a subway from Thirty-Third Street to the new Pennsylvania Railroad station.

It is also recommended that a three-track tunnel be built on Lexington Avenue from Forty-Second Street to and under the Harlem River, and on through Third Avenue to 149th Street.

This is taken as an indication that the Interborough Company, which controls the now nearly completed subway system, will be a rival bidder for the Lexington Avenue extension, which was some time ago suggested by Thomas F. Ryan on behalf of the Interurban Street Railway Company. The Interurban suggestion was not only to build an extension along Lexington Avenue, but through a cross street between Thirty-Fourth and Forty-Second Streets to the West Side and along the North River front to the Battery.

These extensions, in Mr. McDonald's opinion, will meet the most pressing demands for the subway service.

PRUSSIAN PUBLIC WORKS MINISTER ON THE HIGH-SPEED ELECTRICAL RAILWAY

Before the budget committee of the Prussian Diet, Jan. 26, Minister of Public Works Budde, discussing the recent electrical rapid transit experiments, said:

"The studies are still in their preliminary stages. We cannot undertake the transportation of the general passenger public electrically. It is still uncertain whether such roads can be economically profitable. The experiments will be continued with necessary precautions. The operation of the suburban road from Berlin to Grosslichterfelde gives the most favorable results, and we shall soon see the practical introduction of electricity on the Hamburg Elevated Railroad. The Prussian Railroad administration will utilize the results of all these experiments."

CLEARING THE WAY IN CHICAGO

At last some little effort is being made in Chicago to stop unnecessary delay of cars by teamsters, and several arrests have been made. An amusing aspect of the situation is revealed in the following paragraph, which appeared in the Chicago "Inter-Ocean":

Ingratitude is what the union teamsters are charging the union street car men with. The Keg Beer Drivers' Union has appointed a committee to visit the unions of the street car men, and ask them why they have so soon forgotten past favors. The trouble comes as a result of the crusade now being carried on against teamsters who get on the tracks and refuse to move out. Time was, the teamsters allege, when the street car men were anxious to have drivers get in the way and impede the progress of cars manned by non-union men. Now matters are different, and the street car men are appearing as witnesses to prosecute their erstwhile allies. Nicholas Funk, who was arrested a few days ago and fined by Justice Caverly for blocking a street car, is a member of the Keg Beer Drivers' Union. Further, he says it was impossible for him to get his heavy wagon out of the tracks, and his feelings are hurt. So was his pocketbook to the extent of $5. He wants redress, and he has appealed to his union to get it. The union has decided to take the matter up. "The teamsters have fought and bled for the street car men," said one teamster yesterday who had recollections of his first introduction to a policeman's club during the recent street car strike. "It's a shame that they should turn against us now."

This paragraph, in addition to its mirth-producing qualities, gives an excellent insight into the true workings and effects of unionism. It would not be at all surprising if the "Keg Beer Drivers' Union" should seriously take up the grievances of its "persecuted and prosecuted" member. It is just because such grievances as this are being continuously taken up and considered by unions that managements of large undertakings are so averse to seeing their employees pass under union control.

POLE AND TIE YARDS

Among cedar companies in Michigan it is the custom to ship the poles which are bought from small producers and also those lumbered off their own lands, into different convenient storage yards. There the poles are assorted into their different sizes, receiving usually a second careful inspection, the first being made in the woods. Of course, some companies still endeavor to ship the greater portion of their stock direct from the woods, but this is so apt to cause delay in getting cars and confusion in filling "straight" carloads of some one size from a small stock, that the more experienced companies have abandoned it almost entirely.

The small margin in poles and the fierce competition among the buyers of the different companies in the woods has led to the adoption of every economy possible, but this yard expense is something that must usually be borne, if orders are to be filled promptly and accurately, especially the larger orders.

However far this reform, if it may be called that, has gone in the pole business, it has not yet been very extensively introduced in the cedar tie business. The Maltby Lumber Company, of Bay City, Mich., is one of the few firms that has applied the methods of the pole business to ties.

A railway company is very apt to find itself short a few thousand ties, or possibly but a carload or two. Then the advantage of calling on a section of the country where ties can be and are shipped every month in the year is readily appreciated. High water, poor roads, lack of water, have no effect on the shipment of ties that are concentrated in lots of 10,000 to 15,000, especially when piled in yards located in the same favorable position as regards competing railroads, as the best pole yards.

THE COLUMBUS, GREENSBURG & RICHMOND LINE

The stockholders of the Columbus, Greensburg & Richmond Traction Company are to authorize an increase in the capital stock of the company from $1,000,000 to $2,500,000. Contracts for beginning the construction of the line have been signed with Jeup & Moore, of Indianapolis, engineers of a number of electric roads, and the company expects to be ready to let contracts for material as soon as the specifications have been prepared, which will be early in April. It is the intention of the company to build 96 miles of road from Columbus, Ind., through Greensburg and Connersville to Richmond, double track, third rail, all wires to be laid in vitrified conduits. Representatives of the MacAfee Company, of Philadelphia have just made an inspection in the interest of the bondholders, and pronounce the project a thoroughly stable one. The company is arranging for other lines intersecting in Southern Indiana, with Louisville and Cleveland as objective points. The system will aggregate 325 miles. Bonds in the amount of $2,500,000 have been sold, and construction work will be begun as soon as the weather will permit.

SEATTLE ELECTRIC COMPANY'S EARNINGS

The Seattle Electric Company, on its street railway lines, earned gross $1,492,664 in 1903. Two per cent of this amount has been paid to the city of Seattle. Under the terms of the franchise the city receives 2 per cent of the gross earnings until Jan. 15, 1920, and 3 per cent during the remainder of the life of the franchise Besides the city's percentage of the gross earnings, which amounted to $27,208 last year, the company spent approximately $150,000 in the improvement of streets of direct benefit to the city. On every street paved last year on which there were street car tracks the company paved a strip 18 ft. wide.

In 1903 there were 31,400,000 paid fares, and 41,953,967 passengers were carried. The population of Seattle in 1900 was 80,671, and it has been growing rapidly since then. It will thus be seen that the earnings per capita of population are high, as the hills in Seattle are conducive to riding. Further than this, there is not so much the disposition to save the small price of car fare as in Eastern cities.

REMOVAL OF SNOW IN NEW YORK

The government reports show that the January record for snowfall in New York city was phenomenal, and this, combined with the continued cold weather, has taxed the facilities of the railway companies in the city to their uttermost. Most of the companies purchased a large equipment of snow sweepers and plows a little over a year ago, and had little use for them during the mild winter of 1902-03. The apparatus, however, has been in almost continuous service during the last thirty days, and by their use the companies have thus kept their lines in operation when practically all of the steam railroads entering the city were blockaded. According to President Vreeland, the weather conditions have been the worst experienced during his connection with street railway service in New York city.

Considerable unwarranted criticism has appeared in the daily papers, during the last two or three weeks, directed against the Interurban Street Railway Company, because during the storms, certain fenders were temporarily removed from a number of the company's cars. It was assumed from this fact that the company intended partially to discontinue the use of fenders, but nothing is further from the truth. Owing to the large amount of snow which has fallen, the sides of the streets have been blockaded, and drays and other vehicles have been driven onto the tracks in the center of the street, where the electric cars have often been compelled, in self-defense, to assist the overworked horses by pushing the drays from behind. The Providence fender, which is used on the lines of the company, is designed with an elastic cushion over the car buffer to prevent injury to persons caught in the fender, and it was considered desirable by the managers of the company to remove the entire fender on some of the lines until the exigencies of the situation should pass over. President Vreeland states that a number of these fenders have already been replaced, and it is not the intention to take a backward step and abandon either fenders in general, or change the type of fender employed.

NEW PUBLICATIONS

Air-Brake Catechism. By Robert H. Blackhall; 312 pages; two large educational charts printed in colors. Price $2. Published by Norman W. Henley Publishing Company, New York.

This is practically a new book, as it is a complete revision and rearrangement of the work of this title as published in 1898 and revised in 1900, and is brought down to date in this, the eighteenth, edition. It comprises a complete study of the Westinghouse air-brake equipment, and includes the latest devices and inventions used in connection with this system. All parts of the air-brake, their troubles and peculiarities, are considered, and a practical way is suggested to find and remedy them. The book describes in detail the principal features of the Westinghouse air-brake system, and gives some ve-y valuable information to those who are in charge of these equipments. The matter is presented in the form of 1500 questions and answers.

Locomotive Breakdowns, Emergencies and Their Remedies. By George L. Fowler; 250 pages. Price $1.50. Published by Norman W. Henley Publishing Company, New York.

As the title indicates, this work treats of accidents that are likely to happen to locomotive engines while in operation, and remedies are suggested in almost every possible contingency. The author discusses the parts of the locomotive and the several types of compound locomotives, and furnishes some valuable information and suggestions as to the tools and appliances needed for making engine repairs and their use.

L'État actuel de l'Électroculture. By E. Guarini. Brussels, 1903. Published by Ramlot, Fréres et Soeurs. Paper, 24 pages, illustrated. Price, 1 fr.

This is a brief review of the effect on plants of electric currents. This subject is attracting considerable attention among agricultural associations in Europe, and the writer gives views and observations which seem to show that electrical treatment has a stimulating effect on certain kinds of plants, due, probably, to chemical changes in the soil, but nothing is said of the commercial aspects of this form of electrolytic treatment.

Elektrisch Betriebene Strassenbahnen Taschenbuch. By S. Herzog. Munich and Berlin, 1903. Published by R. Oldenberg. Morocco, 475 pages and 377 illustrations. Price, 8 m.

This is the first hand-book on electric railway work published in Germany, so far as we know, and shows a conscientious study of the development of the industry. Mr. Herzog does not confine his subject to the electrical and mechanical departments of his subject. He discusses also specifications, prospectuses and operating accounting, and gives a table of average prices of different railway apparatus, the standard German underwriters' rules, the operating regulations of the Munich tramways, part of the German railroad law, etc. The book is well illustrated by diagrams, and has also a set of tables of squares, cubes, logarithms and trigonometrical functions.

PERSONAL MENTION

MR. WILLIAM G. EVANS, president of the Denver City Tramway Company, has been spending some time in New York.

MR. ARTHUR WARREN, who created and organized the Westinghouse Companies' Publishing Department, and has managed it from the beginning, resigned his position on Feb. 1.

MR. WILLIAM W. PATTERSON has resigned as superintendent of the Tarentum Traction Passenger Railway Company, of Tarentum, Pa., and Mr. A. W. Hargett, of Pittsburg, has been elected as his successor. Mr. Hargett has been connected with street railway work for the past sixteen years, and was in the employ of the Mellons, of Pittsburg, six years. He formerly was the superintendent of the Hilltop Division of the Pittsburg & Birmingh-m lines.

MR. OSCAR T. CROSBY, of Washington, D. C., who was formerly prominently connected with the electric railway industry, has recently returned to Paris from a private exploring expedition in Central Asia. Starting from St. Petersburg last May, Mr. Crosby, in turn, visited Russian Turkestan, Chinese Turkestan and Little Thibet. Mr. Crosby has been invited to deliver lectures before the London and French Geographical Societies on some of the places visited.

MR. H. C. HARTLEY has tendered his resignation as superintendent and purchasing agent of the Lincoln Traction Company after nearly ten years' service. Mr. Hartley said the resignation was prompted by business reasons, and that he will remain in Loncoln, which has been his home for eighteen years. Mr. Hartley was employed by the company as consulting engineer in February, 1894 and June 1, 1894, he took charge of the mechanical and engineering end of the business. He has been in that position up to the present time.

MR. J. H. VAN BRUNT, general manager of the St. Joseph Railway, Light, Heat & Power Company, of St. Joseph, Mo., has been elected vice-president of the company, and hereafter will perform the dual duties of vice-president and general manager. In order to relieve Mr. Van Brunt of the details of his managerial duties, the position of general superintendent has been created, to which place Mr. Charels F. Hewitt has been appointed. Mr. Hewitt is at present with the South Bend & Elkhart Electric Railway & Light Company, of South Bend, Ind.

MR. R. A. AMMAN was recently noted in the Street Railway Journal as having been appointed to the position of master mechanic of the Columbus, Delaware & Marion Electric Railroad Company. In making this statement an error was inadvertantly made. No appointment of that kind has been made, and Mr. G. G. Crane still is master mechanic of the company. Mr. Amman was considered for appointment to the position of assistant master mechanic of the company, but later other arrangements were made. Since then Mr. Amman has severed his connection with the company.

MR. ALBERT H. STANLEY, assistant general manager of the railway department of the Public Service Corporation, of New Jersey, under Mr. Walter W. Wheatly, who recently resigned, has been appointed to the position of general superintendent of the railway department of the company, in which position he will have charge of the practical operation of the street railway lines. Mr. Stanley came on to the East from Detroit, where he was connected with the Detroit United Railway, shortly after the Public Service Corporation took over the New Jersey properties and therefore is thoroughly familiar with the local conditions. The position of general manager, which Mr. Wheatly held, has really been abolished, but in its place has been created the position of assistant to the president. Col. Edwin W. Hine, who has been executive agent of the corporation, has been appointed to this new position to represent the president in all matters pertaining to the street railway department. His headquarters will be in Jersey City. Col. Hine has been connected with the street railways of Northern New Jersey for a number of years, and because of his business and social connections, is particularly well known throughout the entire territory served by the company.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Including all lines operated.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Dec. '03	71,654	41,290	30,363	23,266	7,098
	1 " " '02	64,155	35,650	28,505	17,984	10,521
	12 " " '03	882,276	482,575	399,701	268,132	131,669
	12 " " '02	745,044	410,793	334,251	205,068	129,183
AURORA, ILL. Elgin, Aurora & Southern Traction Co.	1 m., Dec. '03	35,583	23,143	12,439	9,256	3,184
	1 " " '02	34,980	21,871	13,109	9,050	4 060
	6 " " '03	242,261	140,030	102,231	55,118	47,112
	6 " " '02	223,877	125,710	98,167	54,298	43,870
BINGHAMTON, N. Y. Binghamton Ry. Co.	1 m., Dec. '05	19,158	9,669	9,489	------	------
	1 " " '02	18,282	9,656	8,627	------	------
	6 " " '03	128,187	64,191	63,997	38,141	25,856
	6 " " '02	116,617	63,466	53,152	31,219	21,933
BUFFALO, N. Y. International Trac. Co.	1 m., Nov. '03	314,006	------	------	------	------
	1 " " '02	292,878	------	------	------	------
	5 " " '03	3,649,543	------	------	------	------
	5 " " '02	3,143,194	------	------	------	------
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co	1 m., Dec. '03	24,020	15,964	8,057	------	------
	7 " " '03	285,310	133,040	152,269	------	------
Chicago & Milwaukee Elec. Ry. Co.	1 m., Dec. '03	24,085	10,318	13,767	------	------
	1 " " '02	12,859	6,580	6,280	------	------
	12 " " '03	292,247	98,627	193,620	------	------
	12 " " '02	190,110	79,364	110,746	------	------
Metropolitan West Side Elevated R. R. Co	6 m., Nov. '03	1,051,639	496,004	555,635	214,935	340,700
South Side Elevated R. R. Co	12 m., Dec. '03	1,679 310	994 376	684,934	442,883	242,051
	12 " " '02	1,483,843	862,338	621,505	442,874	178,631
CLEVELAND, O. Cleveland & Southwestern Traction Co	1 m., Dec. '03	33,418	21,709	11,709	------	------
	1 " " '02	24,711	17,650	7,061	------	------
	12 " " '03	445,168	264,232	180,936	------	------
	12 " " '02	300,846	171,615	129,231	------	------
Cleveland, Painesville & Eastern R. R. Co	1 m., Dec. '03	15,620	10,172	5,448	6,568	† 1,120
	1 " " '02	14,371	10,333	4,038	6 293	† 2,255
	12 " " '03	214,631	127,149	87,482	78,007	9,475
	12 " " '02	189,187	105,669	83,518	74,551	8,967
DETROIT, MICH. Detroit United Ry *a*	1 m., Dec. '03	357,022	227,631	129,398	87,110	42,288
	1 " " '02	341,283	201,052	140,231	82,595	57,636
	12 " " '03	4,425,836	2,613,976	1,811,860	1,000,000	811,860
	12 " " '02	3,992,650	2,260,786	1,731,864	948,902	782,962
DULUTH, MINN. Duluth Superior Traction Co	1 m., Dec. '03	51,467	30,718	20,749	10,834	9,915
	1 " " '02	48,769	28,699	20 070	10,054	10,016
	12 " " '03	622,045	345,327	276,717	126,590	150,128
	12 " " 02	538,031	288,373	249,658	116,275	133,382
HAMILTON, O. Cincinnati, Dayton & Toledo Traction Co	7 m., Dec. '03	327,954	173,384	154,570	112,511	42,059
	7 " " '02	302,668	155,951	146,717	113,860	32,857
	12 " " '03	514,778	289,245	225,533	192,924	33,209
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., Nov. '03	15,094	10,391	4,703	2,827	1,875
	1 " " '02	13,240	9,236	4,005	2,604	1,400
	12 " " '03	189,449	121,937	67,511	34,840	32 671
	12 " " '02	170,009	109,277	60,732	33,924	26,809
HAZLETON, PA. Lehigh Traction Co.	1 m., Dec. '03	11,092	5,984	5,108	------	------
	1 " " '02	9,553	5,216	4,337	------	------
	12 " " '03	142,770	77,095	65,675	------	------
	12 " " '02	100,950	58,505	42,445	------	------
HOUSTON, TEX. Houston Electric Co.	1 m., Nov. '03	30,736	25,689	5,047	8,109	† 3,063
	1 " " '02	37,597	21,668	15,929	6,250	9,679
	12 " " '03	416,834	272,582	144,252	82,797	61,455
	12 " " '02	358,313	202,160	156,153	------	------
JACKSONVILLE, FLA. Jacksonville Electric Co	1 m., Nov. '03	24,936	14,473	10,463	3,188	7,275
	1 " " '02	19,542	12,542	7,000	2,667	4,333
	12 " " '03	245,341	162,986	82,355	36,151	46,205
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Dec. '03	327,147	133,956	193,191	75,376	117,815
	1 " " '02	282,484	118,747	163,738	71,257	92,480
	12 " " '03	3,096,324	1,526,910	1,569,414	871,685	697,730
	12 " " '02	2,776,294	1,286,035	1,490,258	803,546	686,713
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., Dec. '03	359 184	157,655	201,528	61,020	140,507
	1 " " '02	331,331	151,456	179,875	60,518	119,357
	12 " " '03	4,063,938	1,878,051	2,185,888	731,041	1,454,847
	12 " " '02	3,612,211	1,630,170	1,982,041	711,718	1,270,324
MONTREAL, QUE. Montreal St. Ry. Co	1 m., Dec. '03	189,266	128,032	61,234	17,273	43,961
	1 " " '02	177,367	113,917	63,450	17,406	46,044
	3 " " '03	585,428	355,350	230,078	52,367	177,711
	3 " " '02	531,645	313,965	217,680	49,474	168,207
MUNCIE, IND. Muncie, Hartford & Ft. Wayne Ry. Co.	1 m., Dec. '03	12,738	5,393	7,345	------	------
	10 " " '03	115,399	56,261	59,139	------	------
PEEKSKILL, N. Y. Peekskill R. R. & Lighting Co	6 m. Dec. '03	60,660	*33,397	27,263	14,375	12,888
	6 " " '02	56,546	*33,817	22,729	12,500	10,229
	12 " " '03	106,757	*63,605	43,152	27,215	15,937
	12 " " '02	86,795	*56,392	30,403	23,125	7,277
PHILADELPHIA, PA. American Railways	1 m., Dec. '03	110,311	------	------	------	------
	1 " " '02	96 431	------	------	------	------
	6 " " '03	753,639	------	------	------	------
	6 " " '02	640,377	------	------	------	------
ST. LOUIS, MO. St. Louis Transit Co.	1 m., Dec. '03	600,703	------	------	------	------
	1 " " '02	550,551	------	------	------	------
	12 " " '03	7,259 460	------	------	------	------
	12 " " '02	6,438,788	------	------	------	------
SAO PAULO, BRAZIL. Sao Paulo Tramway, Light & Power Co., Ltd	1 m., Dec. '03	120,500	35,300	85,200	------	------
	1 " " '02	105,187	33,699	71,488	------	------
	12 " " '03	1,303,813	394,462	909,351	------	------
	12 " " '02	1,123,285	417,916	705,369	------	------
SAVANNAH, GA. Savannah Electric Co	1 m., Dec. '03	44,855	22,760	22,095	10,452	11,643
	1 " " '02	41.179	21,571	19,608	9.583	10,025
	12 " " '03	516,882	307,465	209,417	118,456	90,962
	12 " " '02	475,193	275,509	199,683	------	------
SEATTLE, WASH. Seattle Electric Co	1 m., Dec. '03	178,024	142,211	35,813	22,873	12,940
	1 " " '02	174,313	121,136	53,178	23,469	29,709
	12 " " '03	2,084,625	1,513,597	571,029	287,913	283,115
	12 " " '02	1,842,736	1,277,277	565,459	264,575	300,884
TERRE HAUTE, IND. Terre Haute Elec. Co.	1 m., Nov. '03	41,491	27,400	14,092	8,549	5,543
	1 " " '02	33,921	22,420	11,501	6,471	5,030
	12 " " '03	464,104	305,363	158,741	84,319	74,422
	12 " " '02	324,335	262,770	61,565	76,104	†14,539
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Dec. '03	154,494	75,336	79,158	39,292	39,866
	1 " " '02	139,608	63,889	75,719	38,756	36,963
	12 " " '03	1,663,794	856,526	807,268	488,200	319,068
	12 " " '02	1,459,091	726,779	732,312	459,037	273,275
Lake Shore Electric Ry. Co	1 m., Dec. '03	46,415	35,314	11,102	20,371	†9,269
	1 " " '02	38,962	30,185	8.777	20,370	†11,593
	12 " " '03	616,484	395,772	220,713	240,746	†20,033
	12 " " '02	466,051	305,878	160,173	240,746	†80,572
YOUNGSTOWN, O.	1 m., Dec. '03	45,645	*25,602	20,043	------	------
	12 " " '03	511,814	*303,041	208,773	------	------

INDEXED

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, FEBRUARY 13, 1904. No. 7.

Published Every Saturday by the

McGRAW PUBLISHING COMPANY

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York,"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Canada and Mexico......................$4.00 per annum
Single copies, first issue of each month, 25 cents; other issues, 10 cents.

To all Countries outside of the United States, Canada and Mexico.... $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.
Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Railways on the Pacific Coast

We have presented several very interesting articles of late upon the electric railways of the Pacific Coast, and these will be supplemented by further contributions from the same section, describing in detail the latest practice in construction and operation. It must be evident to all who have followed this series of articles closely that great progress has been made in electric railroading on the Coast. These improvements have not been confined to city service but have extended to the wider field of suburban and interurban work. The climate of California is favorable to such enterprises, as it makes it possible for a larger proportion of the people doing business in the large cities to have their homes out of town the whole year round, and in California, as in the East, the electric railway has been found to be the ideal means of communication between city and suburban communities.

A fair example of the possibilities of an electric road in building up a suburban resort is found in the growth of San Mateo, which owes its present popularity and prosperity to the high-speed trolley service afforded by the extension of the United Railroads of San Francisco, for in spite of its natural attractions and unrivaled climatic advantages, San Mateo could not be regarded as a desirable place of residence before the trolley made it accessible to the metropolis of the Pacific Coast. Until recently the only means of reaching it from San Francisco was by steam train or driving. The distance, 23 miles, made driving an impossibility as a regular means of going back and forth, and trains were infrequent. Shoppers had to devote a whole day to a trip, theatergoers had to "catch the last train" or spend the night in San Francisco, with incidental hotel expenses, and if business men missed their regular train in the morning or evening they had to wait an hour or more for the next one. Another drawback under the old service was that the steam line did not take its passengers to the business district, making a 10-minute or 15-minute ride by trolley necessary to reach any point in that section. The new trolley line gives a car every half hour, and on Sundays and holidays a 15-minute schedule is maintained; as a result, heavy traffic has been developed on this line, and San Mateo has grown to be a very popular residence district in a very short time.

The "Key Route," another electric system, which is described in this issue, may be accepted as fairly representative of the most advanced practice on the Coast. It is operating in direct competition with steam service, and has been enabled to do this successfully, because of the higher speeds, more frequent trains and greater comfort and convenience afforded by the new equipment. The San Francisco, Oakland & San Jose Railway, which is the official title of this company, has provided ample facilities both in equipment and terminals for handling the traffic which has come to it. The conditions which obtain in this particular instance are peculiar to San Francisco, as are the provisions that have been necessary for hauling this business. Unlike most suburban and interurban lines four-car trains are run, and a printed schedule is followed after the manner of steam roads. Indeed, the very best features of modern steam railroad practice have been embodied.

Still another installation that has attracted much attention is the North Shore suburban division, between San Francisco and San Rafael. Formerly this was operated as a narrow-gage steam railroad, but two years ago ownership of the property changed, and then it was decided to introduce electricity upon the line. The entire roadbed was rebuilt and a double track was put in for most of the way; third-rail equipment was installed, and on part of the road the contact-rail was protected in a manner similar to that on the Wilkesbarre & Hazelton line, and an automatic block-signaling system was introduced, the first to employ alternating current for the operation of the signals in regular commercial service.

The experience of these roads has been so satisfactory that additional electrical equipments are contemplated for similar service, and it is now known that the Southern Pacific is engaged upon plans for the electrification of its suburban division. What is more noteworthy still, the Santa Fe company has secured control of the North Shore Suburban, since the changes here mentioned have been completed, and it is believed that further electrification of steam lines on the Coast will result from the experience gained with those already in operation. This is really a splendid tribute by steam railway managers to the engineers who designed and built these lines, but all who are familiar with the situation agree that it is well deserved.

New Subway Cars

The Interborough Rapid Transit Company announces that it has succeeded in securing a car for operation in the subway which will be absolutely fireproof and practically indestructible. The new type of car was designed by George Gibbs, the consulting engineer of the Rapid Transit Construction Company, especially for this service, and was built at the Altoona shops of the Pennsylvania Railroad Company. It is the first complete metallic car built for passenger service, and is probably the most radical departure that has yet been made from recognized standards by the subway management. But the conditions governing the operations of this underground railway were different from those that obtain in ordinary city railroad properties, and it was found necessary to make special provision for these contingencies. Mr. Gibbs devoted a great deal of study to this problem, and he believes that he has succeeded in producing a car that will meet all objections that have been made against cars for the subway in which wood or any other inflammable material enters. Naturally, a great deal of interest has been manifested in this investigation by steam and electric railway managers throughout the country as well as by car builders. The latter have maintained that the original type of car adopted for the subway met all the requirements, and that the precautions taken for fireproofing afforded ample protection, but the Interborough management, recognizing the sentiment against the use of wooden cars of any description in the subway, endeavored to meet the public demands by providing steel cars for this service.

The principal objections that have been urged against the operation of steel cars are the danger of short-circuiting the system, and in case of a serious accident, such as collision or derailment, the danger of the car framing becoming twisted and distorted so that it might be difficult to rescue passengers. In answer to the first objection it may be said that the electrical hazard should be no greater in a steel car body, and probably would not be as great as with the wooden frame, as serious accidents that might cause damage in the former would in all probability result in much more serious loss through fire in the latter. It is not considered that there is any serious ground for apprehension of danger from the collapse of the steel car body, as particular attention has been given to this feature of construction, and it is believed by experts that the new car is practically indestructible. It would seem that any accident that would demolish one of these coaches would be of such a character as almost to preclude the possibility of the survival of any passengers who might be aboard at the time.

The inventor of the car claims that he has entirely overcome the minor difficulties which have always been urged against this type of construction, chief among which are the objections in the way of noise and extreme heat and cold. Judging from the short experience of the Interborough company with the sample car this claim is justified by the results achieved. Of course, it is possible that continued operation of the car may develop defects and "loosen up" the metal construction so that the noise may become objectionable, but it would seem that these are merely mechanical details which ought readily to be overcome.

When the subject of steel cars was first broached the Interborough Company found it impossible to interest any of the large car builders of the country, and it was only through the courtesy of the Pennsylvania Railroad Company that facilities were afforded for building the sample car. Even after the car was completed many of those familiar with the plans of the company were skeptical as to the outcome of the experiments, and the decision of the management to order 200 cars of this type at once will awaken universal interest. It is unnecessary to say that many modifications of the original plans were found necessary as the work progressed on the sample car, and that the experience gained will result in further changes which will be incorporated in the plans of the new cars. The policy of the subway company throughout this investigation and the spirit which prompted it are highly commendable, and they should go far toward satisfying the public that every possible means to ensure safe operation are being employed. Whatever may be the ultimate decision regarding the practicability of steel cars the Interborough management has not only contributed its share toward the advancement of the art, but it has certainly earned the gratitude of the public and the railway industry for having carried on the most comprehensive experimental investigation of this subject that has ever been undertaken.

Personal Injury Claims in Texas

It is evident that the people of Texas have not fully discarded the theory that corporations are soulless, and consequently are not entitled to the same consideration as individuals. Following this line of reasoning it becomes natural for them to assume an attitude of hostility toward such institutions, to cheat and defraud them wherever opportunity is offered or can be made, and to regard such practices as perfectly legitimate. Measured by this standard the best citizen is the one who gets the most out of the game, and it is evident that there are many Texans eager for that distinction. The records for the last year indicate that Houston is a stronghold of eminent citizens of this class; the army of patriots is constantly receiving accessions to its ranks, and there is no danger that it will be compelled, for some time at least, to open recruiting offices in that section if there is a corporation doing business.

The latest object against which this public zeal has been directed is the Houston Electric Company, and the favorite form of attack is the familiar personal injury claim. Actions for damages aggregating $1,000,000 were instituted during the last year, and to these were added during the first month of the present year claims for upwards of $100,000. At this rate it will not be many months before the amount of damages claimed will approximate the entire value of the property and franchises. As it is, the suits begun last year are for claims aggregating two-and-a-half times the gross receipts of the system for that period. The rapacity of the lawyers and claimants engaged in this litigation has alarmed the conservative element of the population, and the daily papers have even called attention to the disastrous effect of this policy upon the municipality as a whole. Attention is directed to the fact that the street railway company has invested considerable money during the last year in improvements, including new track, pavements between tracks, additional cars and apparatus, all of which has benefited the people directly, as the transportation facilities were increased and improved and employment given to a large force of men. It is, likewise, pointed out that "there have been no big wrecks during the year, and there have been very few accidents of a serious character," in fact, everything tends to show careful management and skillful operation of the property —conditions which would be appreciated in almost any other part of the country—and utterly disproving and discrediting the validity of the claims presented.

But Texas seems bound to preserve its individuality in this respect. It has long had an unsavory reputation because of this tendency to bilk corporations, and many steam railroad and manufacturing enterprises proposed for that State have

been discouraged from putting their plans into effect on this account. All of which is detrimental to Texas, as it has greatly retarded its development, but considerations for the future seem to be of minor importance when there is a chance to hold up a corporation.

Overhaul Your Wires

We wonder how many railway managers can tell off-hand the percentage of energy lost in their respective systems. When we find one who has definite knowledge on this point we are going to ask him the distribution of the loss in (a) the station, (b) the feeders, (c) the working conductors, and (d) the track return. A good many managers have a general idea of the facts, and a few have systematized information, but from the conditions which we have seen not infrequently there are others who could not even give a fairly close guess at the figures. Now, energy costs money, and an electric railroad gets neither profit nor glory from its efforts to raise the mean annual temperature of its territory. It is no joking matter when at times of full load the losses run up to 20 per cent or 25 per cent, let alone more. There are many roads which have well designed feeding systems, but there are at least as many more on which the conditions are almost unbelievably bad. How about a 10 per cent loss before the current leaves the station, 200 volts lost in feeders, or an equal amount lost in the track return? These are not fancy figures, although, happily, not all derived from the same system, and losses nearly as great as these are by no means as rare as might be imagined. We smile now at the No. 6 trolley wire of the good old times, but No. 00 trolley wire can show much larger losses if regularly overworked in proportionate degree. When bus-bars run blue and boosters are perfumed of simmering insulation, it is a sure sign that there is something doing which will show in the yearly balance sheet. All these conditions should be overhauled before the building season and the heavy summer traffic comes on, else trouble will be at hand. Time spent in finding out and stopping losses is time profitably spent, and there is so far too little thus spent in the railway business.

Low efficiency in the distributing system is not necessarily a grave indictment of a road's management, but countenance of such a condition is. Most of the trouble comes not so much from bad engineering at the start as from failure to grasp the effects of increased service. So long as the cars can be run without a positive breakdown the station bears the brunt of the work uncomplainingly. Half the large systems of the country are perpetually behind their demand for station capacity. The management temporizes with a call for increased capacity, and every week makes the situation more difficult to remedy. A new unit ordered after considerable delay falls behind its promised date of shipment, and by the time it is turned over it has to be overloaded. Meanwhile the feeder copper has stayed at its old figure, the work being shifted back to the station, and presently the losses, at first moderate, have risen to startling amounts. A long line served by a booster gets a few new long cars for its increased business, and the loss rises from a hundred volts up to two or even three hundred. An old track lightly bonded is kept in service unchanged because it seems hardly worth while to rebond, when the track must be relaid with a heavier section within a year or two, and before the true state of things is recognized the drop in the return circuit has stealthily crept up to a couple of hundred volts. It is much easier than it seems to lose a hundred kilowatts of regular output by absolutely needless and undetected shortage in conducting capacity, costing many times more than the interest on the necessary copper to avert the loss. And several times this amount of unnecessary loss must be charged against some of the sinning roads. What the added cost may be in extra repairs we will not attempt to figure. Line copper is not, perhaps, a quick asset, but it is a mighty valuable one all the same, and strongly to be recommended.

The moral of all this is that it behooves every manager of an electric road to find out just where his losses of energy are and how great they are. Having this information, the next step is to get after them *seriatim*, and stop them as quickly and thoroughly as may be. They are not all equally serious or equally likely to involve the equipment in disaster, and there is, therefore, room for the exercise of shrewd judgment in applying the remedies. It is not always the most conspicuous drop in voltage that involves the greatest total energy loss. It may be wise to improve the overhead system in one case and to attack the bonding in another, but in order to know what step to take it is first necessary to know just what the trouble is. If new cars are to be added to the equipment it is as easy to prepare for the extra output required before they are put in service as after, and a great deal more satisfactory to the public. Careful and systematic inspection of the general equipment as well as of the rolling equipment pays. As to the latter it is too often a perfunctory sort of examination that passes a car just about as long as it will run. An interurban car took fire the other day, scared the passenger's out of a year's growth, and badly damaged the car itself. The loss, let alone the possible ensuing legal expenses, was enough to have paid an extra inspector. In these days cars do not catch fire unless something is radically wrong, and it is the business of an inspector to see that things are not going to go wrong. The manager of a road has troubles of his own—he has to be in more places and to be doing more things at the same time than any other functionary with whom we are acquainted, but somebody has to look after these very important matters of detail, for success in operating a complicated system comes by looking after details. We do not wish to be prophets of evil, but there certainly is a bad time coming for the road that neglects its conducting system.

Increase in Traffic on Stormy Days

Among other interesting things mentioned in the report of President Thomas Lowry to the stockholders of the Twin City Rapid Transit Company, operating in Minneapolis and St. Paul, is the influence that semi-convertible cars have had upon the traffic during rainy days in summer. A similar observation was noted in these columns about two years ago, and it is again emphasized by President Lowry's report. It would appear from the experience related that when the ordinary open cars were used, enough would walk or stay at home on stormy days in summer to reduce the gross receipts from 25 per cent to 30 per cent. The semi-convertible car which can be closed against a storm at a moment's notice, and is a comfortable convenience on a rainy day, offers sufficient inducement to people to seek the shelter of the cars. Consequently, many who walk or use bicycles in pleasant weather for short trips, now take the cars in rainy weather, where otherwise they would continue their regular practice of walking on rainy as well as pleasant days. Then, too, the fact that closed cars are available in storms doubtless tempts many to venture out in threatening weather who would otherwise stay at home. The report also contains some interesting figures showing the influence of the new, well-warmed, double-truck cars with double windows and double bottoms, in increasing the relative gross receipts of the winter months.

THE SAN FRANCISCO, OAKLAND & SAN JOSE RAILWAY—"THE KEY ROUTE"—I

California has several very good electric railway systems, both city and interurban, of which the more important are those in San Francisco, Oakland, Los Angeles and Sacramento. In the building up of the communities which they serve these roads have been prominent factors. This fact is especially evident in Southern California, with its many attractions for tourists. The present systems are being extended generally, and are being put into better condition; new lines are under construction, and many more have reached only the paper stage, but give good promise of being built during the coming year. Until last summer only the single-car method of operation was employed on the electric systems. During the last few months the North Shore Railroad of San Francisco has put into service an excellent system of train operation, as described in the STREET RAILWAY JOURNAL of Jan. 2 and 9. This was closely followed by the electric train service on the new line of the San Francisco, Oakland & San Jose Railway, on the Oakland side of San Francisco Bay. In the latter system, which forms the subject of this article, are found many interesting features, some of which are unique, having been influenced by conditions not met with in the Eastern States.

FIG. 2.—TRADE-MARK FOR SYSTEM

The San Francisco, Oakland and San Jose Railway was constructed primarily to afford a rapid and frequent service between San Francisco and the cities of Oakland and Berkeley

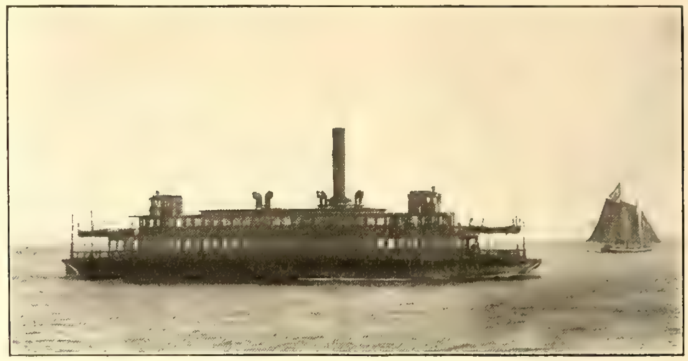


FIG. 3.—ONE OF THE KEY ROUTE FERRYBOATS

across the Bay. These cities and the towns immediately adjoining are preferred for residence by many persons whose business is in San Francisco. They are situated at the base of the foot hills of the Coast Range, and have a milder climate than the metropolis and less wind and fog.

The transbay travel can be handled only by ferryboats, and since the bay traffic began some forty years ago it has been cared for almost exclusively by the Southern Pacific steam railroad and its predecessors.

Since Oakland is the land terminus for all the San Francisco trains of the Southern Pacific road, excepting those of the coast division, the company is obliged to operate an extensive system of passenger ferries across the Bay. These ferries ply between the Oakland pier or mole and the Market Street Ferry

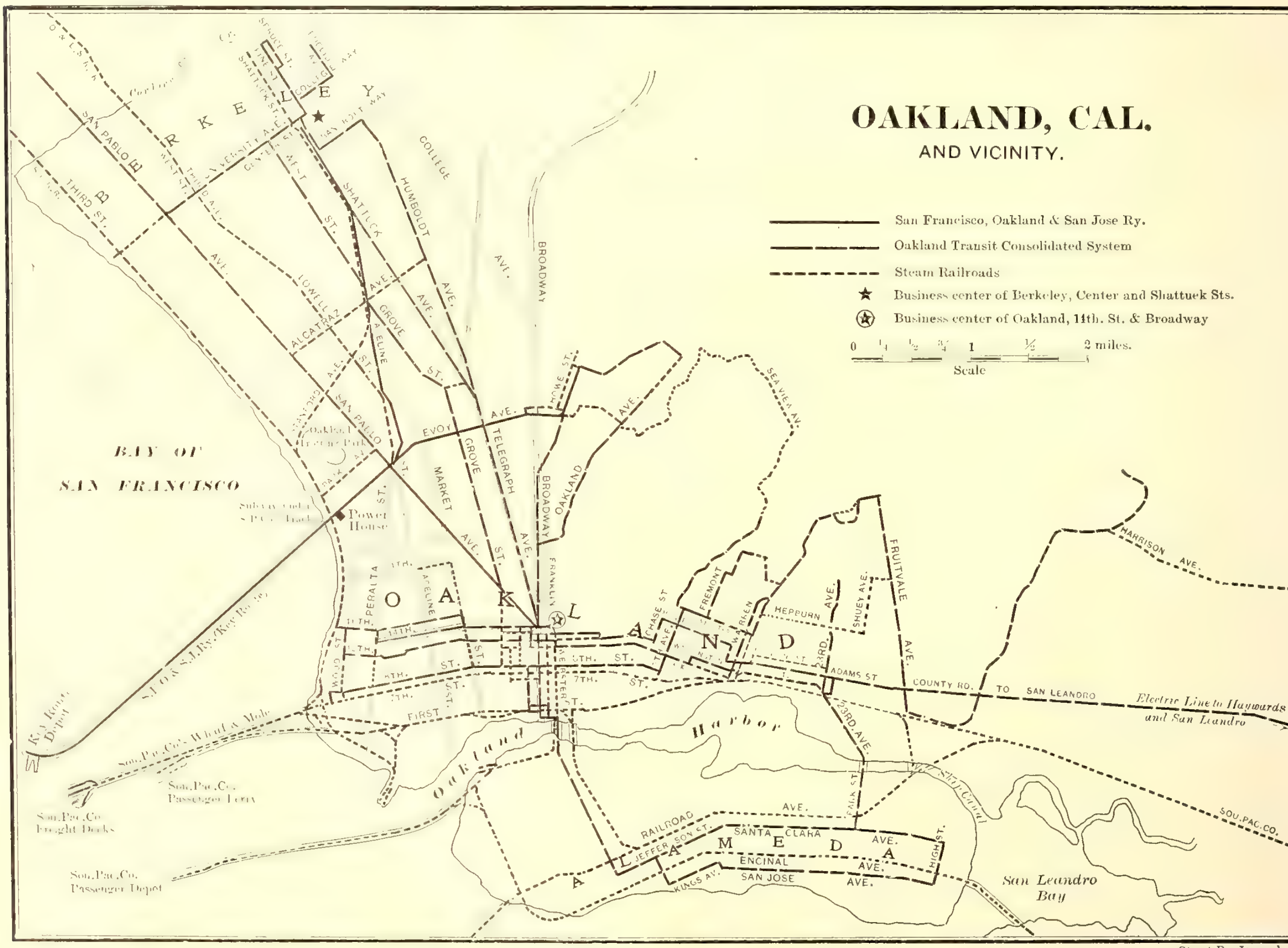


FIG. 1.—MAP OF DISTRICT SERVED BY THE KEY ROUTE

Depot, which is also the San Francisco terminus for ferry lines running to points on the northern shore of the Bay. In order to make connections with the through trains the ferries have to make frequent trips across the Bay, and the plan of operating them at regular intervals with local train connections naturally followed. Hence, at the present time a local train service from the Oakland pier to West Berkeley, Berkeley, Oakland and Alameda is in operation. Another ferry line, known as the narrow-gage, gives a similar service over different routes from the Alameda mole, on the south side of Oakland Harbor, to parts of Oakland and Alameda. Each of these lines gives a half-hour service.

The new San Francisco, Oakland & San Jose Railway Company was organized by interests practically identical with those owning the Oakland Transit Consolidated Railway Company, the local traction company operating in Oakland, Berkeley and Alameda. A pier, over 3 miles in length, has been constructed from the Oakland shore, and fast ferries have been put into service, connecting at the end of the pier with electric trains running with but few stops to the center of Berkeley and Oakland. At this writing only the Berkeley branch is in full operation. As soon as a few track changes have been made and more equipment received, the Oakland line will be started. A line, midway between these two, running to Piedmont, a fine residence section newly developed, is in operation as far as completed.

FIG. 6.—TRAIN SHED AT FERRY DEPOT, WAITING ROOMS AT LEFT, TRAIN AT RIGHT AND FIRE CAR IN DISTANCE AT END OF SHED

FIG. 4.—BOAT SLIP AND PIER AT FERRY DEPOT

FIG. 5.—KEY ROUTE FERRY DEPOT, TRAIN SHED AT RIGHT AND FERRYBOAT LEAVING SLIP AT LEFT

The accompanying map, Fig. 1, shows in heavy, full lines these three branches and the main line. The lines of the Oakland Transit Consolidated are represented, on the map, by long dashes, and the steam lines by short dashes. As the name of the subject of this description indicates, it is planned to extend the road eventually to San Jose, a growing city with a population of about 25,000, situated 45 miles south of Oakland, at the southern end of San Francisco Bay. No definite plans have as yet been made for this extention.

W. F. Kelly, general manager of the San Francisco, Oakland & San Jose Railway, as well as of the Oakland Transit Company, has been indefatigable in his efforts to give the public good and efficient transbay transportation; and to him is given the credit of the happy choice of the name "Key Route" for this new system. By reference to the map and to the drawing (Fig. 12) showing the form of the ferry slip at the pier depot, the resemblance of the outline of the route to that of a huge key is apparent, the slip and depot forming the foot of the key; the long pier, the shank, and the three branches with Berkeley, Piedmont and Oakland as their termini, the three-lobed head.

FIG. 7.—HYDRAULICALLY OPERATED APRON, LEADING TO LOWER DECK OF FERRYBOATS AT KEY ROUTE DEPOT; WAITING ROOMS ON BOTH SIDES OF APRON

The full title of the company being too long for popular use, the name "Key Route" has been officially adopted for the system, and is used on stationery, time-tables, tickets and advertising literature. Fig. 2 is a reproduction of the letter head of the company. The caps of trainmen and boat crews bear the words across the front, and the wearers are further distinguished by small brass keys stamped with the employe number, and worn on the coat lapel.

FERRY BOATS

The company has two ferryboats, both constructed exclusively for passenger traffic. They were designed by H. J. Gielow, engineer and naval architect, of New York City, and were built in Alameda, Cal., by John W. Dickie. Hopper & Ransom, of San Francisco, superintended the construction. The boats are duplicates, and have the following dimensions: Length over all, 200 ft.; length on keel, 175 ft. 4 ins.; beam, moulded, 35 ft. 4 ins.; beam, over guards, 58 ft.; depth of hold amidships, 17 ft. The seating capacity of each boat is 1200, but having a ferryboat license many more passengers can be carried. The net tonnage of each is 758 tons, and it draws 11 ft. of water. Each boat is propelled by stern wheels, driven by a triple-expansion 18-in. x 27-in. x 42-in. diameter, 28-in. stroke marine engine, which develops 1200 hp on 180 lbs. of steam, with 165 r. p. m. The engines were built by G. Sullivan, of New York City. Two Babcock & Wilsox marine boilers, with a collective heating surface of 5000 sq. ft., supply the engine. Crude oil is used for fuel on the boats as well as in the power house, that for the boats being stored in tanks on the company's pier. Each boat has four 17-ft. 6-in. x 6-ft. 2500-gal. tanks for oil storage. Two water tanks, 11 ft. x 7 ft., with a capacity of 3100 gals. each, are provided. Independent air, feed and circulating Dow pumps form part of the equipment, while a 15-kw General Electric direct-connected generator set supplies current for the electric lights and searchlights. The boats are each fitted with four water-tight bulkheads, so that they are practically unsinkable. They have a rated speed of 13 knots, but operate at present at about 12 knots an hour, making the run between the company's own ferry depot on the Oakland

FIG. 8.—PIER SIGNAL LIGHT AND FOG BELL

FIG. 9.—SIDE POLE OVERHEAD CONSTRUCTION, WITH CENTER POLE CONSTRUCTION IN DISTANCE ON THE DEPOT-END OF THE PIER

pier and the Market Street ferry station of San Francisco in 15 minutes or less. These boats are named "San Jose" and "Yerba Buena," the latter being shown in Fig. 3.

FERRY DEPOT

The company's ferry depot on the end of its Oakland pier (Figs. 4 and 5) is built in a medieval style, the idea having been to get away as far as possible from the stereotyped design common to other depots on the Bay. As it stands, the building is the material expression of the combined ideas of Howard C. Holmes, the consulting engineer, and Walter J. Mathews, the architect. In designing this station the question of handling the passengers between the trains and the boats in the most expeditious manner has, of course, received the chief consideration. One particularly good feature of the building is that it provides for each boat to run under a shed, which covers about a third of the boat, and thus keeps the passengers, embarking and disembarking, from being exposed to inclement weather.

The trains, approaching the building, run from the open track into a three-track train shed, Fig. 6, with trussed roof, 65 ft. wide and 358 ft. 6 ins. long. The embarking passengers pass from the trains into waiting rooms at each side of the lower deck apron, shown in Fig. 7, and wait there until the boat is unloaded before being allowed to pass onto it. At the outer sides of the two waiting rooms are inclines leading to aprons that connect with the upper deck of the boat. One of these is used for loading, the other for unloading. In the boat shed are located the hydraulic accumulator and pumps which operate the aprons. Rooms are provided in the building for sleeping quarters of the boat crews, for the superintendent's office, repair shop, etc.

FOG BELL AND SIGNAL LIGHTS

The fog question is one of the most serious problems to be solved in the navigation of San Francisco Bay, the mist rolling in from the ocean being at times so dense that accidents are almost unavoidable, as there are so many ferryboats and other craft on the Bay. On Goat Island, near which the ferryboats pass, is located a government fog whistle station, and on each of the ferry piers fog bells are placed. With the electric power at hand it was decided to operate the bell on the Key Route pier by a motor attachment. Accordingly, the arrangement illustrated in the view, Fig. 8, was devised. The bell is mounted on a scaffold, and is arranged so that it may be rung by hand when necessary. The mechanical ringer consists of an arm and hammer, raised and dropped by a cam, which is in turn driven by a sprocket chain from the motor shaft below. This countershaft is belt-driven, with the aid of a belt tightener, by means of a General Electric shunt-wound, 1-hp, 500-volt motor operating at 1300 r. p. m. The gearing is such that, at the rated speed of the motor, the bell is struck ten times a minute. The bell itself is of special construction, and weighs 1640 lbs.

On the pier's end, at each side of the slip, is a pier headlight, also shown in Fig. 8. Each lamp has seven panes of glass. For the illumination of each headlight fifteen 32-cp incandescent lamps are installed, in the usual multiple-series railway arrangement.

CONSTRUCTION OF PIER

The pier is a double-track wooden trestle, constructed so that

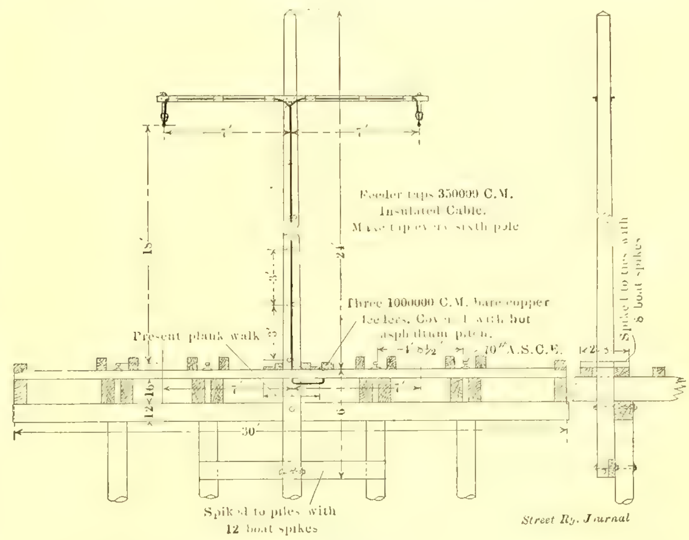


FIG. 11.—TROLLEY POLE CONSTRUCTION ON EMERYVILLE WHARF

the rails will be 7 ft. 9 ins. above high water, and 15 ft. 9 ins. above low water. It has a uniform width of 30 ft. throughout, except at the outer end, where it broadens out for the terminal tracks and ferry depot. From the middle of the boat slip to the west end of the subway under the Southern Pacific tracks at the water's edge, the pier has a length of 16,240 ft., while the total length to the end of the wharf is 16,400 ft. There is 14,423 ft. of tangent track on the pier. Eucalyptus piles were used, the braces and frame work being of Oregon pine. The piles varied in length from 35 ft. to 65 ft., and were driven to hard clay. At the end a water depth of 30 ft. is afforded for the boats. Fig. 9 presents a view of the pier near the outer end, looking toward land from a point just beyond the end of the tangent track. Fig. 10 is a side view of the pier from the depot end, and shows two of the regular four-car trains, one just pulling out of the station and the other pulling in. From these illustrations and the sectional drawing, Fig. 11, the construction of the pier may be understood. The piles are driven in

FIG. 10.—VIEW OF PIER LOOKING TOWARD LAND, SHOWING TWO REGULAR 4-CAR TRAINS

cross rows of five to form the bents of the pier, which are spaced 16 ft. apart. The five piles are capped with a 12-in. x 12-in. pine timber, 30 ft. long, and on this are bolted 8-in. x 16-in. stringers, 32 ft. long, two stringers being bolted together with cast-iron 4-in. separators over each pile and midway between each bent. Across the stringers are laid 6-in. x 8-in. pine ties, 30 ft. long, and on these are placed the 70-lb. track rails, 14 ft. center to center. Double-pine guard rails, 6 ins. x 8 ins. x 32 ft., are laid 6 ins. from the rails. Each bent is fastened by two 3-in. x 8-in. cross braces. Fig. 12 is a diagram, showing the tracks at the end of the pier. The bumping post illustrated in Fig. 13 is similar to that employed at the end of the tracks in the train shed. The 70-lb. rails are turned up for a distance of 7 ft. 2 ins., and secured to the post, each rail being held to the pier at the angle by strut or rail braces.

SUBWAY UNDER SOUTHERN PACIFIC TRACKS

In order to avoid a grade crossing with the Southern Pacific Company's main tracks at the land end of the pier, the tracks of the electric line were carried under those of the other company, through a subway. As this subway had to go below sea level, and as the trains would have to pass through at a fairly high rate of speed, its construction presented some interesting problems. At the point of crossing, the width of the right of way of the Southern Pacific Company is 100 ft., and for that distance the tracks of the Key Route system lie on a level, 16 ft. below the girders which support the steam tracks. The tracks of the steam road are carried on an especially constructed floor, consisting of wooden ties embedded in concrete in steel troughs, the latter being supported between longitudinal girders. The ends of the girders rest upon concrete walls with granite caps, and the centers are supported by a row of laced columns. The walls, or inclined sides of the subway, are also of concrete, but strengthened by 40-lb. old street railway rails, laid on from 2-ft. to 8-ft. centers. This construction gave a strong piece of work and saved considerable concrete. For the sides 6-in. and 4-in. Oregon pine sheet piling was used. The total length of the subway is 1070 ft., and the inclines are of a 4 per cent grade. Fig. 14 is a view of the subway looking toward the bay. Old steel girder rails are used for guard rails in the subway. Storm water and the drainage that runs to the lowest part is collected in a sump, and emptied into the bay by

FIG. 16.—DOUBLE-TRACK CENTER-POLE CONSTRUCTION, WITH FEEDER TAP ON FIRST POLE, AND SPRING TROLLEY WIRE HANGER; BALLASTED AND OILED ROADBED

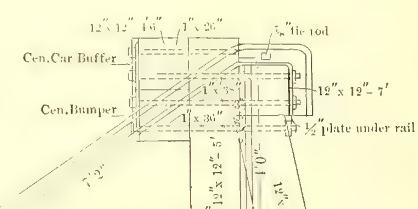
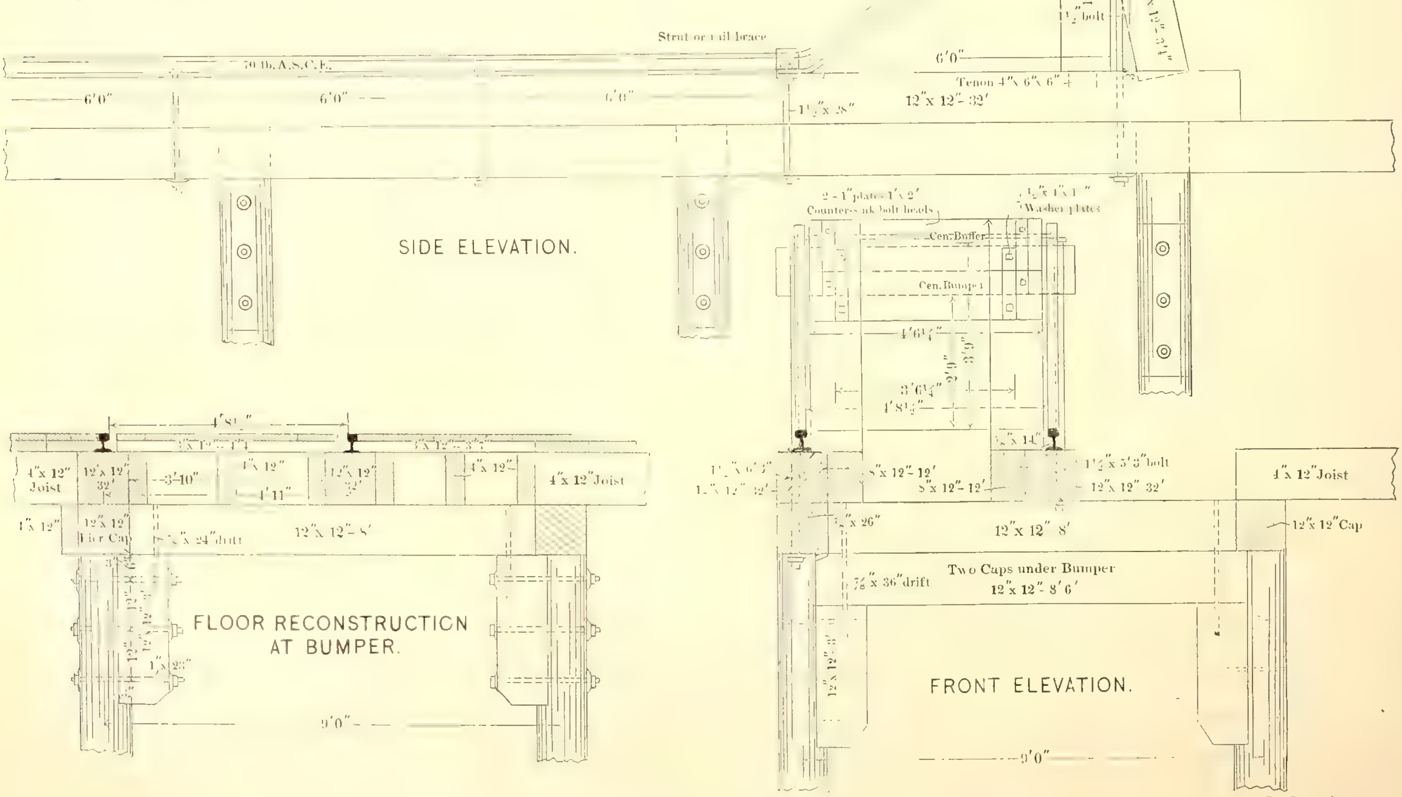



FIG. 13.—BUMPING POST AT FERRY TERMINAL

means of a centrifugal pump, automatically driven by an electric motor.

TRACK CONSTRUCTION

For 2980 ft. east of the subway the double tracks are carried on Yerba Buena Avenue to the station at the crossing of San

FIG. 14.—CONCRETE SUBWAY UNDER SOUTHERN PACIFIC MAIN LINE AT END OF PIER. METHOD OF CARRYING FEEDERS UNDER SOUTHERN PACIFIC TRACKS SHOWN AT RIGHT

Pablo Avenue. At this point, illustrated in Fig. 15, the Berkeley line branches off and runs nearly north to the business part of the city at Center Street and Shattuck Avenue. The Piedmont branch is being constructed east from San Pablo Avenue on Fortieth Avenue, and the Oakland branch will run south on

FIG. 15.—KEY ROUTE STATION AT SAN PABLO AVENUE, AND CROSSING

San Pablo Avenue to Fourteenth Street and Broadway, the business center of that city. The line to Berkeley is all double track with the exception of two portions, aggregating 4980 ft. in length. From Lorin station to Berkeley the Key Route parallels the Berkeley and Berryman local tracks of the Southern Pacific, and the two trains make the same stops, viz., Lorin, Ashby, Dwight Way and Berkeley.

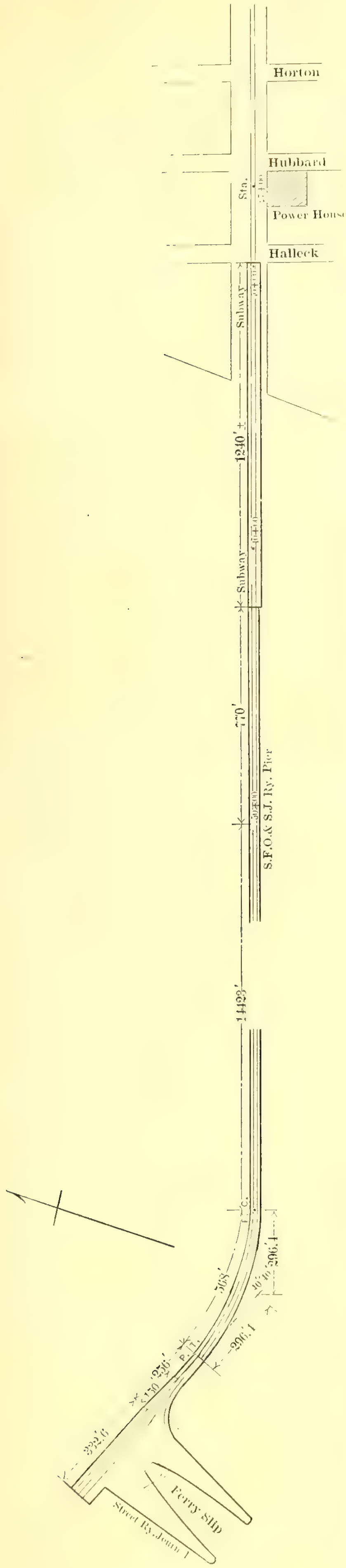


FIG. 12.—DIAGRAM OF TRACKS, SHOWING CURVES AND CROSS-OVERS ON PIER

Figs. 16 and 17 are double-track views on the Key Route line, the former showing center-pole construction on tangent track, and the latter side-pole construction on curves. The track consists of 70-lb. A. S. C. E. section, 30-ft. rails, laid with 26-in.

FIG. 17.—DOUBLE-TRACK, SIDE-POLE CONSTRUCTION AT CURVES; WOODEN CROSS-PIECES TO PREVENT DIAMOND TROLLEY FROM TOUCHING SPAN WIRES

angle-bar, 6-hole joints, the ¾-in. bolts being fastened with National lock washers. The rails are laid on 6-in. x 8-in. x 8-ft. redwood ties, 9-16-in. x 5½-in. spikes and Glendon tie-plates being used. As shown in the vertical section, Fig. 18, the track is ballasted with broken rock 12 ins. below the ties, and drainage is provided through 4-in. tile laid in the center of each track. This drawing also shows the concrete anchoring for the iron trolley poles in the center-pole construction. Nearly all of the work was done by the company's track department. Each joint of the track is bonded with two No. 0000 solid copper Brown-Edison bonds for the track return. On the pier the rails are cross-bonded every 1500 ft. with ½-in. x 3-in. iron clamped to the bottom of the rail with plastic alloy in the joint. The track is connected to the negative bus in the power house by means of six 1,000,000 circ. mil copper cables, and a very good track return is afforded.

Practically all of the special track work was made in the Piedmont shops of the Oakland Transit Consolidated. Samples of the special work used are shown in Fig. 19, which illustrates a bolted and riveted frog, and in Fig. 20, which is a drawing of the double crossing at San Pablo Avenue, switch stands, such as are shown in Fig. 16, are employed. The land lines have needed no bridges, except the Berkeley branch, which crosses Temescal Creek on Linden Street, on the short trestle illustrated in Fig. 21. A row of old 60-lb. girder rails, laid close

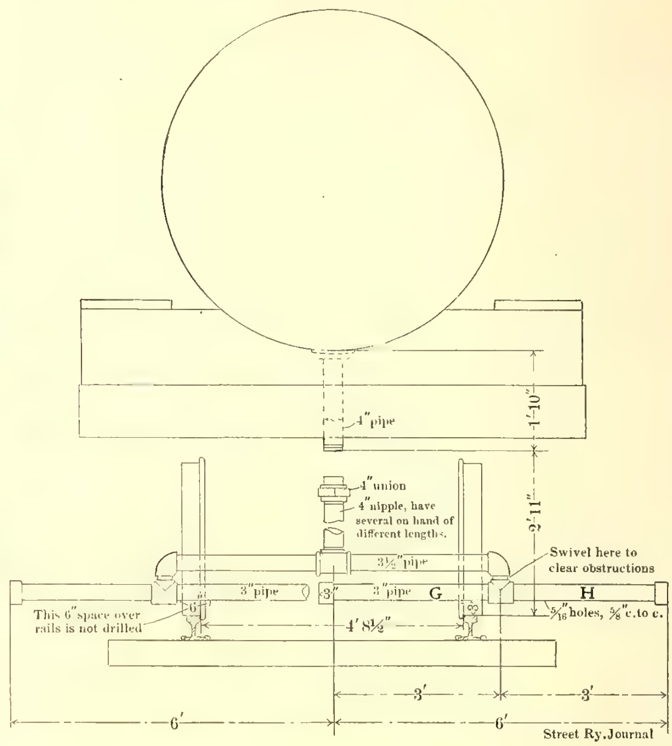


FIG. 22.—TRACK OILING ATTACHMENT FOR RAILWAY TANK CARS

together, forms the principal support for the track. The maximum curve on the line is one with a radius of 420 ft.

The roadbed on land has been treated with crude oil, the advantages of which are that it effectually lays the dust, prevents vegetation in the treated portion of the roadbed, and also tends to unite the rock ballast in a firmer mass. About three oilings are regarded as sufficient for a year. A special device is employed to sprinkle the oil, the ar-

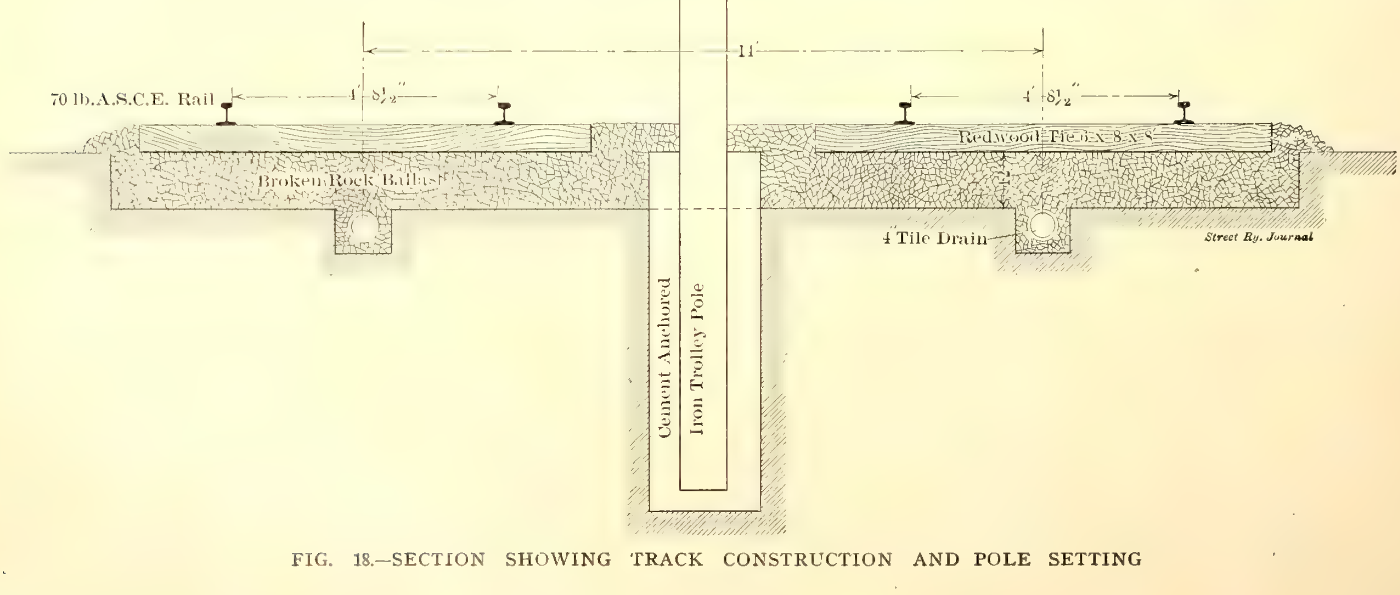


FIG. 18.—SECTION SHOWING TRACK CONSTRUCTION AND POLE SETTING

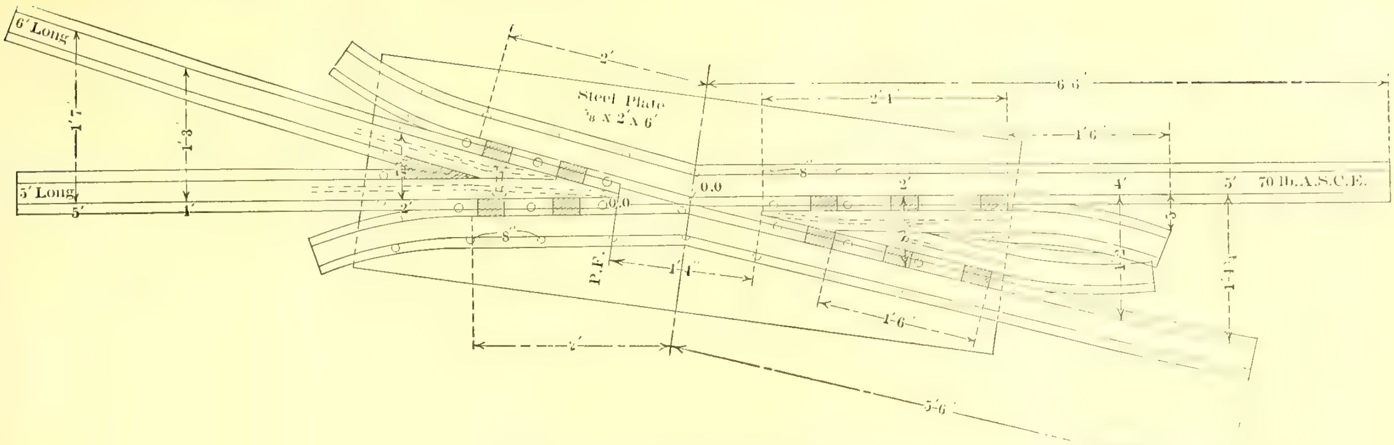


FIG. 19.—BOLTED AND RIVETTED FROG

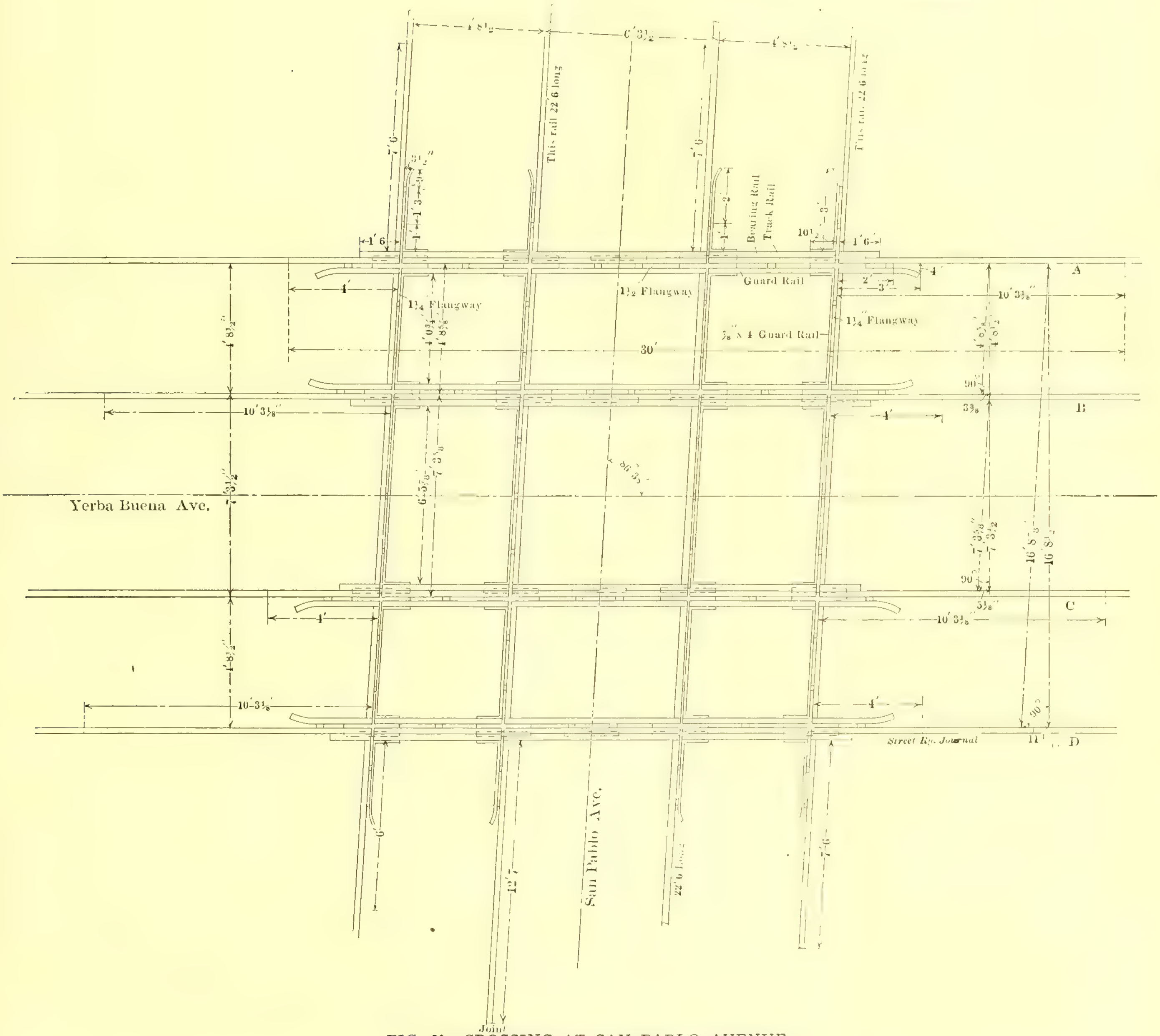


FIG. 20.—CROSSING AT SAN PABLO AVENUE

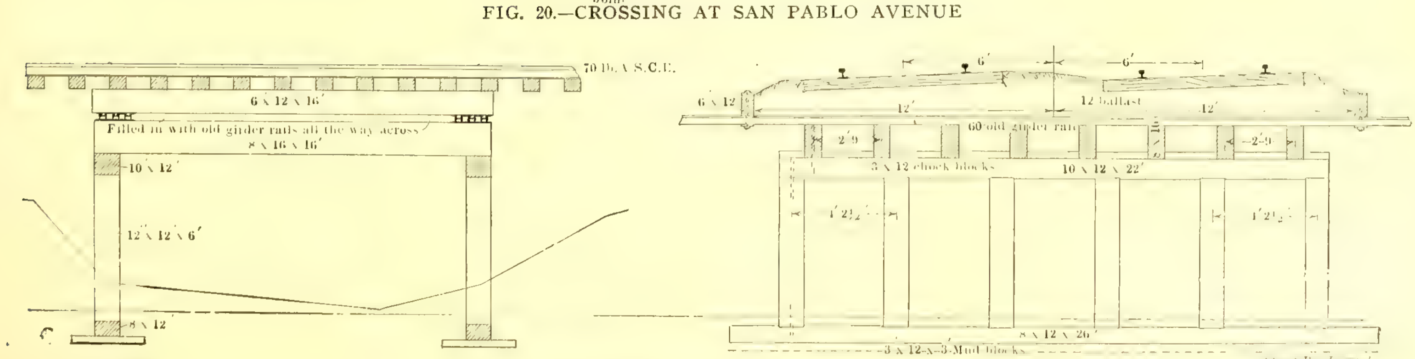


FIG. 21.—TRESTLE OVER TEMESCAL CREEK

rangement being shown in Fig. 22. To an ordinary tank line car is fitted, by means of a 4-in. nipple and union, a 3½-in. pipe, from the ends of which are hung, by swivel joints, two 3-in. pipes that overlap in the center of the track and extend beyond the rails on each side. Along the underside of the 3-in. pipes are drilled 5-16-in. holes

FIG. 24.—STRINGING TROLLEY WIRE ON PIER

on ⅝-in. centers, for the discharge of the oil. A 6-in. space over each rail is not drilled, so the oil does not come in contact with the rail. This arrangement gives a 12-ft. stream of oil, the tank line car being hauled over the track by any work or motor car. To regulate the discharge of the oil, air pressure is introduced at the top of the tank.

OVERHEAD CONSTRUCTION

For the overhead equipment of the Key Route No. 0000 grooved trolley wire is used, it being hung on 8-in. extra heavy ears with ¾-in. studs. Feeder ears for 300,000 circ. mil taps are used. The three 1,000,000-circ. mil feeders, leading each way from the power house, are supported throughout the land portion of the system on glass insulators, which, together with the other overhead fittings just mentioned, were supplied by the Ohio Brass Company.

All the overhead work on the pier was special, the general design of the straight-track center pole construction being shown in Fig. 11. The poles are of sawed redwood, 8 ins. sq. at the top, 12 ins. sq. at the bottom, and 30 ft. long, being placed so that 24 ft. of the poles are above the ties and 6 ft. below. Each pole is fastened to the cap of a pier, bent by means of two ⅞-in. bolts, the bottom of the pole being cut away 4 ins. so as to rest on and be bolted to a 4-in. x 12-in. plank that is spiked across three piles, as shown. To keep the pole from splitting a ½-in. cross bolt is driven through 5 ins. from the lower end. These poles are placed on every seventh bent on the pier, and on every sixth pole are run 350,000-circ. mil feeder taps to the trolley wires, the taps being carried up the poles on insulators, as shown. The feeders, which run the length of the pier, are laid in a three-duct wooden conduit, covered with hot asphaltum pitch. At the outer end of the pier the side-pole span construction is used, as illustrated in Fig. 9.

For the land lines iron poles are used, both for center and side-pole construction, the feeders being carried on a short arm near the top. For use on both the iron and wooden poles a special steel pole bracket has been devised, with a spring support for the trolley wire. The details of this bracket and spring are shown in Fig. 23. The bracket consists of two 3-in. x 3-in. x 5-16-in. angles, fastened to the iron pole by means of two cast-iron clamps, with hardwood insulating blocks, 4 ins. x 4 ins. x 14 ins., next to the pole. In the case of the wooden poles the angle brackets are bolted directly to the pole. Between the ends of the angle-irons are fastened 4-in. x 4-in. x 10-in. hardwood blocks, which support the trolley springs. The springs are made of No. 7 spring steel, 3-16 in. diameter, and are 6 ins. long, with an outside diameter of 2½ ins. and a ¾-in. pitch. The springs are designed to close tight under a load of 60 lbs., and the pressure of the trolley wheel is intended not to exceed 60 lbs. to 64 lbs. At the bottom of each spring are a cast-iron yoke and a clamp, the latter holding the trolley wire insulator. The dimensions of the bracket and springs are such as to bring the trolley wire 18 ft. above the rail and 17 ft. from the center of the pole. At crossings the wire is placed 21 ft. above the rail. The spring construction was adopted so as to make the trolley wire more flexible, thus rendering it less apt to break.

The span-wire construction comprises no distinguishing features except the wooden cross pieces or spanners used on curves, as illustrated in Fig. 17. It was found that there was a tendency for corners of the diamond-shaped trolleys used on the cars, to come in contact with the span wires on curves, due to the elevation of the outside track. To overcome this difficulty the wooden spanners mentioned were introduced, and they serve the purpose very well, as they hold the trolley wire in the proper position and yet are out of the way themselves. They consist of 2½-in. x 2½-in. x 18-ft. pieces, to which the trolley insulators are fastened by iron brackets or yokes.

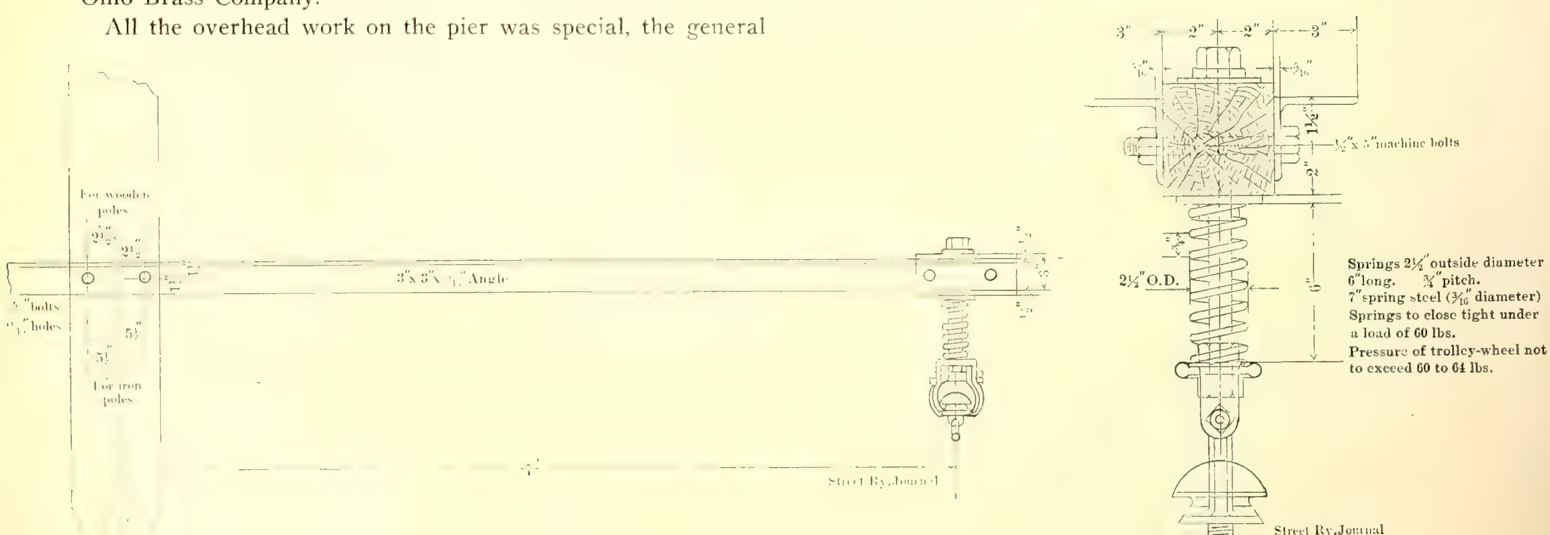


FIG. 23.—STEEL CENTER POLE BRACKET AND TROLLEY WIRE SPRING

In stringing the trolley wire on the pier the method illustrated in Fig. 24 was followed, the reel car and tower car being pushed over the track by an ordinary work car, which obtains its current from the live trolley as it is strung.

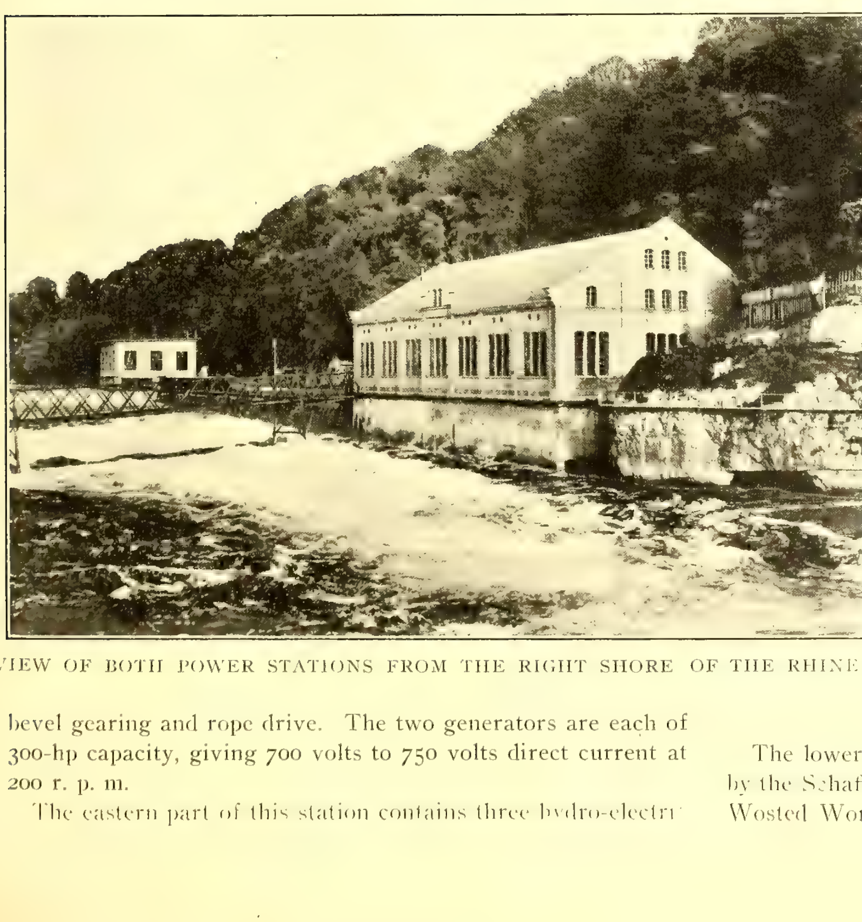
THE STREET RAILWAY SYSTEM OF SCHAFFHAUSEN, SWITZERLAND

The abundance of water-power and scarcity of coal in Switzerland have stimulated greatly the growth of hydro-electric plants in that country during recent years. One of the most prominent Swiss installations is owned and operated by the municipality of Schaffhausen, the capital of the like-named canton. It was completed in 1901, and is divided into an upper and lower station, built on the Rhine River, 3 miles from Schaffhausen. The two stations are not built at the Schaffhausen Falls, but utilize the power from the rapids at the points where they are located. Power is transmitted to the city for manufacturing and lighting purposes, and for the operation of the Schauffhausen-Neuhausen Electric Railway. This railway is also owned by the city, and has been in operation since 1901. All of the electrical apparatus for the power plants and railway was furnished and installed by the Oerlikon Company, of Oerlikon, near Zurich, Switzerland.

LOWER POWER STATION

The lower power station is located on the River Rhine, about 450 ft. below the upper one, and is conected to the shore by an iron bridge, which serves to carry the transmission cables.

The western portion of this station contains the power equipment of the Schaffhausen Worsted Works, consisting of two Jonval type turbines, built by J. J. Rieter; two Oerlikon generators and Oerlikon controlling apparatus. The turbines give 350 hp at 60 r. p. m., with a fall varying from 13 ft. to 18 ft., and 8000 to 8900 second-liters. They are fitted with two concentric paddle-wheels, both being used at high water, and the outer one only at low water. The outside diameter of the turbines is approximately 14 ft., and the inner diameter, 7 ft. The turbines are connected to the generators through bevel gearing and rope drive. The two generators are each of 300-hp capacity, giving 700 volts to 750 volts direct current at 200 r. p. m.

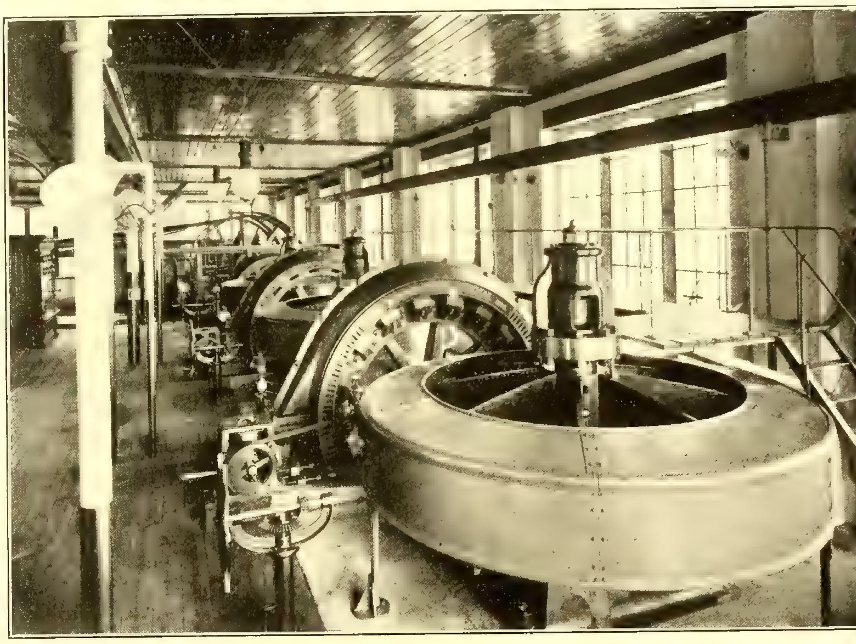


VIEW OF BOTH POWER STATIONS FROM THE RIGHT SHORE OF THE RHINE

The eastern part of this station contains three hydro-electric sets, two of which generate single-phase current, and the third either single-phase or polyphase current, as may be required. The turbines are of Jonval type, and were built by Escher, Wyss & Company, of Zurich. The two turbines connected to the single-phase alternators run at 48 r. p. m., are built for a waterfall of 15 ft. and a flow of 6800 second-liters. Concentric paddle wheels are also used on these turbines. The turbines are connected to the corresponding generators through intermediate shafting and gearing, owing to the low peripheral speed of the turbines and the limited space.

It may be mentioned in this connection that these turbines were not intended originally for electric service.

The 300-hp single-phase generators used with these turbines are of the inductor type, and at 167 r. p. m. generate 100 amps. at 2000 volts and 50 cycles. The full and half-load efficiencies of these machines are 92 per cent and 87 per cent, respectively. Each generator is furnished with a 6-kw exciter.



INTERIOR OF LOWER POWER STATION

The third generator has a rated capacity of 350 hp. As a single-phase machine it gives, at 167 r. p. m., 210 K. V. A., at 2000 volts, 50 cycles, and 300 K. V. A. as a polyphase alternator at same speed and voltage.

The southeast portion of the station contains two motor-generator sets for railway service, of which one is used as a reserve. The motors receive current either from the upper station or from the reserve generator in the lower station. These polyphase motors are of 150-hp capacity, running at 490 r. p. m. The motors are connected to the direct-current generators by flexible couplings. Each of these generators supplies 182 amps. at 550 volts.

All of the controlling apparatus in this station is enclosed in separate housings with marble fronts. There is no general switchboard, as the several units were installed at different times, and the present arrangements do not permit any extensive changes.

UPPER POWER STATION

The lower turbo-generator set in the upper station is owned by the Schaffhausen Co[illegible] Works, which, like the Schaffhausen Wosted Works, lease power from the municipality. The two

upper turbo-generator sets are used for general current distribution. All the generators are connected to their respective turbines by gearing.

The two upper turbines were built by Escher, Wyss & Company, and the lower one by J. J. Rieter & Company, each to give

AT THE SCHEIDEGG CROSSING

350 hp at 60 r. p. m., at a flow varying from 7800 to 8400 second-liters.

The lower turbine is of Jonval type, and is connected to a 350-hp, three-phase generator, which, at 170 r. p. m., gives 420

SCENE AT SCHAFFHAUSEN STEAM RAILROAD STATION

amps. per phase, 400 volts. This generator is direct-coupled to a 6-kw exciter.

The two upper turbines are of Francis type, and run at 60 r. p. m. The generators coupled to them are of the same size and type as the one used with the lower turbine. The exciters are also direct-coupled, as in the previous instance. There are two switchboards in this station, one being owned by the Schaffhausen Worsted Works.

OPERATING COMBINATIONS

Under normal operating conditions the lighting circuits are fed by the two single-phase alternators in the lower station, and the power circuits (including the railway) are fed by the two alternators in the upper station. Should an accident occur the reserve generator in the lower station can be operated in parallel with the generators on the lighting circuit. If, however, one of the power service generators in the upper station is disabled the reserve generator can be used for the power circuits.

The single-phase, 2000-volt current leaves the lower power station through six lead-covered cables laid in clay pits. Upon reaching the city the voltage is reduced to 120 volts for lighting by transformers placed in cylindrical housings at convenient points. The three-phase high-tension current is similarly transmitted and transformed to 200 volts for motor work.

STORAGE BATTERY

A storage battery has also been installed in connection with the railway service. It is located in a building on the left shore of the Rhine, and between both power stations. The battery consists of 276 elements, and has a capacity of 165 amp.-hours. A repair shop is located in the same structure.

LINES AND EQUIPMENT

The Schaffhausen-Neuhausen line begins at the southern portal of the steam railroad station in Schaffhausen, passes to

CROSSING STEAM ROAD BELOW GRADE

the Oberthor, crosses the Government steam railroad below grade, and ends in the center of Neuhausen in front of the Hotel Rheinfall. The second line (Breitelinie) runs between the railroad station and Marksmen's House. The third line connects the Emmersburg quarter and the railroad station.

All of the lines are single-track construction, with turn-outs averaging 263 ft. (80 m) in length. The distance between track centers is about 8 ft. 2 ins. (2.5 m), leaving a clearance

of 1 ft. 7½ ins. (50 cm) between passing cars. The minimum distance between outer rails and curb is 3 ft. 3¼ ins. (1 m). The total length of the turnouts on the Neuhausen line is about 1676 ft. (510 m), and on the Breitelinie 885 ft. 10 ins. (270 m). The Neuhausen line is almost 2 miles (3136 m) long, and the Breitelinie over one-half mile (856 m).

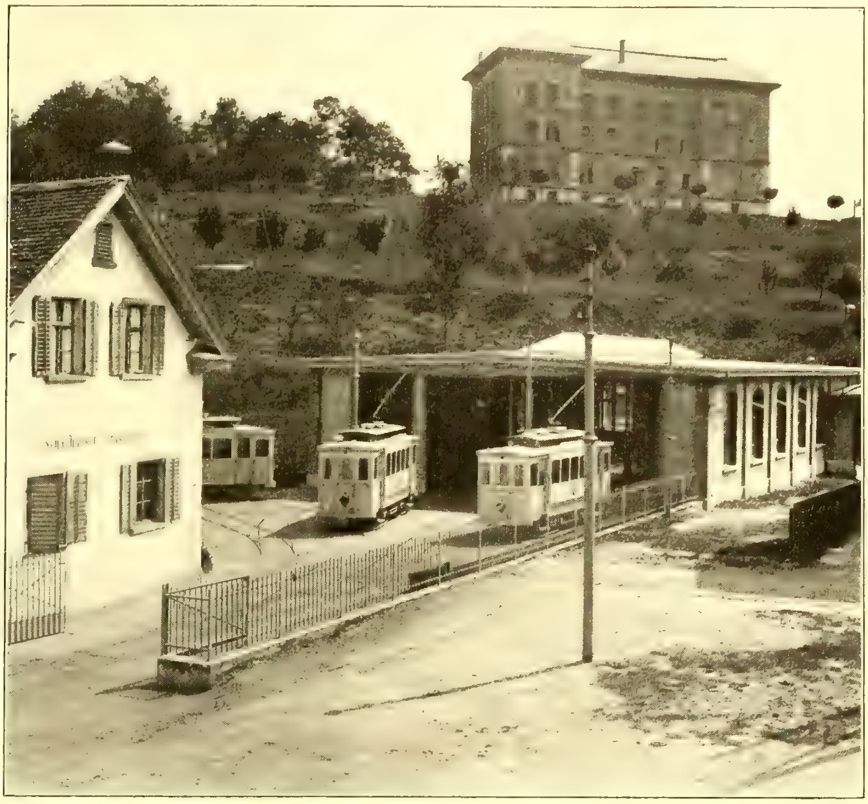
The smallest radius of curvature on either line is 65 ft. 7 ins. (20 m). The track is divided on the Neuhausen and Breitelinie lines respectively, as follows: Straight track 53 per cent and 66 per cent, curved track 47 per cent and 34 per cent.

The Neuhausen line climbs a 5.4 per cent grade on the way to Oberthor, and a 4.6 per cent grade between the steam railroad crossing and Scheidegg. The Breitelinie route has a maximum grade of 8.1 per cent.

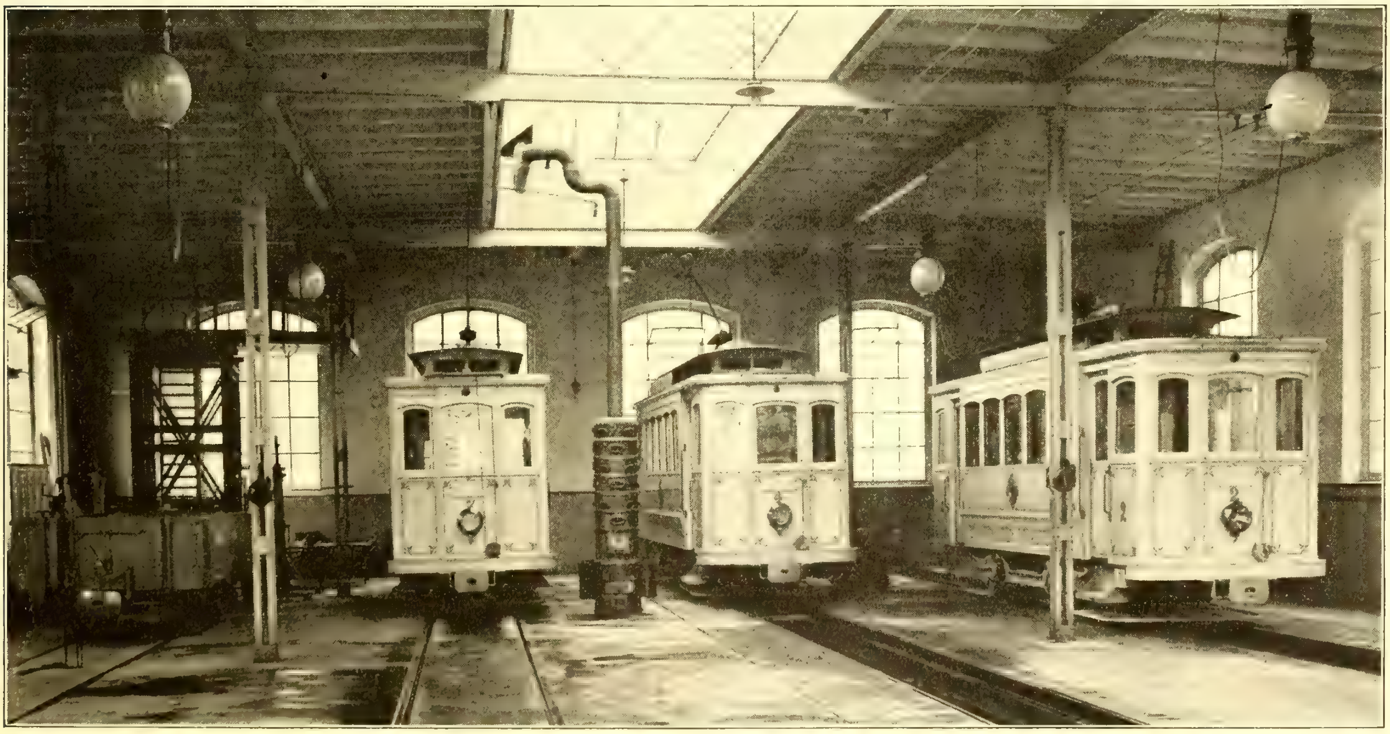
All of the lines run on the public highway, and, as the rail-heads are flush with the street, wagon traffic is not inconvenienced. The rails are laid on a foundation of large stones, averaging 16 ins. x 10 ins., covered by rubble.

The track gage is 39.37 ins. (1 m). Grooved rails are used throughout. The height of rails is 5.9 ins. (150 mm); width of top, including groove, 3.8 ins. (97 mm); width of base, 5.9 ins. (150 mm); weight per running foot, 28.5 lbs. (42.4 kg per meter); length of rails, 39.37 ft. (12 m). The joints are made by mitering in a way common in Germany, milling out a portion of the head of the rail each side of the joint and extending the top of the outer angle-bar, so that it fits into the milled section and carries part of the weight from the wheel. Edison-Brown bonds are used throughout.

The line voltage is 550, and the drop is not permitted to exceed 50 volts. Current is transmitted by buried cables from the two motor-generator sets located in the lower power station. The power wire is made of No. 0 hard-drawn copper (8 mm thick), supported by No. 3 (6 mm) steel span wires, 21 ft. 3 ins. (6.5 m) above the rails. Return to the power station is made through the rails. The lines are protected by lightning arresters mounted on poles, and an automatic arc extinguisher is also placed at the point where the feeders leave the power station. Steel guard wires are placed parallel to the power wire to prevent contact with falling telephone or telegraph wires. These additional wires are attached to a No. 3 (6 mm) copper wire connected to the running rails. All the trolley poles are constructed of steel tubing.



ENTRANCE TO CAR HOUSE

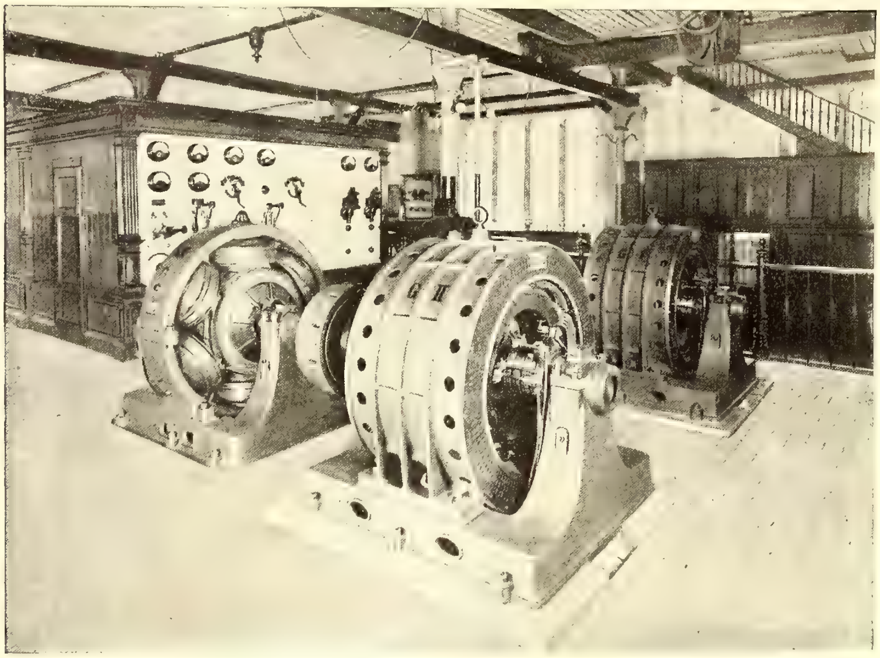


INTERIOR OF CAR HOUSE

ROLLING STOCK

The rolling stock consists of nine single-truck motor cars,

one sanding car and one repair car. The mechanical part of the motor cars was built by the Schweizerischen Industrie-gesellschaft, of Neuhausen. All car seats are made of wooden slats, and are arranged longitudinally. The windows have metal runways and are furnished with roller curtains.



MOTOR-GENERATOR SETS FOR RAILWAY WORK IN LOWER STATION

Each car has two 24-hp motors. The poles are made of laminated iron and tin, and are screwed to the inside of the frame. The latter is divided into two parts, and its interior may be inspected from the top by first lifting the part of the car floor above the motor. The frame may also be opened from the bottom, making all parts easily accessible.

INTERIOR OF MOTOR CAR, SHOWING TOP OF MOTOR AND GEAR CASE

Current is taken through four collector brushes, which are so placed that they may be quickly removed from above even when the motor is mounted for immediate service.

The armature is 13 ins. (335 mm) in diameter and 4.7 ins. (120 mm) in width. Each of the thirty-seven grooves contains 36 wires, triple-covered with silk and varnished. The four poles, which are connected in series, have each 20 turns of wire.

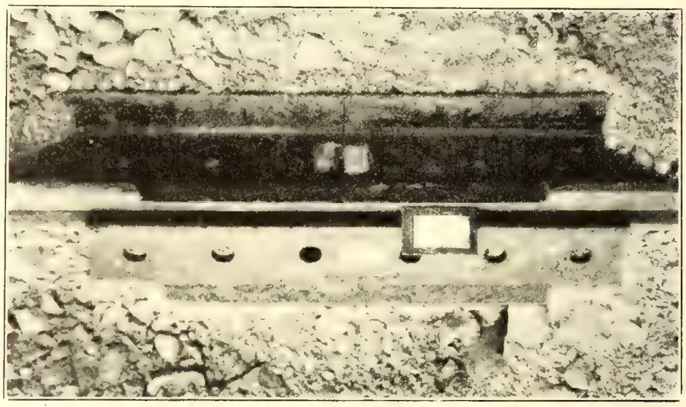
The motors are series-coupled when running slowly, and parallel-coupled at high speeds and heavy loads. For control there are four series, six parallel and six braking positions. One of the motors can be put out of circuit, without interfering with the running and braking of the car, by lifting a contact on the reversing handle. All of the controller contact-fingers are furnished with arc extinguishers. Some of the cars are fitted with emergency brake beside the usual hand brake.

CAR HOUSE

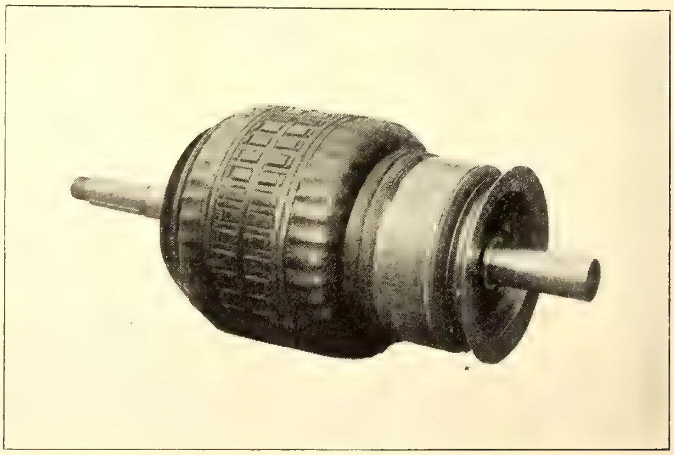
The car house has a capacity of twelve cars, with two car pits and four tracks. It is constructed of brick with skylights and wood and cement roof, and is lighted by four arc lamps and ten incandescent lamps. A smithy and repair shop adjoin the car house. The repair shop contains two lathes, planer, boring machine and grinder. All of the machines are operated by belting from a 2-hp Oerlikon motor.

GENERAL DATA ON COST, TRAFFIC AND OPERATION OF SYSTEM

The total cost of the street railway system was $108,284.66 (561,060.4 francs), or $36,167.21 per mile.



ELECTRIC RAIL CONNECTION



RAILWAY MOTOR ARMATURE

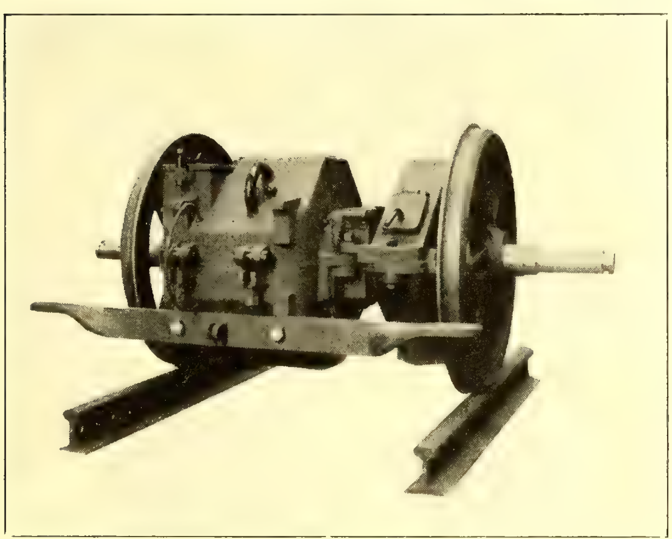
The total number of passengers during 1901 was 481,143, or 6.5 per trip. The consumption of 131,541 kw-hours was required to carry this traffic.

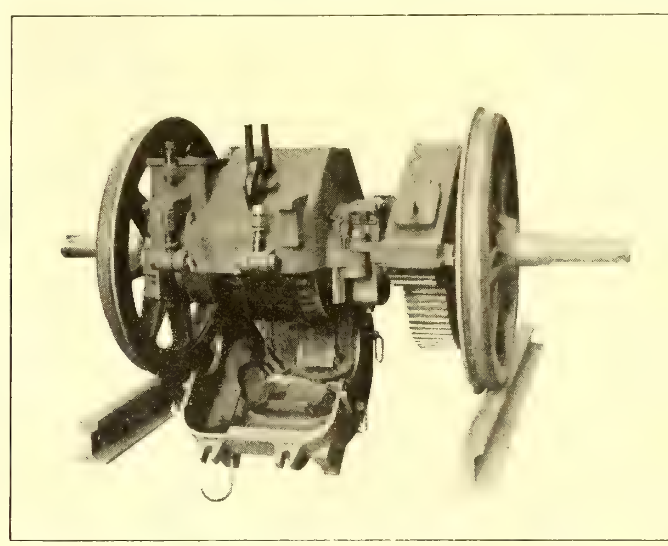
Fares are paid according to the zone system, the first zone

costing 1.93 cents (10 centimes), and .965 cents (5 centimes) for further zones. The highest fare is 4.825 cents (25 centimes). Reduced-fare tickets are sold to school children and workingmen. Passes are granted to employees of the railway.


INTERIOR OF REPAIR SHOP

The cars are run under the following headways: Thirty minutes between 6 a. m. and 7 a. m., 15 minutes between 7 a. m. and 8 a. m., 10 minutes between 8 a. m. and 8 p. m., 15 minutes between 8 p. m. and 10 p. m.


RAILWAY MOTOR, CLOSED


RAILWAY MOTOR, WITH LOWER HALF OPEN

The operation of the system (exclusive of power stations) requires the services of twenty-nine men, including the director, starter, cashier, two ticket agents, three shop men, three track men, nine motormen and nine conductors.

AUTOMATIC COAL SCALE

Since the introduction in large power stations of the present method of storing coal in overhead bunkers and allowing it to fall by gravitation to the stokers, engineers seeking efficiency with economy have experienced the necessity of providing a reliable method for accurately weighing and registering the coal thus delivered to the boilers. An automatic device to meet these requirements has been designed by Henry Richardson, of the Richardson Scale Company, of New York, and is now being manufactured in this country.

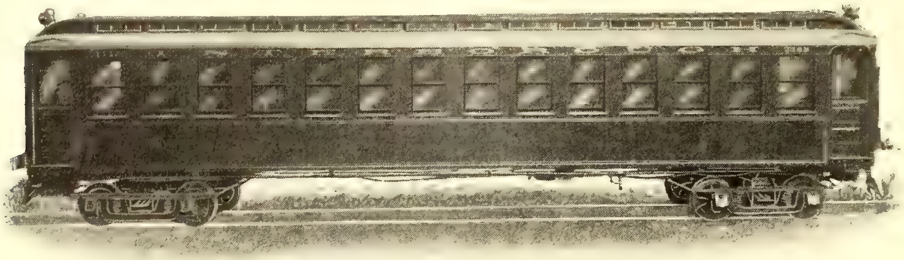
This apparatus is by no means experimental, but thoroughly perfected, and has been introduced largely in the chief power stations of Great Britain—that of the Glasgow Corporation, which is shown herewith, having as many as fifteen machines, each fitted to a Babcock & Wilcox boiler. The coal stored in the bunker is delivered to the receiving hopper, through which it passes to the weighing hopper on the apparatus—an automatic scale fitted below the bunker by special brackets. Constant delivery is insured by a feeding device driven by a rope gear, the only power necessary in connection with the entire arrangement. The scale is of the "beam" type.


AUTOMATIC SCALES IN GLASGOW POWER HOUSE

The machine is fitted with double shutters, which regulate the supply, adjusting themselves to the coal consumption so as to pass automatically only so much coal as the stoker requires. Every time the exact weight has been drawn from the bunker the supply is cut off, and due allowance is made by a special contrivance for the amount descending at the moment of cut-off and the charge dumped to the automatic stoker. The scale is also fitted with a mechanical self-registering instrument, hermetically sealed, which records every weighing so that a glance suffices to show the quantity consumed during any desired time.

STEEL CAR FOR THE NEW YORK SUBWAY

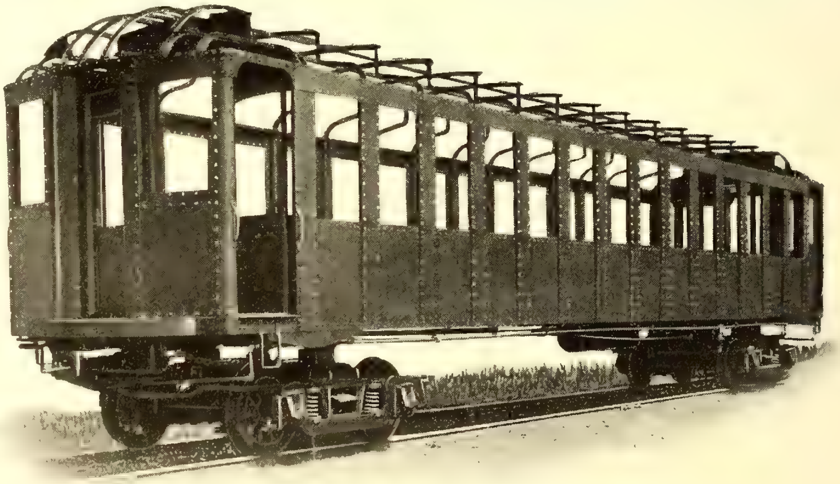
The Interborough Rapid Transit Company has received the new steel car which was designed for the subway by George Gibbs, consulting engineer for the Rapid Transit Subway Construction Company, and it will soon be placed in regular service on the Second Avenue elevated structure, where the other subway cars are being used. The new car is intended to be absolutely fireproof, and to ensure this it has been constructed entirely of metal, transite board and asbestos. No inflammable material whatever enters into the construction of the car body itself. In fact, the seats are the only part of the car, or its furnishings, which are of wood, and it has been determined to replace these by pressed steel frames as soon as they can be provided. The new car differs materially in appearance from the copper sheathed wooden coaches already built for the subway. It will be remembered that the sides of the latter slope toward the roof, giving them rather an unusual appearance, but in the new car the usual form of construction was followed, as it was found that steel framing resulted in economy of space so that approximately the same interior width at the floor as in the wooden car could be secured without encroaching upon clearance.



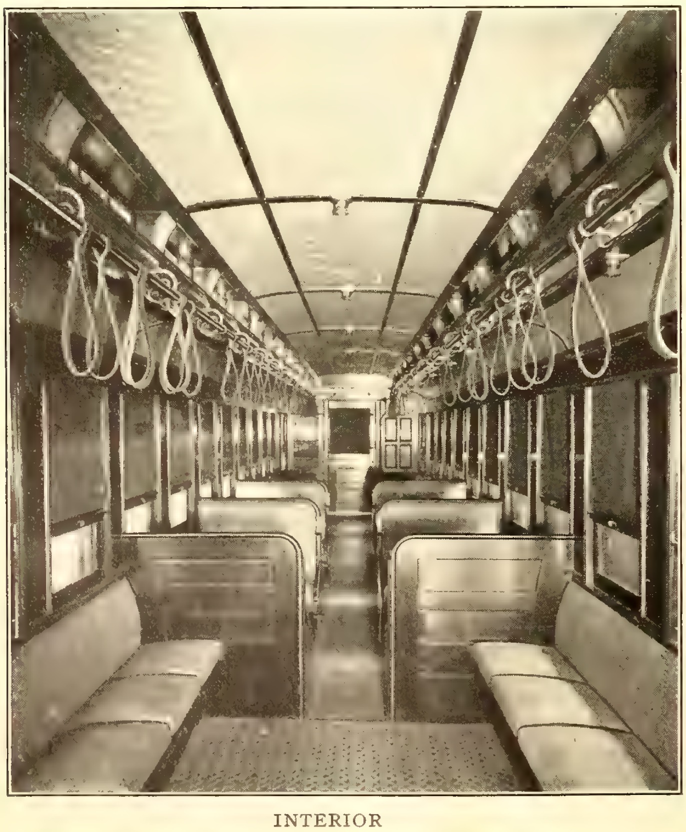
EXPERIMENTAL STEEL CAR FOR SUBWAY

The steel car is of the same dimensions as the wooden car, has the same capacity, and in general design follows similar lines. The car framing is unusually heavy, and the body weighs about 2 tons more than the wooden cars. A number of modifications will be made, however, based upon the experience gained in building this car, by which the weight can be reduced without sacrificing structural strength, thus making the steel car approximately the same weight as a wooden car.

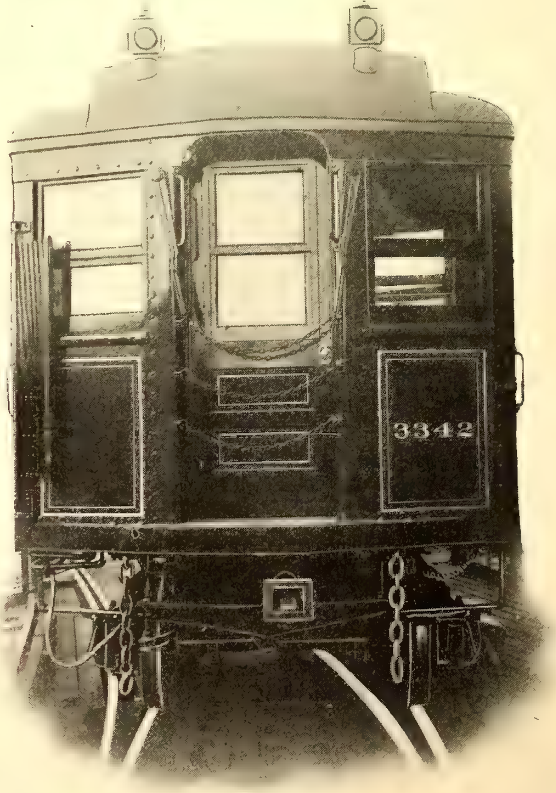
The car body is double lined and is built of steel and asbestos composition. The sides are covered with steel plates, and the outside roof is of transite board. The inside lining is of electrobestos, the ceiling being covered with stamped sheet steel. Electrobestos is also used for the under panels, and the mouldings throughout are of copper. The flooring is of corrugated steel covered with monolithic composition. Longitudinal seats have iron frames covered with cushions, but the cross-seat frames, as already mentioned, are of wood, and are the same type as those



FRAME OF STEEL CAR



INTERIOR



END VIEW

used in the regular cars, but these will be replaced by pressed steel frames as soon as the latter are completed.

The accompanying cuts show the appearance of the completed car and also give some idea of the principal features of construction. An examination of these illustrations will convince those who are familiar with car construction that the new coaches are exceptionally strong. It is believed that the designer has entirely overcome the chief objection to the steel car, namely, the excessive noise which it was believed would inevitably accompany the operation of a car of this description. It has always been asserted that cars of this type would be extremely cold in winter and hot in summer, but these objections have also been overcome. As far as practical operation is concerned the present car meets all the requirements of the service, the principal difference between it and those formerly employed being that the steel car is heavier, but even in its present form it will be noticed that this car does not exceed the weight of cars ordinarily used for this class of service in steam railway work. However, if the reduction in weight now proposed can be accomplished without entailing any structural weakness in the car framing, the last objection will be entirely removed.

BRITISH PATENT OF B. G. LAMME ON THE SINGLE-PHASE SERIES MOTOR

In a recent British patent, No. 2746, of 1902, B. G. Lamme sets forth the principles of the series railway motor which he has been developing for the last two years. The patent specifications include a drawing of the motor, which gives much information showing how the result that has been claimed for these motors has been accomplished.

The principle of the series alternating-current motor is not, of course, a new one, but hitherto it has only been utilized in small size machines, and even then difficulties have arisen in the form of undue heating, excessive sparking and want of regulation. By varying the proportions of the machine and making suitable arrangement of the circuits, Mr. Lamme has overcome these troubles, and his changes in design form the basis of his claims. The inventor points out that there are three very important electromotive forces which must be taken into consideration in designing such a motor, namely, the self-induction of the field magnets, the self-induction of the armature, and the counter electromotive force set up by the armature due to its rotation in the field. Mr. Lamme's theory is that certain definite relations must obtain between these electromotive forces in order that the motor shall have proper performance curves of torque and speed.

To prevent sparking provision is made that the short-circuited bobbin shall have as few turns as possible, and shall contain a resistance properly proportioned to keep down the commutating current in the bobbin. Means are provided for minimizing the cross magnetizing of the armature by ingenious shaping of the pole pieces, and also by employing a closed secondary circuit.

Mr. Lamme directs attention to the fact that the self-induction of the field magnets and counter electromotive force set up by the armature depend upon the strength of the field, and, therefore, that a relation exists between them which is proportional to the speed of rotation of the armature, the relative ampere turns of the field and armature, and the alternating-current frequency. A high speed gives a high counter electromotive force in the armature; a low frequency and a minimum number of turns on the field magnet give a small counter electromotive force of self-induction in the fields; all of which is taken into consideration in the design of the present instance.

If saturation is not approached the field strength and armature magnetism increase with the current, and the torque increases as the square of the current, which is highly advantageous for electric traction. Unfortunately, however, the self-induction of the fields increased under these conditions, and consideration must be given to this fact. The resultant of all the electromotive forces is, of course, equal to the applied electromotive force, and, therefore, increase in self-induction would result in a fall of speed. The field magnet would act as a choking coil and the speed would reach zero when the electromotive force of self-induction became practically equal to the applied electromotive force, the resistance of the system in this case being relatively so low that it does not enter materially into the computation.

If the strength of the field be kept constant by working the field magnet at saturation or other devices, the armature speed will not fall unless the self-induction of the armature itself is very high, but the torque curve will not be as good.

The first case prevents a good torque curve in the early stages, but the maximum torque may be kept down by the limitation of the current, due to choking coil action. In the second case, the torque is not so limited, but it does not rise as rapidly in the early portions of the curve, which is a very desirable feature in railway work. Mr. Lamme has adopted proportions for his motor which combine these two features, and has thus acquired a condition where the field strength is approximately proportional to the current, while the motor is still capable of developing the required torque. It is further asserted that the self-induction of the motor, as a whole, in normal working should not absorb an undue proportion of the applied electromotive force, and it should have such a value that it is less than the applied electromotive force, even when maximum current is flowing, so that there will still be both torque and speed.

The self-induction of the field is equal to the alternations multiplied by the field turn in series by the induction of one pole and by a constant. The back electromotive force of the armature is equal to the speed, times the number of armature wires, times the induction of one pole, times a constant. If these two are placed in ratio the following fractional relations obtain:

$$\frac{\text{Field self-induction}}{\text{armature C. E. M. F.}} = \frac{\text{line frequency} \times \text{field turns} \times \text{induction per pole} \times \text{constant}}{\text{speed} \times \text{armature wires} \times \text{induction per pole} \times \text{constant.}}$$

The induction per pole in the numerator and the denominator cancel, and since the number of armature wires equals twice the number of poles, times the armature turns in series in the case of a lap winding armature, the fraction becomes

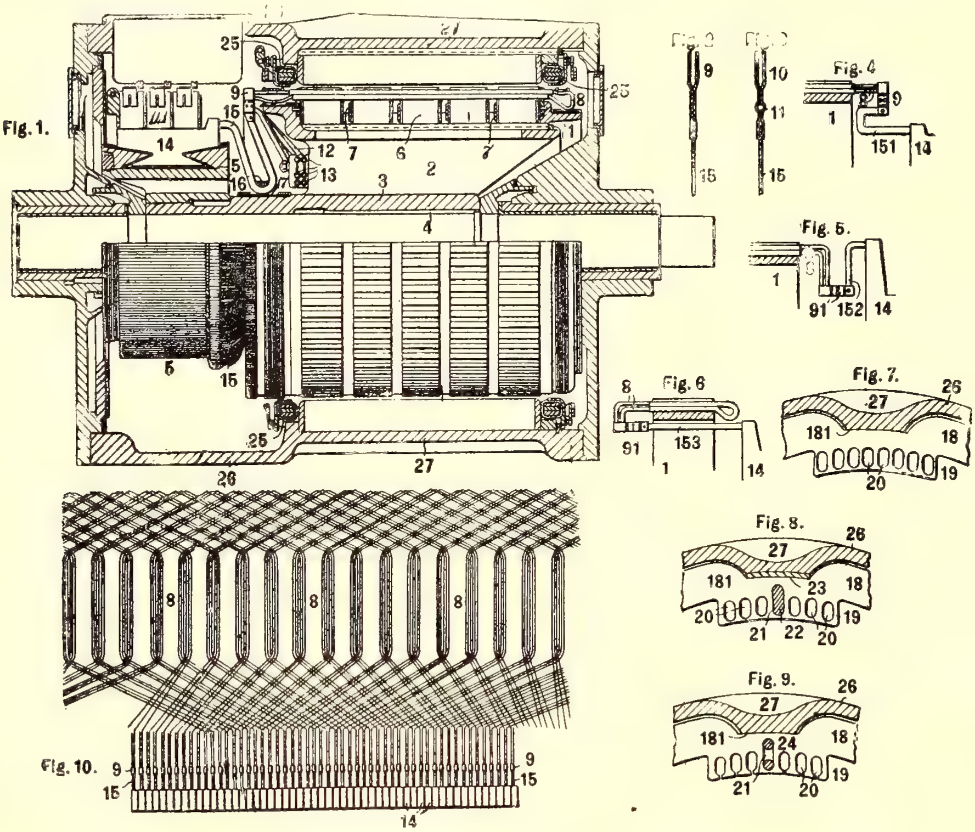
$$\frac{\text{Line alternations} \times \text{the field ampere turns} \times \text{a constant}}{\text{Poles} \times \text{revolutions} \times \text{armature ampere turns.}}$$

In order that the ratio of self-induction and counter electromotive force of the armature be low, it is clear that there must be a small number of line alternations, a small number of field ampere turns, a relatively large number of armature ampere turns, a high speed and a large number of poles. Mr. Lamme has found that the minimum ratio of the field ampere turns to the armature ampere turns, should be greater than .5, and may sometimes be as high as .75. This is very unusual motor design, and is important in suggesting field distortion, because, according to Mr. Lamme's method, the magnetic power of the armature is always greater than that of the field, and the reverse arrangement is a condition which has always been sought for in direct-current design. These two ratios having been fixed there now comes a definite relation between the alternations of the supply circuit, the number of poles in the motor and its rate of revolution, or, practically speaking, between the line alternations and the armature alternations. Mr. Lamme has found that for a certain number of revolutions the number of poles must be directly proportional to the number of alternations of the supply circuit increasing and diminishing with

them, and that in order to obtain a motor that is simple in its polar structure, the line alternations must be very low; for instance, a 700-revolution motor having 2000 alternations per minute must have eight poles.

The method by which these motor characteristics are secured is interesting. Both the field self-induction and the armature self-induction are limited by a special construction of the pole pieces. Referring to the diagram it will be noted that slots or holes are cut in the pole piece from end to end, parallel to the shaft. These spaces are holes rather than slots, on account of the greater magnetizing power required when slots are used. The cross section of the field magnet is such that the principal magnetic reluctance is found in the air gap and in the teeth of the field and armature, and the magnetic circuit is so proportioned that beyond normal current the teeth in the pole slots rapidly approach saturation.

The self-induction of the armature is, of course, proportional to the square of its turns and to the permeability of its magnetic circuit, and that part of the magnetic circuit which is in the armature itself must have low permeability for the reason that it carries the main torque producing flux. The poles of a direct-current armature, which are due to the armature winding, appear between the pole pieces of the field on the surface of the armature, and find their return magnetic circuit through the structure of the pole pieces from tip to tip, in accordance with well-known laws and many familiar diagrams. At this point Mr. Lamme attacks the integrity of the armature magnetic circuit, and by means of his slots in the pole pieces he has evidently contrived to reduce the cross magnetizing of the armature to such an extent that in spite of the very large number of armature turns the reactions are brought within reasonable limits. This cross flux in the armature is further limited by the interposition of a secondary circuit, which may be used if desired. It has been found convenient to install this secondary circuit in the slot in the middle of the pole, which consists of a conducting plate or closed coil, and by reason of the currents induced any magnetic flow which tends to cross the slot is opposed..



DETAILS OF LAMME MOTOR

Mr. Lamme has adopted the type of armature winding which is closed on itself before being connected to the commutator, and high resistance leads are inserted between the winding and the commutator bars. When a turn of the armature is short circuited by the brush two of these high-resistance leads are included in the short circuit, which keeps down the secondary circuits set up in the bobbin by reason of alternations of the supply circuit. When these currents are large, as has been the case with series alternating-current motors heretofore designed, the sparking is severe, and Mr. Lamme has found that if the resistance of the leads is sufficient the sparking can be cut down to a point where it is not injurious. The resistance of these leads in their position in the armature circuit constitute a very large factor in the resistance of a short-circuited bobbin, but a very small factor as compared with the resistance of the entire armature, and, consequently, does not entail serious loss. He proportions this resistance so that the current in a short-circuited bobbin to a full current in the motor will not be more than twice the value of the full-load current. He finds, also, that for good commutation the armature circuits of the motor should be connected in parallel, therefore his armatures are lap wound. Moreover, the number of turns between consecutive armature bars should be small. This fits in exactly with the first condition that the armature ampere turns should largely exceed the field ampere turns. Naturally, this calls for a large number of turns in the armature, and a system of winding is, therefore, possible whereby the number of turns between bars can be reduced to a single turn. However, if this arrangement is to be adhered to throughout, it limits the working voltage of the motor. In direct-current motors this would be a serious matter, because it would limit also the voltage of transmission, but in alternating-current motors the employment of a transformer allows the armature voltage to be adjusted to any value, which is found best to enable minimum turns per bar in the design of the motor. This flexible arrangement also allows the controller to handle currents which are small in comparison with the currents taken by the motor.

In the diagram which appears with the patent, and which is reproduced herewith, a number of features of great interest are shown. The high-resistance armature leads are shown in the loop, passing from the corner of the closed coil winding at 9 and looping down to the shaft of the motor and then up to the commutator lug 15. At suitable points along the winding the armature is tapped to balancing rings shown at 12 and 13, in order to prevent reaction between the various parts of the armature. The field coils are connected in parallel, the transformer action between them producing a condition of balance. Figs. 4, 5 and 6 show alternative methods of resistance construction in forming the armature leads, and Figs. 7, 8 and 9 show methods of slotting the pole pieces to prevent cross magnetism of the armature. In Figs. 9 and 8 are shown also the introduction of a closed circuit-secondary winding to prevent additionally the demagnetizing action of the armature.

The armature is a skeleton open frame, or spider, suitably keyed to a shaft and built in the usual manner with thin plates or laminæ. In the form shown there are seventy-two slots,

eight conductors per slot, each coil spanning the first and ninth slots. In Fig. 3 the arrangement of the commutator leads is provided with a socket (11), which is connected to the balancing rings. The leads are made of strips of German silver, and their dimensions are very accurately determined. The motor here shown and illustrated has eight poles and eight brushes, and is designed for a frequency of 2000 line alternations per minute.

The field magnet is in the form of a hollow cylinder, built up in the form of thin plates or laminæ, and held together in their proper relation to the shell by the thin frame 27, which is not intended to be any thing more than a support, and is no part of the magnetic circuit. The slots in the pole pieces are made shallow, being only of sufficient depth to keep down the cross magnetism, and are so dimensioned that the iron frame between them shall be quickly saturated when the current in the field winding exceeds the rated amperage for which the field magnets are designed.

The patent rehearses a number of methods of controlling the motor by well-known alternating-current principles. The claims are very interesting and are rehearsed herewith:

1. A single-phase alternating-current series-wound motor, in which the ratio of the field-magnet self-induction to the armature counter E.M.F. is approximately equal to the ratio of the line alternations to armature alternations, substantially as described.

2. A single-phase alternating-current series-wound motor having a closed-coil parallel-wound armature with relatively high resistance leads connecting the armature coils with the several commutator bars, and a field-magnet the poles of which have slots transverse to the direction of rotation of the armature and with or without a closed conductor inserted in one of the slots and extending through approximately the central portion of the pole, substantially as described.

3. For use with single-phase alternating electric currents, a series-wound motor having the ratio of the number of its field poles to the number of current alternations per minute approximately as 1 to 250, and having a ratio of field ampere-turns to armature ampere-turns approximately as 20 to 27.

4. Electric motors for use with single-phase alternating-currents constructed substantially as described with reference to the accompanying drawings.

STATE BUILDS A TROLLEY LINE

Construction work is now nearing completion on an electric railway at Bismarck, N. D., which was financed by the State. It seems that when Bismarck was first settled the pioneers thought that the city would soon grow to be a metropolis, and in the enthusiasm of their expectations for the future they set the capitol upon a high hill, more than a mile from the business section of the town and the various hotels at which legislatures and visitors to the city had to stop. It turned out, however, that the city did not boom as much as the founders of it had anticipated, and the capitol now stands far removed from the center of population, with practically no means of transit. The fierce weather that prevails throughout the Northwest so added to the trials and tribulations of the law-makers in attending sessions, that they decided to lessen their troubles by appropriating State money for the construction of an electric railway to the capitol. In order to do this, part of a parcel of 82,000 acres of land, which was a separate allotment made by the Government for the endowment of each of the State institutions, was sold.

The line begins at the railroad depot, and is 8500 ft. in length. The construction was begun last autumn, and is under the direction of an electrical engineer employed by the State. No contracts were let for building the line, and the actual work of construction is being carried out with labor paid by the State. The road will be operated by the State under a franchise granted to the State authorities by the Common Council of the City, which gives the State the right to operate a street railway for a term of twenty years, with a maximum fare charge of 5 cents.

The purposes to which the road will be put are unique. It will serve as a freight and passenger line. Coal for heating the capitol will be transported over it, and mail, express and other matter will be taken daily to the State House in a trolley car. Then, too, the legislators and representatives of the State will be transported free of charge.

The plant that will supply power to operate the road will also be used to light the administration buildings.

NEW SURFACE CONTACT SYSTEM

The accompanying illustrations show the method of constructing the Bourne Surface Contact System, which is designed not only for street railway service but also for interurban and heavy trunk line traffic.

In street service the system employs two sets of studs; the main operating set, from which current for operating the car is obtained and an energizing set. In interurban or trunk line traffic an overlapping double third rail is used.

The special feature of this system is the solenoid circuit closer, which is the invention of Frank Bourne, E. E., of New

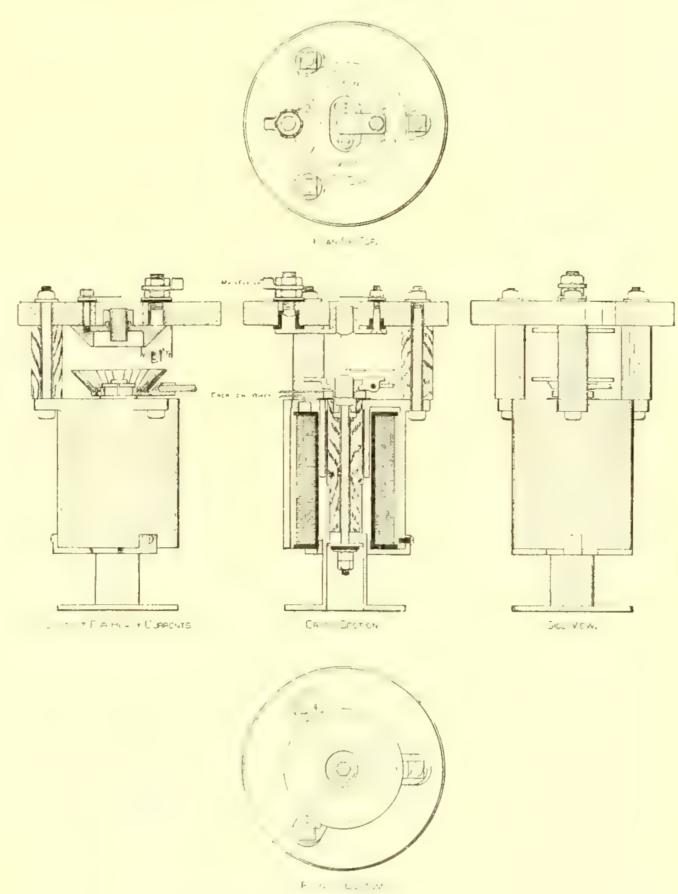


FIG. 1.—SOLENOID CIRCUIT CLOSER FOR SURFACE-CONTACT SYSTEM

York. This is shown in the cross-section, Fig. 1. The movable core, or plunger, is a hollow iron stem filled with a wooden plug, which carries at its base an iron plate, and on its upper end a gun metal contact-plate. This plate is provided with a rocking joint, which automatically adjusts itself to any inequalities of the upper contact-plate, which is connected with the street stud or third rail. In the center of both upper and lower contact-plates are carbon contacts. The upper carbon contact has a free vertical movement of about ¼ in., and is guided by a hollow stud on the top plate. This allows it to act as an automatic secondary break. In ordinary street railway service

the contacts are $1\frac{1}{2}$ ins. apart when the circuit is broken. The solenoid is excited by means of line current taken from the energizing set of studs referred to and shown in the general diagram or from the energizing half of the third rail.

When the magnet is energized the plunger is raised, bringing

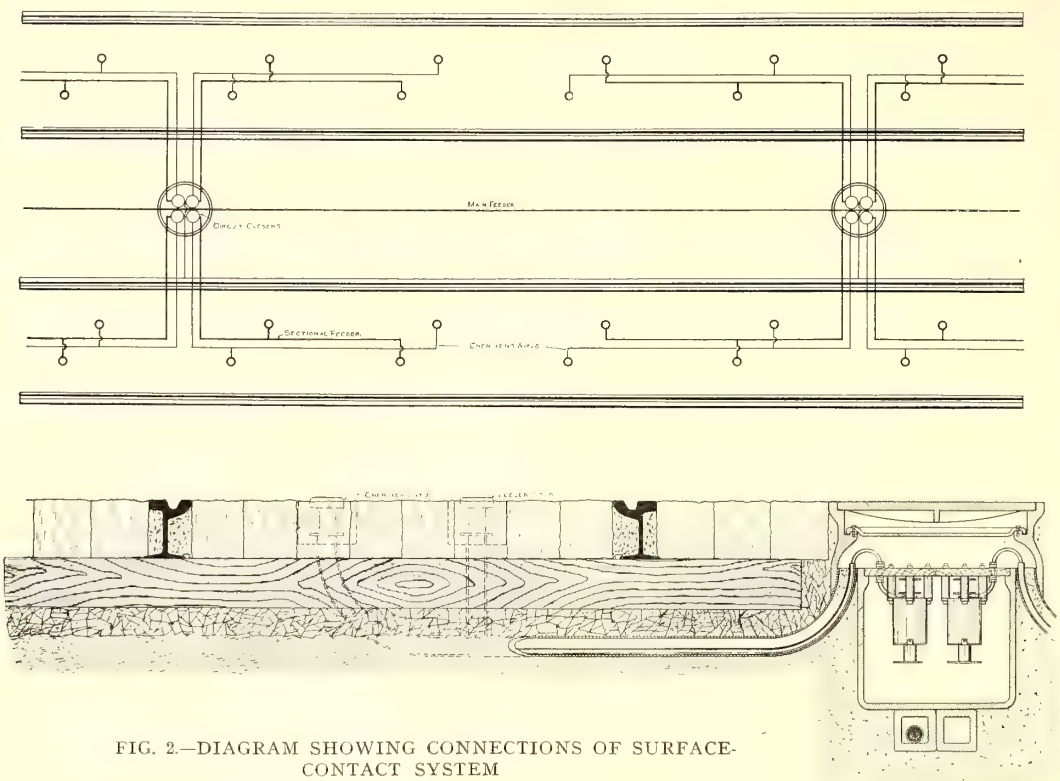


FIG. 2.—DIAGRAM SHOWING CONNECTIONS OF SURFACE-CONTACT SYSTEM

up the lower flange of the armature until it is within the magnetic field. In this way the forces on both the plunger and armature are in unison up to a certain point. After the solenoid reaches its neutral position in the center of the magnetic coil, the force on the armature is opposed to that on the solenoid. By this method a comparatively uniform magnetic pull is obtained throughout a large part of the movement, and it requires almost as much current to keep the circuit closer closed as to raise it. Where heavy currents are used a special form of split cup-shaped contact for the top of the plunger is used.

One of the special features claimed for the system is that there is no tendency for the solenoid to stick when there is a slight current due to surface leakage flowing through the magnet coil, for, as stated above, it requires almost the full current to hold it closed.

A working section of double track, about 1400 ft. in length, has been built at Aberdeen, Scotland, for experimental purposes. This has been successfully operated in various conditions of weather, and in no single instance has the circuit closer failed to work satisfactorily.

The company has also worked out a method for applying the same system to third-rail roads, using the same circuit closer and an overlapping twin third rail, both members of which are spanned by the collecting shoe on the car. In this way the third rail of an interurban road can be divided into sections of any convenient length, and only that section from which current is being taken for the operation of the train is alive.

The system is owned by the McElroy-Grunow Electric Railway Company, of Bridgeport, Conn.

FIG. 3.—LAYING CONTACT SYSTEM IN ABERDEEN

CUTTING ICE BETWEEN RAILS

Manager F. E. Merrill, of the Detroit, Ypsilanti, Ann Arbor & Jackson Railway, believes that he has solved the difficult problem of preventing ice forming between the rails in the center of the track. During the severe weather of last month ice formed in considerable quantities at different points along the road, and on the night of Jan. 23 the large interurban cars had great difficulty in moving, on account of the solid hammocks of ice in the center of the track. In some places they were raised so high that the motor cases of some of the cars scraped in passing over them, and there was constant danger of the car being thrown off the track. Mr. Merrill had a car rigged up with a large, knife-shaped piece of iron plate, between the motors on the rear truck. This cutter projected 3 ins. over the rails on both sides, and was controlled from the car above, so that it could be raised and lowered at will, working on the plan of a road scraper. The car was first taken out on Saturday, Jan. 30, and the ice cutter worked satisfactorily. Mr. Merrill says the arrangement comprised the ideas of his men and himself and was not the idea entirely of any one man, but was worked out in the shops.

A muskrat was responsible for the complete suspension of traffic on the Springfield & Xenia Railway, of Xenia, Ohio, a few days ago. The rat was drawn in through the feed-water in-take, and the engineer had to shut down the power house. After about 12 hours work the pipe was cleared.

FINANCIAL INTELLIGENCE

WALL STREET, Feb. 10, 1904.

The Money Market

A slight change has come over the money market during the past two weeks, pointing toward a gradual raising of interest rates. The banks, which, a short time ago, were freely offering their funds on the long-term contracts at 4 per cent, are now restricting their offerings, and holding out for 4¼ per cent. Owing to the fact that demands for speculative purposes have been light, call money has not yet hardened. But it is to be remembered that when the tendency of rates is upward, it is always apt to appear first in the time money market before it appears in call money. The hardening of rates on time loans is directly due to the decrease in the surplus bank reserves, which, from the high point of the season, a fortnight ago, amounts to $4,200,000. This, in turn, has been caused chiefly by the winter's remarkable bank loan expansion, which has reached a larger total than for any corresponding period in previous years. The loan account now stands very close to the billion-dollar mark, and it is $46,000,000 larger than the high total of last year, which heretofore has been the record. Nothing in the present financial situation has attracted so much attention and such eager controversy as the circumstances which have produced this great inflation. Some critics insist that it is due almost entirely to the shouldering of credits formerly borne by the trust companies and out-of-town institutions, by the Clearing-House members, the argument being that the outside institutions find it more profitable with call money at 2 per cent to keep their funds on deposit. On the other hand it is well known that enormous sums have been borrowed during the last two months by the railroads, the principal transaction of the kind being the $50,000,000 loan announced last week by the Pennsylvania Company. In the cases where new securities have been issued against these borrowings, it is well known that they have not yet been sold, and that in consequence large sums of bank capital has been tied up and have necessarily been made to show in the loan item. We are inclined to the view that it is these corporate borrowings, rather than the shifting of credits, which is responsible chiefly for the recent enlargement of Clearing-House loans. On this assumption it is impossible to look upon the present money outlook optimistically. The season has now arrived when currency usually ceases to flow in the direction of this city. The interior markets will soon begin to prepare for the spring trade, and will draw upon their New York balances more or less heavily. At the same time, the abnormal demands for cotton financing are drawing money in considerable quantity to the South. Already the effect has begun to appear, last Saturday's bank statement showing a decrease of $2,500,000 in cash holdings. The Secretary of the Treasury has given notice that he will draw upon the banks for at least $30,000,000 of the total sum of $60,000,000 odd, which the government must pay for the Panama Canal. Whether or not this will lead to the export of gold, is a doubtful point, but it is at least certain that the operation will tend to diminsh rather than increase local cash supplies. With the probability, therefore, of a considerable decline in cash holdings during the next two months, and with the loan account in its present shape, where liquidation cannot be easily effected, the chances are all in favor of a heavy reduction in surplus reserves with the inevitable tendency toward rising money rates.

The Stock Market

The stock market has gone through another severe experience during the last ten days. Prices have fallen heavily, and liquidation on a large scale has occurred through the entire list. Had there been nothing else than the conditions just described in the money market these would have undoubtedly sufficed to produce a fall in prices. The Stock Exchange, of course, foresees that should it become necessary to forcibly curtail bank credits the pressure would fall heaviest in their quarter. It is simply last year's situation over again, the alternative lying between forced liquidation of securities, which have a ready market, and those which cannot be easily sold, and the choice falling necessarily upon the marketable securities. Preparation for such a contingency is undoubtedly one of the main causes for the past week's decline in stocks. But the movement has been very much more violent than it would otherwise have been, owing to the presence of three extraordinary factors on the outside. One of these is the collapse in the speculation on the commodity markets, particularly in cotton, in the course of which enormous losses have been incurred by speculators actively identified with the stock market. The second is the outbreak of war between Russia and Japan, which although pretty well expected for several weeks past, has nevertheless been a severe blow to investment confidence. Finally, and worst of all, is the appalling disaster at Baltimore, the full consequences of which, at this writing, are still undetermined. Monday's collapse on the Stock Exchange was largely the result of this astounding news. Apprehension is gravely felt that this may mean the wholesale suspension of insurance companies, and that the enormous security holdings of these institutions will be pressed for sale upon the market. This fear may prove to have been greatly exaggerated, but it is certain that it was the real motive for the tremendous outpouring of stocks in Monday's Wall Street dealings. When the more immediate disturbances have subsided the market will be entitled to a fair recovery. But in the present pessimistic state of sentiment, it takes a very sanguine person to look for any permanent change for the better.

The downfall of speculative values has told more heavily against the traction stocks than any other quarter, because of the fact that these have been a favorite object of manipulation for the rise. A very large account in Brooklyn Rapid Transit has been hastily liquidated, the gossip being that many of the politicians who bought the stock around 50, have been forced out at a heavy loss. Rumors that the Brooklyn company were about to announce another sale of bonds contributed toward the decline, but there seems no reason to believe this is anything more than a story gotten up for speculative purposes. The statement of earnings for the December quarter, showing a fairly satisfactory increase over a year ago, attracted little attention. In both Manhattan and Metropolitan there has been some liquidation of speculative holdings, but the selling has been comparatively light, and both stocks seem to have been well taken on the decline.

Philadelphia

The traction stocks suffered comparatively little during the general slump in prices of the past week. The most that happened was a check upon speculative operations for a rise, which had begun to make headway in a few of the active specialties. Philadelphia Rapid Transit, which two weeks ago sold as high as 15¼, fell by gradual stages to 14. Union Traction declined a point from 48 to 47. Philadelphia Electric dropped from 6¼ to 5 13-16. American Railways declined from 45 to 44 bid, but no sales were reported at the lower figure. The only heavy liquidation occurred in Philadelphia Company shares, in which a fair-sized account for the rise was open. The common stock on active trading, broke from 42½ to its extreme low point of 38¾, reached in Monday's session; then it rallied to 39⅛. The preferred sold down a point from 46 to 45, and recovered to 45½. Philadelphia Traction held stubbornly at 97½. Other sales included United Traction of Pittsburg preferred at 49, Reading Traction (110 shares) at 30, Railways General at 1¼ and 2, and Consolidated Traction of New Jersey from 64 to 63½.

Chicago

Liquidation in some quarters of the Chicago market, at least, seems to have definitely ceased. This is particularly true of the Lake Street Elevated securities, which, since the successful completion of the reorganization plan, have been holding very steady, and of South Side Elevated stock which is being well taken around 93. Lake Street trust receipts sold a week ago as high as 2¾ but later reacted to 2¼. The strength in South Side shares is partly due to the excellent earnings statement recently submitted for November, which broke all records for the period. Although the increase in gross receipts is accounted for by what the road gained by the strike on the surface lines, and may therefore be temporary only, it is noteworthy that the November operation ratio—51 1-3 per cent—was the smallest in the history of the South Side system. It compares with an average ratio for the year 1903, of 59 per cent, with 58 per cent in 1902, and with 63 per cent in 1901. In contrast to the strength of these stocks, other parts of the traction list have shown renewed weakness. Metropolitan Elevated preferred, on intimations tnat dividends cannot be maintained, declined from 52 to 49½, which is a new low record figure. The common stock held comparatively steady at 17. One hundred shares of Northwestern Elevated common sold at 17. The surface line securities have all lost ground during the fortnight. North Chicago after selling as high as 73 for a small lot, dropped on sales of about 100 shares to

70. West Chicago rallied from 45 to 47, but fell back to 46. City Railway declined from 167½ to 165. Union Traction common was noticeably heavy at 5, and the preferred lost a half point from 30 to 29½.

Other Traction Securities

Realizing sales, owing to the unfavorable state of the general market, caused a decline in Massachusetts Electric issues, the common dropping from 22¼ to 20¾, and the preferred from 80¼ to 77½. West End common lost a point from 91 to 90, and the preferred suffered an equal loss from 109 to 108. Boston Elevated sold to the extent of a few hundred shares at 137, "ex" the dividend. Business has been suspended during the last two days in Baltimore, owing to the great fire. Previous to that time, decided strength was shown in the United Railways bonds, the incomes holding at 56½, and the general 4s at 92. The stock sold down from 8⅜ to 8, and back again to 8⅛. Other sales in Baltimore during the fortnight comprise City Passenger 5s at 106⅝, Lexington Street Railway 5s at 97, City & Suburban of Washington 5s at 95, Anacostia & Potomac 5s at 93¾, and Charleston Consolidated Street Railway 5s at 103. On the New York curb the feature was a sharp decline in Interborough Rapid Transit which naturally accompanied the weakness of the other local tractions on the Stock Exchange. It took 3700 shares to put Rapid Transit down from 108¾ to 107, 2000 shares to put it down to 104½, and 1000 more to carry it to the low level of 101½. After this there was a slight rally to 102¼. Nassau Electric 4s advanced from 79 to 80, but later reacted to 79½. Washington Traction 4s declined from 76⅝ to 76, while 300 shares of the preferred stock sold at 47. Chesapeake Traction 5s were bid up sharply to par. One hundred shares of American Light & Traction sold at 50, 150 United Railways of St. Louis preferred at 56½, and New Orleans 4½s at 80¼ to 80½. On the Stock Exchange, both Twin City Rapid Transit and North American lost all their recent gains in the general market decline.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with two weeks ago:

	Closing Bid	
	Jan. 26	Feb. 9
American Railways	44¼	44
Aurora, Elgin & Chicago (preferred)	a55	a55
Boston Elevated	140	*136
Brooklyn Rapid Transit	49⅞	41
Chicago City	160	166
Chicago Union Traction (common)	5¼	5
Chicago Union Traction (preferred)	30	29
Cleveland Electric	70½	70½
Consolidated Traction of New Jersey	64	63
Consolidated Traction of New Jersey 5s	105½	105
Detroit United	65	59¾
Elgin, Aurora & Southern	a30	a30
Interborough Rapid Transit	107½	104½
Lake Shore Electric (preferred)	—	—
Lake Street Elevated	2	2¼
Manhattan Railway	145	141½
Massachusetts Electric Cos. (common)	22¼	20½
Massachusetts Electric Cos. (preferred)	79	77
Metropolitan Elevated, Chicago (common)	17½	17
Metropolitan Elevated, Chicago (preferred)	52	49
Metropolitan Street	122¼	117⅜
Metropolitan Securities	89	84½
New Orleans Railways (common)	9¾	9
New Orleans Railways (preferred)	29	30
New Orleans Railways 4½s	a79½	80
North American	88½	83
Northern Ohio Traction & Light	15¼	14
Philadelphia Company (common)	42¼	39¼
Philadelphia Rapid Transit	†14⅞	13½
Philadelphia Traction	97⅝	97½
St. Louis Transit (common)	11½	5¾
South Side Elevated (Chicago)	92	92½
Third Avenue	121½	115
Twin City, Minneapolis (common)	94	89
Union Traction (Philadelphia)	47¾	46¼
United Railways, St. Louis (preferred)	52	50
West End (common)	90⅛	90½
West End (preferred)	108⅛	108½

a Asked. † Includes new $5 assessment.

Iron and Steel

According to all accounts the iron market has taken on a distinctly better tone during the last fortnight. The reports now are that the demand for steel is much more active than it has been for several months; a large business is being done in wire products, sheet steel and plates, and that a better inquiry has developed for structural material. There is some reflection of this naturally in the lower branches of the industry, where an increasing tonnage in pig iron is recorded. Nothing further is said of the situation in steel rails, but the predominant feeling here is that the mills must sooner or later make concessions. Quotations are as follows: Bessemer pig iron $13.50 to $13.75, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 12¼ cents, tin 28¼ cents, lead 4 7-16 cents, and spelter 4⅞ cents.

THE BALTIMORE FIRE

A particularly distressing feature of the lamentable Baltimore fire is the destruction of the Pratt Street power station of the United Railways & Electric Company, from which the main street railway and lighting lines received current. The street car service has necessarily been greatly curtailed because of lack of power, and the lighting service has been even more seriously crippled. It is not thought that the curtailment of the street car service will materially hinder the work of salvage, but the cutting down of the lighting service is particularly unfortunate, because the work of policing the burned district at night will be rendered more difficult, not to mention the other inconveniences that will result from inadequate illumination.

From the information at hand as the STREET RAILWAY JOURNAL goes to press, the Pratt Street plant is a complete loss. It was the largest of its kind in the city, and a model in design and construction. Built up from one of the smaller plants of one of the constituent companies of the United Railways, it was well located on tide-water front and near the theoretical load center of the system. The original building comprised the northerly wing of the completed plant and contained the direct-current apparatus. Adjoining this on the west was the boiler house. The southerly wing housed the alternating-current machinery. The boiler house, which supplied steam to the engines in the new addition, was erected between the site of the new annex and the old plant. The outlying districts were supplied by high-tension distribution from the alternating-current plant, while the suburban lines in the northwest and western sections of the city were furnished with current from the same source through two sub-stations.

ELECTRIC RAILWAY PROJECTS IN VENEZUELA

The conversion into electric motive power of a number of steam and horse car lines operating in Venezuela is being contemplated. The most important project refers to the proposed change of power on the steam railroad system which runs between La Guaira, the port of Caracas, and Caracas, the capital city of Venezuela. The road is operated by La Guiara Railroad Company, of which Harry J. Almond is general manager, and whose head offices are in London. It is a 36-in. gage line, 26 miles in length. Power is to be derived from an hydraulic plant, there being considerable water power available in the vicinity.

There is also a proposition on foot to develop power at Juan Diaz, where there is a water fall capable of developing 5000-hp. The power will be largely utilized to operate the Macuto & Maiquetilla Street Railway, which is to be extended along the seashore to La Guaira, making about 15 miles in all.

The horse car lines in Maracaibo, about 15 miles long, are also to be converted into electric traction. The change into electric motive power of the horse car lines of the Compania Anonima Tranvias Bolivar (the Bolivar Tramways Company), and the Tranvias de Caracas (the Caracas Tramways), aggregating 12 miles, is also being considered.

Carlos G. Palacios, the chief engineer of the electrical department of the Caracas Gas & Electric Light Company, is now in the States for the purpose of investigating the latest electric traction and power systems. Mr. Palacios, some twenty years ago, was connected with the old United States Electrical Company, of Newark, N. J., and has been the pioneer introducer of Yankee electrical equipment into Venezuela. He will be here for about three weeks, and can be found at the offices in the Orient Building, 79-81 Wall Street, of the export commission house of Kates & Bok.

ANNUAL REPORT OF THE TWIN CITY RAPID TRANSIT COMPANY

The reports of President Thomas Lowry, of the Twin City Rapid Transit Company, of Minneapolis and St. Paul, are usually full of interesting facts regarding the condition of that prosperous company, and this year's review is no exception. It is given here in full:

Minneapolis, Jan. 21, 1904.

To the Stockholders:

The increased travel of the Twin City Rapid Transit Company predicted in our last report has been more than verified, and the growth of St. Paul and Minneapolis has proved the necessity of providing additional power, as stated in the report of 1902.

NEW POWER PLANT

The work on our new steam power plant is rapidly nearing completion. This building is located near our present water power plant, and is 156 ft. x 255 ft. x 86 ft. high, with heavy limestone foundations and brick superstructure. The floors, roof and coal bunkers are a combination of steel and concrete, and the building is entirely fireproof.

This building will contain three engine and generator units of 27,000-hp. maximum capacity; boilers and stokers of 30,000-hp. maximum capacity; coal bunkers of 3000 tons capacity with a complete equipment of condensers, heaters, pumps and auxiliaries.

The plans allow an increase in the total equipment to five engine and generator units of 45,000-hp. maximum total capacity and 24 boiler units of 40,000-hp. maximum total capacity.

Work on the two sub-stations and office buildings in Minneapolis and St. Paul is nearing completion. Both buildings are located near the business district of the two cities and are constructed of pressed brick, terra cotta trimmings, roof and floors of steel and concrete, and entirely fireproof. The Minneapolis building being three stories in height with dimensions 80 ft. x 150 ft., and 56 ft. high, and the St. Paul building being two stories, with dimensions 80 ft. x 150 ft., 44 ft. high.

Each sub-station will contain three rotary convertor units of 9600-hp maximum total capacity, and the buildings will allow for an increase of 100 per cent. The present equipment of rotaries will be rearranged, four of the units being installed in the present water power station, two in a sub-station located in the Midway district and two in a sub-station on the Stillwater interurban line.

The steam power house will be connected with these sub-stations by a complete system of underground conduits, cables and overhead transmission lines, sufficient cables being installed at present for the present capacity of stations, and the conduits are sufficient for the ultimate capacity of the stations.

CARS AND TRAFFIC IN BAD WEATHER

The company builds its own cars, and has adopted a standard car 45 ft. 2 ins. in length, with four motors, 40-hp capacity each, and air brakes. For interurban lines the seats are similar to passenger cars on steam roads, and on local lines the cars have half cross and half longitudinal seats, each car having a seating capacity of fifty-two persons. They can be changed from open to closed cars in five minutes, and greatly increase our earnings by being able to follow any change in the weather.

On stormy days in summer, previous to adopting these cars, when operating open equipment, receipts would drop from 25 to 30 per cent, but with the standard cars now in operation, earnings on such days have largely increased.

During the period from 1893 to 1897, the style of our equipment was 18 ft. and 22 ft. open and closed motors, with trailers converted from old horse cars.

The following table shows the difference in earnings between summer and winter months to be $614,398.80:

		Per cent
1893-1897—April, May June, July, August and September	$5,367,837.80	53.03
1893-1897—October, November, December, January, February, March	4,753,439.00	46.97
	$10,121,276.80	100.00

In the spring of 1897 we introduced the large cars and have gradually replaced the small equipment. A similar table to the above, for the years from 1898 to 1902, inclusive, shows winter earnings in excess of summer, $3,792.60:

		Per cent
1898-1902—April, May, June, July, August and September	$7,299,987.45	49.99
1898-1902—October, November, December, January, February, March	7,303,780.05	50.01
	$14,603,767.50	100.00

EXTENSIONS

Many new extensions and improvements will be made as soon as possible, among which are the following:

The Marshall Avenue line in St. Paul will be extended across the Mississippi River on Lake Street and connect with Cedar Avenue and across Thirty-first Street in Minneapolis, which completes a third interurban between St. Paul and Minneapolis, and will extend across the city of Minneapolis to connect with Lake Harriet, giving the residents of St. Paul direct connection with the beautiful lakes of Harriet and Calhoun, an important part of the Minneapolis park system. In the near future it will extend to Lake Minnetonka, the largest summer resort in the Northwest. The Minnehaha line in Minneapolis will be extended about 3 miles to Fort Snelling, making a connection with St. Paul, and complete a fourth interurban between the two cities. The government has within the last two years expended large sums of money in improving Fort Snelling, and has under contract large improvements for the coming year. It will be one of the six large permanent forts in the United States.

An extension will be made to South St. Paul, where are established the large packing industries; one to White Bear Village, a popular summer resort; one to South Stillwater, a manufacturing point, and another to Lake Phalen, in St. Paul, which is part of the St. Paul park system. These are all short extensions, and would have been built long ago if the company had had sufficient power for their operation. They will all be attractive to excursionists and have sufficient regular travel to make them more than self-sustaining the entire year.

GROWTH OF BUSINESS

The growth of business has been most satisfactory, gross and net earnings having more than doubled in the period between 1897 and 1903, as will be seen by the following comparative statement:

	Gross Earnings	Net Earnings
1897	$2,009,121	$1,007,041
1898	2,170,716	1,151,324
1899	2,522,794	1,365,821
1900	2,839,356	1,534,667
1901	3,173,976	1,758,524
1902	3,612,211	1,982,041
1903	4,063,938	2,185,888

NEW BOND ISSUE

A joint mortgage has been issued by the Minneapolis Street Railway Company and the St. Paul City Railway Company, providing for an issue of twenty-five-year 5 per cent gold bonds not to exceed $10,000,000—$1,000,000 of said bonds are reserved to retire a like amount of joint bonds of said companies maturing in 1911; $3,500,000 to pay for the new power plant, sub-stations, electric equipment, conduits and other requirements, new shops and fifty new large double-truck cars. The remaining $5,500,000 of bonds under this mortgage are to be issued for future extensions and improvements of 90 per cent of the cash cost of the same.

The Minneapolis Street Railway Company and the St. Paul City Railway Company are the two most important of the underlying companies of the Twin City Rapid Transit Company, and operate under franchises and ordinances which are unusually valuable and liberal in their provisions. They own all the street railways in the cities of Minneapolis and St. Paul. The fares are irrevocably fixed at 5 cents in each city. It also operates a line from St. Paul to North St. Paul, to Wildwood on White Bear Lake, and to Stillwater—a distance of about 20 miles—and all the lines in Stillwater, a city of about 14,000 inhabitants.

The properties of the company have been maintained in excellent physical condition and substantial improvements and betterments have been made each year, the cost of which has been met largely out of the current revenues. With the completion of the new power plant, the additional equipment and the other improvements provided by the sale of these bonds, the revenue earning power of the company will be considerably increased, further economies in operation will be developed and the physical condition of the properties will be unequaled by any other street railway system in the country.

Former reports of this company have shown a large surplus. The 1901 report shows $2,700,284.86, and the 1902 report $2,991,346.01 This is, in a sense, misleading, as it does not represent actual cash surplus on hand, but shows surplus earned over operating expenses, interest charges and dividends, but expended in betterments and improvements. We have, therefore, transferred former surplus to roadway, equipment, etc., and surplus appearing in future reports will mean cash on hand or its equivalent.

The gross earnings for the fiscal year ending Dec. 31, 1903, show an increase of 12.51 per cent over the previous year, and 10.28 per cent net over same period with same mileage. The operating expenses including taxes and all charges, except interest and dividends, were 50.36 per cent of the gross, as against 49.30 per cent for

the preceding year. Twenty thousand dollars ($20,000) 7 per cent bonds of the Minneapolis Street Railway Company were cancelled May 1, 1902, and twenty thousand dollars ($20,00) May 1, 1903, and in lieu thereof $39,000 consolidated bonds of the Minneapolis Street Railway Company were issued.

We have paid four dividends of 1¼ per cent on the common stock and four dividends of 1¾ per cent on the preferred stock leaving a net surplus of $419,296.97, which has been expended in betterments.

The company has expended during the year $2,216,810.43 for power plants, cars and new paving construction, distributed as follows:

Paving, St. Paul	$306,052.74	
Paving, Minneapolis	285,732.98	
		$591,785.72
New Power plants		1,273,252.[illegible]
Car equipment—		
Forty-two cars complete, four motors and air brakes	$309,294.03	
One hundred and thirty-four additional air brake equipments	42,478.00	
		351,772.03
Total		$2,216,810.43

The following is a comparative statement of the liabilities of the company Dec. 31, 1902, with Dec. 31, 1903:

	1902	1903
Total common stock issued	$16,511,000	$16,511,000
Total preferred stock	3,000,000	3,000,000
Funded debt	10,868,000	12,637,000
	$30,379,000	$32,148,000

Respectfully submitted,

THOMAS LOWRY,
President.

In addition to the foregoing report a number of statements are submitted on receipts, and other matters which will also be found equally interesting. They are therefore appended herewith:

MONTHLY STATEMENT OF GROSS EARNINGS, 1903

	Passenger earnings	Miscellaneous earnings	Total earnings
January	$310,084.50	$1,753.35	$311,837.85
February	280,946.75	1,654.07	282,600.82
March	317,838.70	1,717.65	319,556.35
April	315,464.50	1,713.99	317,178.49
May	337,698.70	2,036.58	339,735.28
June	346,018.15	1,726.45	347,744.60
July	362,702.05	1,769.15	364,471.20
August	363,579.10	1,887.13	365,466.23
September	370,348.75	1,903.53	372,252.28
October	346,673.10	1,973.07	348,646.17
November	333,423.60	1,841.07	335,265.57
December	357,451.70	1,731.85	359,183.55
Total	$4,042,229.60	$21,708.79	$4,063,938.39

RECEIPTS

Passenger earnings	$4,042,229.60
Miscellaneous earnings	21,708.79
Total earnings	$4,063,938.39

EXPENSES

Maintenance of way and structures	$117,535.95
Maintenance of equipment	211,297.54
Operation of power plants	331,281.21
Car service	825,462.16
General expense	165,675.02
Legal expense	22,999.90
Injuries and damages	162,694.52
Insurance	41,104.20
Total operating	$1,878,050.50
Net earnings from operation	$2,185,887.89
Interest on debt and taxes	$731,040.92
Surplus applicable to dividends	$1,454,846.97
Dividends, preferred stock	$210,000.00
Dividends, common stock	825,550.00
Total dividends	$1,035,550.00
Surplus used for betterments and new construction	$419,296.97

Per cent total operating (including taxes) to total earnings	50.36

TRACK MILEAGE AND PASSENGER EARNINGS, PER MILE

Total miles single track	38.57
Total miles double track	97.53
Total miles special track	18.98
Total miles all track reduced to single	252.61
Total miles street occupied by tracks	139.31
Gross passenger earnings per mile single track	$16,001.86
Gross passenger earnings, per mile street occupied by single track	29,016.08
Gross passenger earnings	4,042,229.60

STATISTICAL STATEMENT

	1903	1902	1901
Gross earnings	$4,063,938.39	$3,612,210.88	$3,173,975.85
Operating expenses	1,878,050.50	1,630,169.54	1,415,451.70
Net earnings	2,185,887.89	1,982,041.34	1,758,524.15
Revenue passengers carried	80,844,592	71,830,971	63,009,957
Transfers redeemed	20,429,043	17,789,105	15,587,858
Operating per cent earnings	50.36	49.30	48.35
Per cent on preferred stock earned & paid	7.00	7.00	7.00
Per cent on common stock earned	7.54	7.06	5.87
Per cent on common stock paid	5.00	5.00	4.00
	1900	1899	1898
Gross earnings	$2,830,355.78	$2,522,793.85	$2,170,716.01
Operating expenses	1,304,689.11	1,156,972.37	1,019,392.14
Net earnings	1,534,666.67	1,365,821.48	1,151,323.87
Revenue passengers carried	56,284,102	49,526,845	42,901,859
Transfers redeemed	13,909,535	12,983,112	10,602,078
Operating per cent earnings	49.16	48.71	49.92
Per cent on preferred stock earned & paid	7.00	7.00	7.00
Per cent on common stock earned	4.70	3.66	2.49
Per cent on common stock paid	3.00	2.50	...

CLOSED THEATERS INJURE CHICAGO TRAFFIC

The closing of the theaters in Chicago, pending extensive improvements, suggested by the Iroquois Theater fire, has naturally resulted in considerable loss of revenue to Chicago transportation lines during the month of January. The reports of the elevated railroads of Chicago for January show that these roads had a great part of their natural increase of traffic wiped out by the closing of the theaters, and the very cold weather which prevailed during that month.

The daily average of passengers carried on the Northwestern Elevated during January was 70,204, or 2.86 per cent increase over last year. The Metropolitan Elevated carried 112,413 daily, a decrease of .31 per cent. The South Side Elevated carried a daily average of 87,601 passengers, an increase of 1.11 per cent.

ANOTHER WESTERN COMPANY ABANDONS STEAM

J. J. Burns, who was connected with the Chicago & South Shore Electric Railway, has become associated with Simon Bamberger in the Salt Lake & Ogden Railroad, and together they have worked out extensive plans for the extension and rehabilitation of the latter road. In addition to building an extension of the line from Farmington to Ogden, Utah, it is proposed to abandon steam as a motive power on the line already in operation, and equip the entire system for operation by electricity. This will call for an expenditure of about $115,000 on a power station, which will be erected at Farmington or Coleville, and not less than $100,000 on passenger coaches. In order to provide for these improvements, the capital stock of the company will be increased from $800,000 to $1,000,000, and $1,000,000 of bonds will be sold. The plan of campaign as laid out for the extension of the line calls for the work of construction to begin at once. The extension from Farmington to Kaysville is to be completed by April, and the entire line is to be finished and equipped as far as Ogden within eighteen months. The extension will be laid with 60-lb. rails. The policy heretofore maintained by Mr. Bamberger, of keeping his right of way on private ground, and well fenced, will be adhered to; this, of course, will permit of a very fast schedule.

CHICAGO CREATES TRANSPORTATION BUREAU

The Chicago City Council on Feb. 1 adopted an ordinance creating a transportation bureau which will have direct supervision of all matters pertaining to local transportation service. The ordinance provides for appointment by the mayor of a local transportation expert as head of the department, to hold office two years. His assistants shall be civil service employees, with the exception of an attorney. It is provided that this attorney shall be assigned to the department from the corporation counsel's office and shall have charge of all suits and legal work of the department. He is expected to give advice regarding the powers of the head of the department to enforce provisions of the ordinances referring to the street car corporations and the exercise of police powers for the efficiency of the service desired from the companies. If deemed advisable an expert engineer will be added to give advice and information for the department and the committee of the council.

NINETY-NINE YEAR FRANCHISE RIGHTS ATTACKED

The most sensational proceeding in the Chicago traction litigation, involving the franchises of the Union Traction system, was the attitude taken by the city on Feb. 1 when it presented its case in legal form. The principal contentions of the city are:

1. That in amending original incorporation act of 1859 the ninety-nine-year act does not refer to section authorizing the organization of the North Chicago City Railway Company; hence the rights of North Side Company in streets expired in 1884.
2. That the receivership proceeding was collusive and that Judge Grosscup has no jurisdiction because creditors are residents of Illinois.
3. That receivers' claims of rights under the ninety-nine-year act are reckless and dishonest.
4. That the traction interests have failed to give adequate service.
5. That the capitalization of traction interests and floating debts aggregate $96,000,000, and that the present cash value of the tangible property does not exceed $23,000,000.
6. That the traction companies have promoted infamous legislation.

The contention of the city that all the franchises ever held by the North Chicago Railway Company expired in 1884 is based on the ground that it was organized under section 10 of the act of Feb. 14, 1859, and that this section was never amended. The act of 1859 specifically limited the duration of the franchises granted the Chicago City Railway Company to twenty-five years. Later this act, together with that of 1861, which incorporated the Chicago West Division Railway Company, was amended by what is commonly known as the ninety-nine-year act. This act, passed in 1865, amended only sections 1, 2, 4 and 5 of the two acts. As the North Chicago City Railway Company was incorporated under section 10 of the act of 1859, the contention is that the act, in so far as it applied to the charter, was unamended, and that the privileges of the company expired in 1884. If this contention is upheld the Chicago Union Traction Company, which acquired its right to the north side lines from the North Chicago City Railway Company in 1899, is now operating its lines on the north side illegally, according to the city's legal advisers.

This claim affects nearly all the trunk lines on the north side and several of the cross-town lines. It is set out in section 33 of the answer that it is the intention of the city immediately to take legal steps to prevent the operation of these lines unless restrained from so doing by an order of the courts..

While the attorneys for the city declare that the discovery made by David T. Watson, the Pittsburg attorney called in the case, effectually disposes of the claim of the North Chicago Railway Company and the Chicago Union Traction Company to rights or privileges under the ninety-nine-year act, they admit that the discovery does not effect the lines of the Chicago West Division Railway Company now being operated under the management of the Chicago Union Traction Company.

Against the claims that the franchises of all the underlying lines of the Chicago Union Traction Company were extended by the act of 1865, however, the claim is made that this act is unconstitutional.

THE BEGINNING OF THE NINETY-NINE YEAR ACT CASE IN CHICAGO

The attorneys for the City of Chicago have filed their answer to the bills of the Chicago Union Traction Company in the Federal Court. This bill points out that the act of the Legislature known as the ninety-nine-year act, extending the charters of the various street railway companies of Chicago in 1865, omitted to mention the name of the North Chicago City Railway Company, which at that time held the North Side franchises. It is maintained in the bill that the North Chicago City Railway Company, therefore, went out of existence by virtue of the expiration of its charter in 1884. The city therefore denies that these North Side franchises existed longer than the life of the company. These North Side franchises were granted in 1859 for a period of twenty-five years. The validity of the ninety-nine-year act of 1865, as far as it relates to extending the life of the franchises of the other companies is questioned, because, in the old State Constitution, which was in force in 1865, there was a clause that "no private or local law passed by the General Assembly shall embrace more than one subject, and that shall be expressed in the title." As the future extension of the traction system was not brought out in the title, the city's lawyers believe that this part of the law is invalid. The answer further attacks the good faith of the Guarantee Trust Company, of New York, in applying for a receiver for the Chicago Union Traction Company, and maintains further that Judge Grosscup is without jurisdiction in the case because the suit does not involve a case within the jurisdiction of the United States Court. It is denied that the companies had any right to construct or operate any systems beyond the limits of the city as defined when the charters were granted.

Judge Grosscup has set March 1 as the day to begin the hearing of the arguments in the case. The city's bill is a voluminous document accompanied with maps showing the different franchise grants. It was prepared by David T. Watson, of Pittsburg, Edwin Burritt Smith and John C. Mathis, of Chicago, assisted by Corporation Counsel Tolman of Chicago.

THE TRIALS OF THE TOLEDO COMPANY DURING THE FLOODS

The system of the Toledo Railways & Light Company was twice tied up as the result of the recent high water, although the worst of the flood was passed through without a shut-down. The fight made against the elements by the company's officials and employees was a most remarkable one. For nearly two weeks the contest was carried on, and then the plant was forced to shut down through a rather strange cause—the lack of water. The plant is located immediately adjoining the Maumee River, and when the flood was at its worst the water in the boiler room was within a few inches of putting out the fires. Owing to a gorge in the river, this level was maintained for several days. The condensers located in the basement were flooded, and it was necessary to shut them down. The automatic oiling system was also thrown out of service through the flooding of pumps, and tanks and all machinery had to be oiled by hand. The fly wheel pits of the large, direct-connected units were filled with water, and streams were sprayed through the engine room as a result.

One of the greatest difficulties was the removal of the ashes from the pits below the boilers, which were filled with water. Holes were broken through the basement floor and divers employed to rake out the ashes. No attempt was made to get the ashes out of the building, and for five days the ashes from 200 tons of coal per day accumulated on the basement floor. The hot ashes falling into the water caused blinding clouds of steam which rendered movements dangerous. One man was severely scalded by the explosion caused by a hot clinker falling near him. An exhaust pipe burst under water which added to the steam, and as it was an essential part of the system it could not be shut down. The insulation on certain cables which were carried through conduits became soaked, causing a pyrotechnic display that was brilliant in the extreme, but dangerous. Finally a number of lines had to be shut down.

A number of the current transformers in the basement were flooded, which necessitated shutting down many of the lighting circuits. The coal conveyor system was put out of service early in the trouble and fueling had to be done by hand. Switches into the yard were cut off, and for days nearly 100 men were kept busy wheeling fuel across a temporary bridge erected over the flooded street.

The first shut-down of the street railway system was caused by the railroad company delivering coal of such poor quality that steam could not be raised. After the high water had receded and the troubles seemed practically over, a second shut down was caused by the bursting of the water main supplying the station. Under ordinary conditions the station takes water from the river, but the high water disabled the feed-water pumps, so the breaking of the city main left the station without water, but with water all around it.

For parts of two days the people of Toledo walked or rode in cabs.

cabs. All the interurban lines were forced to leave their passengers at the city limits, and the mail and freight delivery throughout a large territory was interfered with. General Manager L. E. Beilstein, Superintendent E. J. Bechtel and Chief Engineer Wm. Long were on duty almost constantly during the two weeks, and for a number of days the superintendent and engineer did not leave the power station.

GRANT TO THE NEW YORK, WESTCHESTER & BOSTON COMPANY

After debating the proposition for more than three hours the Board of Aldermen of New York, on Feb. 9, by a vote of 54 to 14, granted the application of the New York, Westchester & Boston Railroad Company for permission to cross sixty-eight streets in the Borough of the Bronx in the construction of its road, defeating at the same time the application of the New York & Port Chester Railway Company for a like grant. This ends, as far as the Board of Aldermen is concerned, the fight that has been waged during the past two years by the New York & Port Chester Company to get the necessary grant.

Both companies plan to build four-track, third-rail electric railways from New York to Port Chester. The New York & Port Chester Company was opposed in its application to the State for a certificate of necessity by the New York, New Haven & Hartford Railroad, whose lines it will parallel. Its ability to carry out its plans was proved to the satisfaction of the State Railroad Commission and the Supreme Court. The New York, Port Chester & Boston Company has recently come into prominence after having passed through a receivership in 1875. Of its real backers nothing further is known than that Dick & Robinson, prominent New York financiers, have agreed to finance the company after certain rights are secured.

TRAMWAY ACCIDENT IN AUCKLAND, NEW ZEALAND

On the night of Dec. 25 a very serious collision occurred between a double-deck and combination car on the Auckland, New Zealand, electric tramways, near Kingsland. The double-decker was climbing a heavy grade and passed into a loop to await another car. The current was shut off, but the ratchet brake refused to work and the car dashed down the long incline at headlong speed with all lights out, except a couple of oil lamps. As it rounded a bend, the car crashed into a combination car, causing the death of three persons and the severe injury of several others.

The coroner's jury, in returning its verdict, found that the collision might have been avoided if the emergency brakes had been applied by the motorman of the double-decker. It recommended that life-guards be placed on all cars, and that double-deck cars should be discontinued in and about Auckland, owing to the many severe grades in that vicinity.

PURCHASED A COAL MINE

The annual report of President Everett, of the Northern Ohio Traction & Light Company, developed the fact that the company recently purchased 1011 acres of coal lands in Noble County, Ohio, at a cost of $38,000. The property was purchased as an investment, and insures the company against any shortage or advance in the cost of fuel. At the Akron power house the company has erected a coal-storage house, capable of holding 2500 tons. An overhead trestle permits the use of bottom-dump cars. During the year the company added a 1000-hp engine and a 500-kw generator to its equipment; erected a $50,000 trestle which eliminates a number of dangerous curves and reduces the power necessary to operate this portion of the line; reballasted and laid new ties over a considerable portion of the line; made a cut-off over 2½ miles of private right of way, besides making a number of other improvements. The gross earnings of the property show a gain of 18.4 per cent, while the per cent of operating expenses to gross earnings was reduced four-tenths per cent. In view of the improvements, it is expected the property will show even a larger gain this year.

Arrangements have been made with a Norwalk caterer to board through Cleveland-Toledo cars at meal hours and sell prepared lunches to passengers. Tables are provided in the cars, if desired, and the man in charge rides down the road until he meets the next car. In this way cars are not delayed. The service is much appreciated.

CHANGES IN THE CONSOLIDATED CAR HEATING CO.

The Consolidated Car-Heating Company's New York offices will, after March 1, be in the new office building at 42 Broadway, Rooms 1747-49.

The company has recently made the following changes in its sales department: Cornell S. Hawley, general Eastern agent, to be general sales agent, with headquarters in New York; S. B. Keys, of the New York office, to be Eastern representative with headquarters in New York, and W. S. Hammond, Jr., of the Denver office, to be Western representative, with headquarters in Chicago.

TO HAVE NEW YORK CITY BUILD ELEVATED STRUCTURE CONNECTING THE BRIDGES

A director of the Brooklyn Rapid Transit Company is quoted as having said that the company, as a solution of the rapid transit problem, will, if the city build an elevated railroad structure, connecting the Manhattan ends of the Brooklyn and Williamsburg bridges, lease the structure and operate a system of belt line trains. The company owns all the elevated structures in Brooklyn, and with the Manhattan link would connect with those on the other side so as to form an unbroken circuit through Manhattan, Brooklyn and Williamsburg and over the bridges.

The plan would be to run continuous trains on this circuit in opposite directions, transferring passengers at any point in Brooklyn to its own system without an extra fare.

In Manhattan the line would run from Delancey Street down the east side of the Bowery, with frequent stations, so that passengers would be able to walk in two minutes to almost any place in the lower business section of Manhattan. Thus people would be able to get from home to business with one fare. According to this plan the Brooklyn lines to be used in the belt would be the Myrtle Avenue and Broadway Elevated. One great advantage of the plan would be that passengers would board the Brooklyn cars all along the line from Delancey Street to the Bowery on both sides of the street, because, no matter in which direction the train was running, they would have about the same distance to ride to their homes. A free transfer between surface and elevated lines would be a feature of the plan.

IMPROVEMENTS BY THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

President John I. Beggs, of the Milwaukee Electric Railway & Light Company, has outlined improvements to be made to the system during 1904 that will call for an expenditure of about $2,000,000. A general office, central car barn and terminal station is to be erected at Third and Sycamore Streets. An addition is to be built to the Commerce Street power house and the interurban line is to be extended from Hale's Corners to Muskego Lake. A new line is to be built to Wauwatoso and West Allis, and double tracks are to be laid in a number of places where, at present, there is a single track. To provide for the increase in passenger traffic, fifty new cars are to be placed in operation on the city lines, and twenty new trailers are to be added to the interurban equipment. The construction of the northern half of the Commerce Street power house is to be resumed soon. Ten thousand horse power was installed there last year, and 15,000 hp is to be added during the present season. It is thought that it will require about fifteen months to complete the general office building and the central car house.

STANDARD FORM OF OPERATING REPORT

Secretary Brockway of the Street Railway Accountants' Association, and Elmer White, committee of blanks and forms, have just published a pamphlet containing the standard form of report for electric railways as approved by the Street Railway Accountants' Association at Detroit, in October, 1902, and as adopted by the National Association of Railroad Commissioners at Portland, Me., on July 6, 1903, subject to such modifications as the requirements of individual States may make advisable. This pamphlet has been published in conformity with the decision of the association as adopted at the Saratoga meeting, and copies have been mailed to each commissioner of the various State boards, to the Interstate Commerce Commission, and to each member of the Accountants' Association. The pamphlet, being 11 ins. x 9 ins., shows the form to much better advantage than given in the report of the Accountants' Association, and will prove a great convenience to members of the association.

TO RELIEVE BRIDGE CROWDS IN NEW YORK

Bridge Commissioner Best, of New York, says that of the many plans considered by him during the last month for the relief of congested conditions at the Brooklyn Bridge, three seem worthy of special notice and will be laid before the Board of Estimate and Apportionment within the next two weeks. The Commissioner refuses to go into details about any of the plans, except to say that they will probably be perfected and laid before the public on or about March 1. However, it is generally understood that the best-liked plan, which is believed to have the support of Chief Engineer O. F. Nichols, is a revision of the old Martin plan of constructing an elevated track up Centre Street, so that the elevated bridge trains could go up that way, and then follow the Delancey Street extension to the Williamsburg Bridge. By taking this plan and effecting connections on the Brooklyn side, a belt line would be effected, and with cars and trains running in both directions, it is believed that ample transportation facilites could be afforded for all Brooklyn residents. The plan has been laid before the Mayor in a general way, and will have to come before the Board of Estimate and Apportionment, because of the amount of money involved.

THE TROLLEY IN THE ADIRONDACKS

From Paul Smith's comes the report that plans are under consideration for the construction of an electric railway to connect Upper St. Regis Lake and Lake Clear with Paul Smith's. This means that the electric railway soon is to encroach upon the sacred domain of the hunter and camper. Power for the proposed road will be taken from Franklin Falls, in the Saranac River, 20 miles away. It is understood that the plans provide for the connection of Saranac Lake with all the villages thereabouts, as well as with Utica.

PLAN TO COMPEL USE OF DOUBLE TROLLEY IN RICHMOND

So threatening has the attitude of the City Council of Richmond toward the Virginia Passenger & Power Company become that the company has ordered the suspension of all work on improvements until it is definitely learned whether the attempt to usurp the rights of the company will be carried out. It seems that the differences between the city and the company have been caused by the threatened action of the City Council to require the company to install a combined double overhead trolley, and the underground conduit system, in order to prevent damage to the city water system by electrolysis. It seems that immediately after Mr. Gould and his associates assumed control of the Richmond properties they looked into the question of electrolysis, which was then being discussed by the city. In their interest they had a thorough examination of the system made by experts, and adopted recommendations of these experts.

S. W. Huff, general manager of the company, has recently sent to the city a letter, in which the position of the company is clearly defined. Mr. Huff calls attention to the measures adopted to minimize the damages of the escaping return current, and says that the company stands ready, as in the past, to compensate the city whenever specific damages are proved. To the refusal of the city, to give the company an opportunity to prove the value of the means it has adopted to correct the evil, Mr. Huff says:

These companies must decline to submit to what seems to them an unjust demand, but they still stand ready to meet the city on any equitable plan. We regret very much that the committee has not seen fit to receive and consider the report of the result of the work done by these companies for the city's protection in the matter of electrolysis, which report was offered under date of Oct. 15, 1903, and we feel sure that a careful examination would satisfy you that this cure has been complete and permanent, and we believe that, with this feature settled, the adjustment of damages could be approached by both sides with better prospects for an amicable settlement.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED JAN. 26, 1904

750,247. Mono-Railway and Truck Therefor; Lina Beecher, Batavia, N. Y. App. filed March 6, 1903. The truck has two grooved traction wheels in alignment with each other, and guard wheels suspended from the truck and arranged to bear upward against their tracks, their bearing portion having rubber tires.

750,261. Brake for Vehicles; William H. Cooley, Brockport, N. Y. App. filed Dec. 9, 1902. In a combined electrical hand brake, an operating-handle and means controlled by the tension applied to the braking apparatus, whereby, when the handle has reached a point in its course, where a predetermined braking effort is applied by the hand-operated mechanism, a breaking effort is also applied by the electrically-operated mechanism.

750,368. Trolley for Electric Railway Cars; Charles J. Johnson, St. Louis, Mo. App. filed May 14, 1903. Details.

750,387. Bogie or Truck for Tramway-Cars, Railway-Carriages, or the Like; Andrew S. Nelson, Albert Stewart and Thomas J. Foster, Motherwell, Scotland. App. filed July 7, 1902. Details of construction.

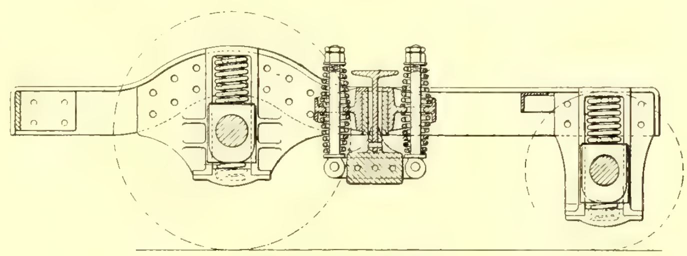
750,396. Convertible Vehicle; Hermann Romünder, Bloomsbury, N. J. App. filed Feb. 24, 1903. The movable side sections are composed of a rigid curved window-sash and a flexible panel, which consists of a number of wood-veneer plates connected together by a number of horizontal slats, so arranged as to leave air spaces between the slats on the inside of the plates.

750,421. Electric Brake; George C. Anthon, Medford, Mass. App. filed Nov. 30, 1901. Consists of a liquid or fluid lock and release for the brakes and means for controlling the same; also in certain improvements in electro-magnetic clutches by which a brake-winding drum is brought into frictional engagement with a driven axle.

750,422. Electric Brake; George C. Anthon, Medford, Mass. App. filed April 11, 1902. A storage battery, charged by the line current, actuates the brakes; provision also for operating the brakes direct from the line.

750,434. Electric Brake; Perley P. Crafts, Boston, Mass. App. filed Nov. 29, 1899. A braking device consisting of a magnet operating the brake, a controlling-switch admitting line current to the magnet, an emergency braking device, consisting of a switch controlling the motor circuits and a disabling device for the latter switch controlled by the line current.

750,458. Overhead Trolley Attachment; Charles Holyland, Sr., Pittsburg, Pa. App. filed June 6, 1903. A trolley harp attachment for retaining the wheel upon the wire.



PATENT NO. 750,387

750,719. Car Fender; Emile Sprich, St. Louis, Mo. App. filed Aug. 28, 1903. Consists of two horizontally-adjustable, telescoping sections and means for operating the same.

750,733. Trolley Pole; John J. Tartt, Los Angeles, Cal. App. filed March 30, 1903. The trolley harp is mounted upon an arm which is pivotally connected to the body of the trolley pole near the wire, and given an upward spring pressure.

UNITED STATES PATENTS ISSUED FEB. 2, 1904

750,818. Trolley Harp or Fork; Fred. P. Crockett and Osro P. Johnson, Kalamazoo, Mich. App. filed April 4, 1903. Those parts contacting with the wheel are massive, so that they will not be quickly consumed by wear.

750,825. Automatic Trolley Line Reel; Charles F. Davy, Mohawk, N. Y. App. filed March 19, 1903. A spring drum and ratchet controlling the trolley cord.

750,852. Pneumatic Roadbed Cleaner; Eli S. Hart, Chicago, Ill. App. filed April 2, 1902. Consists of the combination of a movable car, a suction pipe thereon provided with an inlet-opening arranged adjacent to the surface of the roadbed, an outlet-pipe, and means for creating a vacuum between the inlet and outlet of the suction pipe.

750,913. Railway Rail Crossing; Fredrich W. Umbreit, Clarion, Ia. App. filed Sept. 8, 1903. Main and guard rails provided at the corners receiving the rims of the wheels with recesses located at the heads of the rails, and arranged in the tread thereof, removable plates fitted in the recesses and having upper faces arranged flush with the treads of the rails, the outer edges of the plates arranged at an angle and disposed flush with the adjacent side edges of the heads of the rails.

750,951. Convertible Cab for Railway Cars; James S. Doyle, New York, N. Y. App. filed Sept. 24, 1902. A convertible cab having a movable partition, in combination with a convertible seat, which, when the controlling apparatus on the car is not in use, occu-

pies the space inclosed by the cab when the controlling apparatus is in use by the motorman, the movable partition acting as a support for one end of the seat when the controlling apparatus is not in use and the seat is in position for use by passengers.

750,981. Movable Car Step; Franz Keilwerth, Cincinnati, Ohio. App. filed Oct. 3, 1903. The combination with a car body, of a horizontally slidable step, racks secured thereto, a longitudinally slidable shaft, parts thereon having teeth engaging the racks, a lever for shifting the shaft endwise and means for rocking the shaft.

750,996. Railway Switch Mechanism; Henry B. Nichols, Philadelphia, Pa. App. filed July 20, 1903. Means for operating the switch from a point more or less distant from the track and at the same time permitting the operation of the switch at the track independently.

751,021. Automatic Signaling System for Electric Railways; Harry B. Snell, Cement City, Mich. App. filed April 25, 1903. Details of a signalling switch, operated by a trolley wheel.

751,120. Electrical Controller and Brake-Operating Device; Walter W. Tice, Rahway, N. J. App. filed April 7, 1903. Details.

751,175. Third Rail for Electric Railways; Lloyd G. Johnstone, New York. N. Y. App. filed Oct. 10, 1903. A metal spring-supported plate covers the rail, and is adapted to be forced downward by the shoe on the car to obtain the necessary contact.

751,254. Railway Switch; William H. Braim, Vancouver, Canada. App. filed May 25, 1903. Two guide frames in the line of approach to the switch, blocks slidable endwise in such guides, having positions upwardly projecting through elongated slots in the upper sides of the guideways and designed to engage with depending members from the car, means for connecting the two slidable blocks, so as to be oppositely movable in relation to each other, and means for connecting the blocks to the switch, so that the forward movement of one block operates the switch for the main line, and the other for the branch.

751,277. Car Seat; Charles W. H. Frederick, Melrose, Mass. App. filed April 21, 1903. Details of a walkover seat.

751,298. Trolley; James Kelly, Pittsburg, Pa. App. filed July 11, 1903. Guard arms or finders are thrown into position by the lessening of pressure of the wheel on the wire, thereby preventing the wheel from actually leaving the wire.

751,312. Reversible Car Seat; Paul G. Leistner, St. Charles, Mo. App. filed March 23, 1903. When the back portion of the seat is reversed, and angle of the seat-section is also reversed, a foot-rest is placed in position to be used by the occupants of the next adjoining rear seat.

PERSONAL MENTION

MR. WILLIAM HENRY HAZZARD, who became president of the Brooklyn City Railroad in 1882, died recently at his home in that city.

MR. BISHOP M. BELL, formerly superintendent of the Macon Consolidated Street Railway Company, of Macon, Ga., during a period of fifteen years, is dead.

MR. T. B. REDMOND, who has been superintendent of the Saginaw Valley Traction Company, of Saginaw, Mich., has been appointed superintendent and manager of the East Moline & Watertown Railway, of Moline, Ill., to succeed Mr. Stuart Wise, who has become connected with Blood & Hale, of Boston.

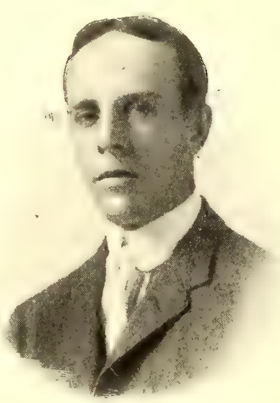
MR. L. TRUDEAU has been appointed to the position of superintendent of the Montreal Street Railway Company, succeeding Mr. L. Robinson, who recently resigned from the company. Mr. Trudeau was at one time manager of the street railway system at Bordeaux, France, and later established the electric car system at Alexandria, Egypt.

MR. W. S. LAYCOCK, the largest British contractor for railroad fittings, supplies, etc., who has introduced a number of American devices for use on steam and electric traction roads on the other side, including the Gold electric car heater, is now in New York. He intends to place substantial contracts for various electric equipment, notably for electric car lighting outfits for British steam railroads. Mr. Laycock is accompanied here by his chief engineer, Mr. George A. Wyld. They are stopping at the Waldorf-Astoria.

MR. GEORGE STEWART JOHNSON, vice-president and general manager of the Grand Rapids Railway Company, of Grand Rapids, Mich., died suddenly at his home in that city, Jan. 30, from the effects of an operation. Mr. Johnson was born at Pontiac, Mich., Dec. 8, 1850, and came to Grand Rapids with his parents at an early age. Here he received his early education, which was supplemented by engineering courses at Philadelphia and Ann Arbor. He was graduated from the University of Michigan in 1873. After preliminary work at Ludington, and in Canada, he entered the engineering department of the Grand Rapids & Indiana Railroad Company as assistant. Rising to the position of chief, he remained in that place, until he resigned some nine years ago to accept the position of general manager of the Grand Rapids Company.

MR. T. E. MITTEN, general manager of the International Traction Company, of Buffalo, N. Y., and Henry J. Pierce, of the Manhattan Spirit Company, sailed from New York Tuesday, Feb. 9, on the Kaiser Wilhelm der Grosse for Amsterdam, Holland. The object of their trip abroad is to inspect the properties of the Netherlands Tramway Company, of which Mr. Pierce is president, and in which Mr. Mitten, Mr. W. Caryl Ely, Mr. Charles W. Goodyear, Mr. Pendennis White, Mr. Spencer Kellogg, and other well-known Buffalonians have extensive holdings. The Netherlands Company has just completed the building of about 17 miles of electric railway, extending from the city of Amsterdam to Haarlem. Mr. Pierce and Mr. Mitten, during their stay at Amsterdam, will prepare for the running of the first cars over the road, and will represent the stockholders of the company in other business transactions relative to the operation of the first electric railway in Holland. Mr. Mitten and Mr. Pierce expect to be gone until the middle of March.

MR. ALBERT H. STANLEY, who, on Feb. 1, was given charge of the street railway department of the Public Service Corporation, of New Jersey, has been in the street railway business over fifteen years, although he is but thirty-one years old. He began his career as office boy for the Detroit City Railway in the horse-car days, afterward serving for the same company and its successors as timekeeper, bookkeeper, traffic superintendent, division superintendent, assistant general superintendent, and finally as general superintendent. During his service in Detroit the daily business of the company increased from $600 to $12,000, and the length of the lines from 43 miles to 550 miles. Mr. Stanley left Detroit last October to accept the position of assistant general manager of the street railway department of the Public Service Corporation. His present title is general superintendent of the railway department, and he will have general supervision of the technical operation of the system.



A. H. STANLEY

MR. WILLIAM COLLINS WHITNEY, whose activities extended in so many directions, and whose success in so many diverse undertakings was so conspicuous that he was often described as one of the foremost of American citizens, died at his home in New York, on Tuesday, Feb. 2. To street railway men Mr. Whitney is principally known through his connection with the Widener-Elkins syndicate, and his active participation until a few years ago in the affairs of the Metropolitan Street Railway Company, of New York. To attempt to sketch his public career would be to summarize the principal political history since late in the sixties, so closely has his name been connected with city, State and national affairs. Born in Conway, Mass., on July 15, 1841, he entered public life in New York almost directly after his graduation from the law school at Harvard in 1865. In 1870 he was active in the campaign against the Tweed ring in New York. Thus began a political career which terminated in his selection to the cabinet position of Secretary of the Navy under President Cleveland in 1884. While serving in this position he outlined a progressive policy for the department, and actually laid the foundation upon which has been built the navy as it is today. After his term of office as secretary ended, Mr. Whitney returned to New York to carry out the scheme, formulated in his mind years before, of unifying the transportation system of New York. To assist him in this work he secured the services of Mr. H. H. Vreeland, now president of the New York City Railway Company, the successor of the Metropolitan Company. His subsequent activities were devoted to his financial interests, in which one of his chief associates was Mr. Thomas F. Ryan. At the time of his death Mr. Whitney was director in not less than twenty different companies.

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, FEBRUARY 20, 1904 No. 8

Published Every Saturday by the

McGRAW PUBLISHING COMPANY

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: 929 Chestnut Street.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York,"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Canada and Mexico......................$4.00 per annum

Single copies, first issue of each month, 25 cents; other issues, 10 cents.

To all Countries outside of the United States, Canada and Mexico.... { $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

The Track Association

The proposal to start some kind of an association for electric railway track engineers has resulted in the expression of various opinions as to the most desirable form of organization to adopt, although track engineers generally seem to be unanimous in the belief that something should be done to secure a trackmen's convention. One of the suggestions which has been made differs somewhat from any of those previously outlined in our editorials on the subject, but proposes a plan which appeals very strongly both to some track men and to certain prominent members of the American Street Railway Association. It is this. The idea of having a separate association for each important branch of railway work shall be given up, and, in its place, the American Street Railway Association will divide its work up into departments, with a vice-president for each department. This would centralize matters and might result in some economy financially. It is argued in favor of this proposal that there are many small companies which would not care to join all the various associations, but are, nevertheless, as much interested as anyone in all the branches of work which each represents.

To carry this plan out to its logical conclusion the accountants and master mechanics should also become departments of the American Street Railway Association. The master mechanics have at present a membership vested in individuals as well as in companies. To combine all these various associations would, of course, require some radical changes in the constitutions of all of them. One condition which experience has shown to be a very essential factor of ultimate success is that each convention should be conducted directly by those immediately interested in that particular convention. That is, under the plan proposed, the master mechanics should arrange for and conduct their own convention, the track men their own convention, and so on through the list. As to whether these conventions are to be organically separate or part of the parent association is for the various interested parties to decide, but the one absolute essential is that the men interested in a certain department have full charge of the convention relating to that department. This will secure interest and discussion which will make these various department conventions a success and will avoid the difficulties which these department associations were originally intended to overcome. Another suggestion in connection with the foregoing which has been made is that certain days be allotted to the convention of each department, so that those officials who are interested in only one department of street railway work need attend the cenvention during that period only.

The plan outlined above is one submitted to F. G. Simmons, of Milwaukee, in reply to the circular letter requesting suggestions as to an organization of track engineers sent out by him and published in our issue of Feb. 6. In its scope it is so radical and would require so many changes in existing organizations that its feasibility is doubtful. Nevertheless, it is at least interesting as affording a solution to the problem of the best way of organizing the track engineers and other departments of railway service, which have as yet no distinct organization of their own. If the several conventions proposed were held on successive days, the plan would also simplify the question, now serious, of sufficient hotel accommodations, as well as that of having a considerable number of the prominent officials of a railway company absent from duty at the same time.

Discipline and Railway Accidents

Slason Thompson, the press representative of the General Managers' Association, recently issued a pamphlet for that body on railway accidents in the United States and Europe, and the precautions taken for the prevention of such catastrophes. This organization is composed of the general managers of steam railroads centering in Chicago, and is one of the most representative bodies of railway men in the country. The document just issued appeals to the general public, which is, of course, deeply interested in the safe operation of all transportation properties, but some of the lessons that are taught by the experience thus recorded are of especial significance to electric railway managers and should be carefully studied, particularly by those engaged in interurban operation. One conclusion that is inevitable as a result of the investigation of accident statistics is that the great majority of collisions are due, not to inherent defects in apparatus or methods of operation, but to the mistakes and carelessness of employees. Another point brought out

is that the introduction of block signals does not by any means prevent collisions, though it may be a valuable safeguard.

Mr. Thompson says that conditions indicate "that the block signal system, though it seems to be correct in principle, has, for some reason, failed of anything like complete efficacy in practice." Why? Because it is not a system that can work itself. Its name has promised more than its principle is capable of fulfilling. The word "block," in the popular acceptation, infers the power to stop or prevent the passage of anything. When the word "automatic" is added to this it conveys an impression of absolute stoppage by a mechanical contrivance without human intervention. Just here is the weakness of the block signal system, for it depends wholly on the human observance of and obedience to its signals, and Mr. Thompson declares that "the lack of strict discipline and the presence of negligence account for nine-tenths of the collisions, not only where the block signal system is used, but where it is not."

Following this preliminary statement regarding what the block signal system can and cannot accomplish, the document affords the public an insight into the working of unionism that will go far toward indicating to those inexperienced in such matters why the responsible officers of large undertakings are averse to union rule aside from any question of wages. "What accounts for the laches of operating officials in enforcing regulations?" is a very natural question prompted by the statements quoted. "Is it not because they are in a constant dilemma between the public demands for fast schedules and a division of authority over their employees, from the engineers to the switchmen?" Mr. Thompson goes on to explain that every act of an operating official is not only subject to appeal to his own superior, but to the officials of the employees' unions or brotherhoods. It is conceeded to be a fact that no body of employees is represented by a more intelligent and well-informed class of officials than comprise the leaders of the several railway brotherhoods, but it must also be admitted that beneficial as these organizations may be in other directions, they exercise an influence over the entire field of railway employment that is detrimental to discipline. In England it is an invariable rule to dismiss a driver, as the engineer over there is called, if he passes a danger signal. Here, before disciplining him, the railway officials have to be prepared with proofs of habitual and dangerous insubordination, to face a demand for his reinstatement. The trouble is, that having neither authority nor responsibility, the organizations of railway employees do interfere with the authority of railway officials in innumerable ways. They seek to dictate appointments to the several branches of the service and to restrict employment to their own members. They also act as a check on the prompt suspension or dismissal for cause covered by the "good of the service." If the organizations guaranteed that all their members were competent and reliable men, and would be loyal employees, amenable to discipline in whatever branch of the service employed, their watchfulness lest injustice be done to such members would be justified. But no such guarantee is furnished; no such assurance is possible. "Discipline carried to the point where obedience to signals is involuntary must eventually become the reliance of the American railway system," is the conclusion of competent experts, whose deliberate judgment is voiced in this publication. This discipline, it is explained, can only be practically effective when the authorities responsible to the public are untrammeled in its enforcement by any secondary responsibility. This subject is of great importance, and we hope that it will not be allowed to rest.

Recent Street Railway Motors

We have previously called attention to several designs of street railway motors brought out recently. It has been thought many times during the past few years that the design of direct-current street railway motors had reached such a state of perfection that important changes were unlikely. While it is true that the electrical efficiency of street railway motors has not been greatly increased, there has been a steady improvement in mechanical design and perfection of numerous details. An example of this is shown by the new Westinghouse motor adopted in St. Louis and described in a recent issue. This motor is similar to and at the same time has points of dissimilarity as compared with the new General Electric motors designed for service in Milwaukee, and described in our issue for Sept. 5. The two features which are common to the design of both motors are, first, the introduction of bearings which provide for oil lubrication, such as has been common for some time on the heavier types of elevated and interurban motors, but not for smaller sizes, and, second, provision for opening the motor case from above only. In both of these motors the ordinary babbitted bearing shells are contained in larger shells or heads, and the motor case is bored out to receive these heads. The heads are large enough to permit of an ample oil well underneath the journal, from which oil is fed to the journal by waste. In the new General Electric motor the bearing head or shell is fastened to the motor casing by bolts running parallel with the armature shaft. In the new Westinghouse motor lugs are provided on the oil-bearing shells, by which they are bolted to the lower motor casing. In the General Electric motor the top part of the motor casing lifts off without the use of hinges, and dowel pins are used to align the casing. In the new Westinghouse motor the top casing is hinged. The General Electric motor was designed primarily for use as an interurban motor on an M. C. B. type of truck, where the truck would not permit the top part of the motor casing to swing back, as it does in the new Westinghouse motor. The latter was planned primarily to go on a truck of the Du Pont type, as an outside-hung motor. Consequently, there was little restriction, and the motor casing is divided in line with the armature journal and swings back on a hinge, an arrangement that would not be feasible on a truck, where the motor is less accessible.

Leaving aside, however, these questions of detail it is evident that there is now the beginning of a movement on the part of large street railway companies to do away with pit work and take the trucks out from under the cars whenever overhauling and repair are necessary. It is not to be supposed that pit work is to be abandoned generally for a number of years to come, even by those companies that are working away from it, as many companies have a large number of equipments on which the motors are designed to be opened from beneath. Many companies have pits equipped with motor and armature lifts that do not have facilities for quickly hoisting car bodies. The latter apparatus is almost a necessity with any company which is to adopt the principle of overhauling from above and doing away with pit work. There is no doubt that repair men can do more and better work when working from above with the motor open before them on a level floor than when working from below in a dark pit.

The other important principle embodied in these motors, namely, the use of oil for lubrication, is a principle which has been tested out thoroughly on heavier motors for several years, and the designs under discussion are simply adaptations of it for the smaller sizes. There is no doubt that a good oil lubrica-

tion will result in much longer life for motor bearings than the old-fashioned grease lubrication which depends upon the heating of a bearing to feed the lubricant to the bearings, and, hence, cannot be efficient in operation unless conditions of heating exist which should not be present.

Esprit De Corps in Corporation

Among the problems which confront those who are responsible for the success of modern industrial enterprises, the question of operating efficiency occupies an important place. Much attention has lately been paid to obtaining the maximum output consistent with a reliable product for a given expenditure of capital and labor in manufacturing establishments. In like manner operating companies have striven to reduce the cost of service rendered, to increase the volume of business done, and to stop the little leaks in operation wherever possible. To this end the machinery of plants is being critically examined and often replaced by apparatus of greater economy; methods of handling materials and carrying on office work are being improved, and the results are justifying the changes made. But while directing attention to the mechanical equipment the equally important fact should not be overlooked that in all organizations where the labor element is large, one of the chief factors of success is the cultivation of a proper esprit de corps among the employees.

A great deal has been accomplished in fostering this feeling of loyalty in some of our present-day corporations, and a great deal remains to be done in others. The policies of various companies differ in regard to the best method of securing the results sought, but experience has shown that it is unwise to run to either extreme of generosity or niggardliness, if the most satisfactory results are to be attained. Sympathy is at the bottom of the whole question, and appreciation grows out of it.

One of the most important questions in this consideration, although not the only one, is that of wages, and while it would be a hopelessly impossible task adequately to discuss this subject in all its phases in this article, there is one precept that should be laid down here. No company can secure the most loyal, lasting and skilled service which does not pay a reasonable and fair amount of money for services rendered. The reader, whether he is employer or employee, will probably agree to this, but may consider the precept a glittering generality. Two illustrations which recently came to our notice, however, will be cited to make it more specific. An electric railway company operating in a city of over 100,000 inhabitants, refused to pay even a motorman's wages to its electrical engineer, who was assistant to the superintendent of motive power and machinery. The electrical engineer was a graduate of one of the best engineering schools in the East, a man of four years' practical experience, and an able constructor and designer. Of course, no such man would stay with a road standing behind such a niggardly policy. Another large company appointed one of its best engineers chief engineer of its most modern power station, at a certain salary, and after he had become established in his new position the company cut his salary over 5½ per cent. To-day this engineer is general manager of a large electric lighting, power and railway company, at several times the salary which was his portion before he made the change. A little encouragement in the direction of salary will do much toward eliminating the petty personal jealousies which cause so much friction between different departments in various companies that might be mentioned—quite apart from the retention of desirable employees.

One electrical engineer, whose day as head of a large department in a large operating company has long since passed, used to give out work to his subordinates in piecemeal Each man would be assigned a certain small part of a particular job, and when the scattered bits were finished the departmental chief would put them together, and work out the conclusions himself, so that none of the under employees would become sufficiently competent to do the entire piece of work alone. This policy speaks for itself; although the illustration is not to be taken as an argument against the evident right of every department head responsible for his subordinates' work to present their work to his superiors over his own signature.

Daily lunch meetings and annual outings of officials, such as have been a feature for the past ten years of the New York City Railway Company, and, possibly of other companies, offer another means of increasing esprit de corps among the department heads. They constitute excellent examples of how loyalty to the corporation may be conserved through the medium of interchange of opinions, social intercourse and social events.

In like manner lectures to the rank and file of a great company's employees may be productive of much good. The president of more than one street railway system in this country makes a practice of speaking on occasion to his employees, and the good feeling that results is mutually helpful. Along with this may be mentioned the advantages of a well-stocked company library, equipped with the technical and popular journals as well as the latest works of fiction and standard technical books. It would not seem necessary to enlarge here upon the influence of well ventilated and lighted work rooms, properly heated in winter, and wholesome sanitary and washing arrangements upon the employees' attitude toward a company. If an employee once becomes imbued with the idea that his personal welfare is a matter of sublime indifference to the corporation which employs him, it is difficult to obtain his sympathetic loyalty in times of crisis, even though he may perform his daily work without mistakes or complaint.

Various kinds of co-operation are of interest in this connection. The privilege of buying stock, the formation of savings associations for employees' benefit, the offering of free legal advice by the law department, and the gift of money by the company to employees' benefit associations are all means of increasing the esprit de corps in the rank and file. Of course, in buying stock employees should be made to understand that they take precisely the same chances as regards dividends as though it was purchased in the open market, but the conditions of purchase may be made easy through the installment plan, or the employee favored in some way which gives him a real advantage over the outside. One savings association paid 6 per cent dividends on all employees' deposits, and it was a strong incentive to both thrifty habits and loyalty to employers. The Boston Elevated Railway Company sold coal at less than cost to its employees during the great coal strike of 1902. About 7250 tons of coal were supplied in this way at an estimated saving to employees of about $40,000. This was a transaction which had the best interests of perhaps 7000 employees at heart, and it is safe to say that it could not have but increased the good feeling of the men toward the company.

When all is said on this subject that can be said, it will be found that unselfishness on the part of both management and employees is the foundation of corporation loyalty. In just so far as each appreciates the conditions under which the other works, so will the opportunity arise for the attainment of a unified and homogeneous organization. The highest success is reached when the esprit de corps felt by every employee of a company is a maximum.

THE SAN FRANCISCO, OAKLAND & SAN JOSE RAILWAY—"THE KEY ROUTE"—II.

POWER HOUSE

The power station (Fig. 25) is situated about midway between the land end of the pier and the Berkeley terminal of the road. Salt water for condensing purposes is conveniently obtained from the bay, and excellent facilities are secured for receiving freight through a side track from the Southern Pacific road, and a branch from the new Oakland Terminal line of the Santa Fe. As the present demand for power is for short but heavy hauls, the station is equipped with only direct-current generators. Ample space has been left for the installation of alternating-current equipment to take care of future extensions or the proposed San Jose road.

The power house is of red brick, with outside ground dimensions of 153 ft. 6 ins. x 125 ft. 4 ins. The central portion of the building, containing the engines and generators, and the west wing, containing the boilers, form one room, the only division being a longitudinal row of built-up steel columns. This unusual arrangement is allowable, as oil is used for fuel, and the boiler room can be kept very clean. This division gives the engine room a width of 45 ft. 6 ins., and the boiler room a width of 40 ft. 5 ins. The east wing of the building is cross divided into a storage battery room, 91 ft. 3 ins. x 35 ft., and a shop room 57 ft. 8 ins. x 35 ft. The roof of the station is supported by steel trusses and covered by galvanized, corrugated iron roofing. A clear height of 32 ft. is given above the engine room floor, 22 ft. for the boiler room, and in the battery room a clear height of 14 ft. to the wooden ceiling is provided. Brick pilasters, 15 ft. apart on the longitudinal brick wall, support the engine room roof trusses. A plan of the station is given in Fig. 26, and an elevation of the engines and boilers is shown in Fig. 27.

The construction views of the station, shown in Fig. 28, illustrate the method of erection of the building. As the plant was built during the summer months, which, in California, are especially favorable for out-door work, most of the machinery was installed before the walls were up or work on the roof was begun. The latter was placed the last thing. The needs of the station did not demand a traveling crane, so the engines and boilers were placed as soon as the foundations were ready,

FIG. 25.—EXTERIOR OF MAIN POWER HOUSE

avoiding the interference of walls. Fig. 29 shows the completed engine and boiler room.

The boiler equipment of the station comprises eight 264-hp water-tube, Cahall boilers. They have 14 x 9 18-ft. tubes, 4 ins. in diameter; giving 264 sq. ft. of heating surface, 59½ sq. ft. grate surface, 36-in. drums, 23 ft. 3 ins. long; butt-strap triple-riveted joints and flowed-steel headers. The working pressure is 200 lbs. The boilers are set in four batteries of two each, and space is left for an additional bank. Asphaltum base crude oil, from the Bakersfield district (California) is used as fuel, and is fed to the furnaces through Pfieffer burners. Storage capacity for the fuel oil is provided by two 35-000-gal. iron tanks, 20 ft. in diameter, outside the building. The oil is pumped by two Snow duplex 6-in. x 4-in. x 6-in. pumps.

The hot gases from the boilers pass through a brick breaching, 7 ft. 8 ins. wide, and varying in height from 4 ft. to 5 ft. 3 ins., to a Green fuel economizer, thence to the brick stack, set 15 ft. from the wall of the building. In the construction of the stack the foundation piles were driven to hard pan, and on top of them were laid six rows of old car rails, with lengths alternative. On these was placed a 9-ft. concrete foundation bed for the stack proper. The inside diameter of the firebrick flue is 8 ft. throughout, and the top of the stack is 121 ft. 2 ins. above the station floor. The outside diameter at the bottom is 18 ft. 10 ins., and the walls are carried up with a batter of one in twenty-four.

The generating equipment of the station is composed of two direct-current u its. The larger of these consists of a Pennsylvania Iron Works cross-compound condensing Corliss engine, 32 ins. and 52 ins. x 48 ins., directly driving, at 80 r. p. m., an 850-kw General Electric 525-575-volt multipolar generator. The smaller engine, built by the St. Louis Iron

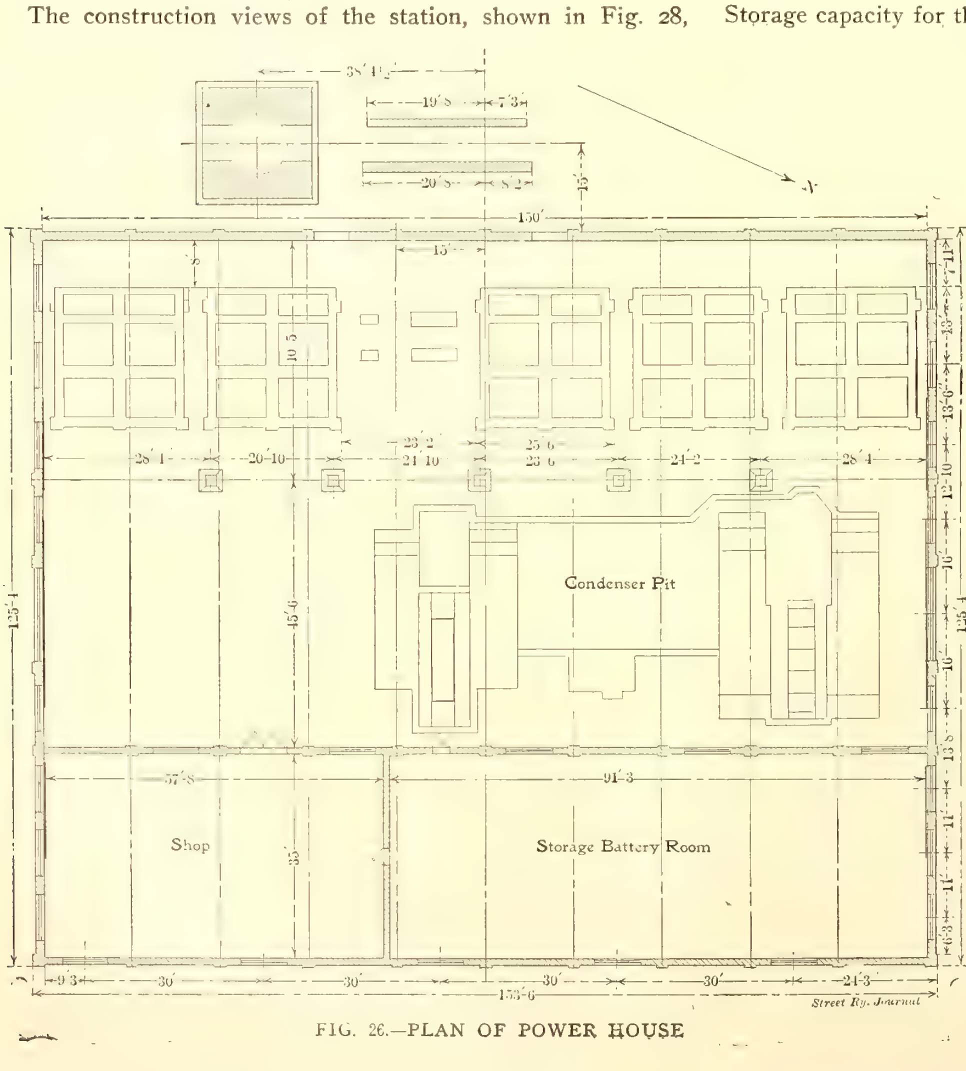


FIG. 26.—PLAN OF POWER HOUSE

& Machine Works, has cylinder dimensions of 18 ins. and 38 ins. x 42 ins., and is of the cross-compound Corliss condensing, heavy duty type. It is direct-connected to a 600-kw Westinghouse 550-volt, direct-current generator, which it drives at 100 r. p. m.

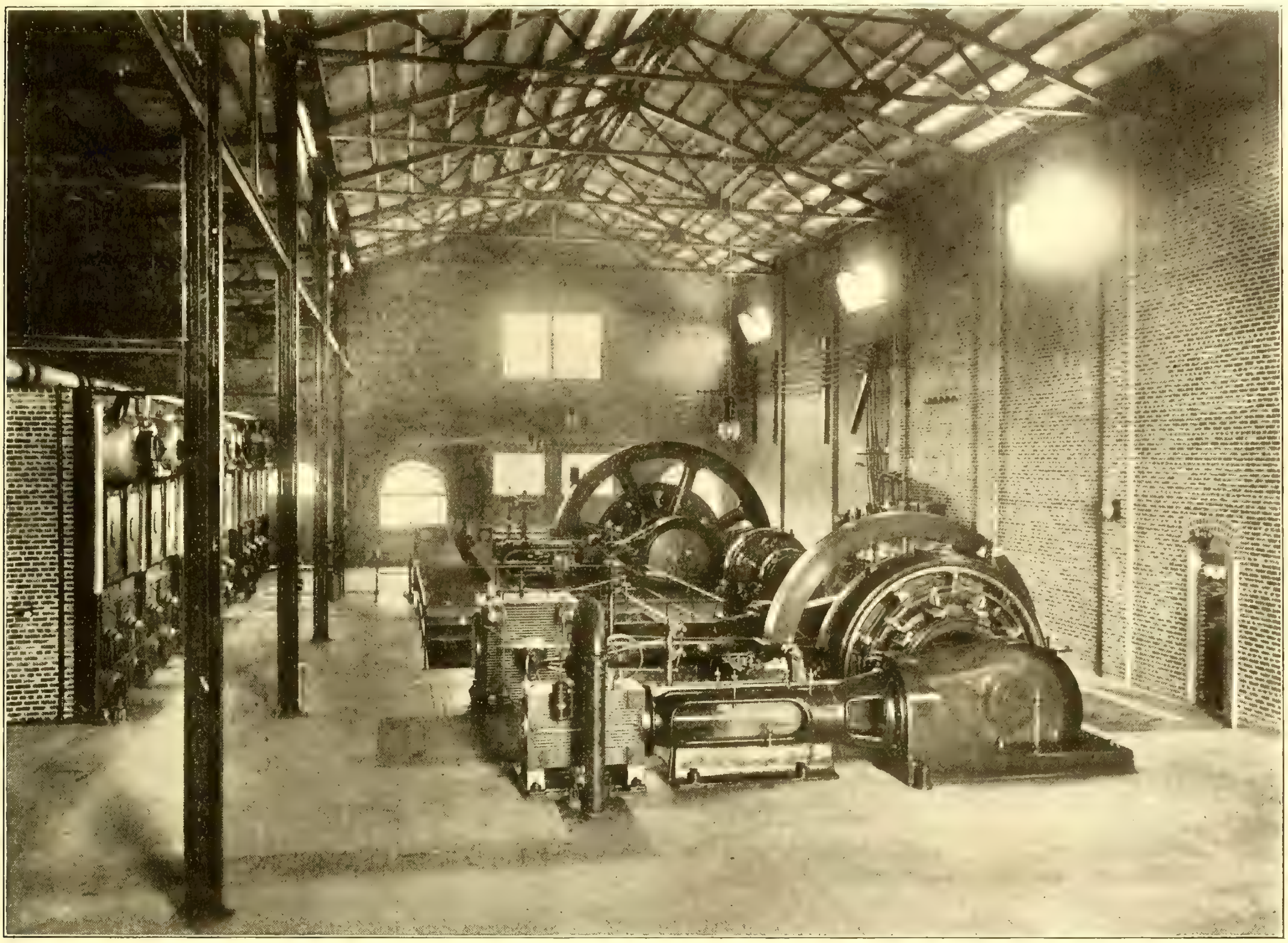


FIG. 29.—ENGINE AND BOILER ROOM IN MAIN POWER HOUSE

Cooling water for the condenser system is obtained from the bay, being impounded at high tide by means of a flood gate.

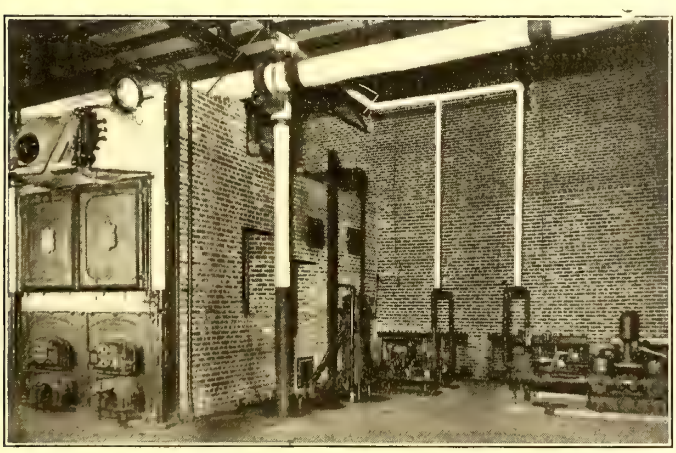


FIG. 31.—FUEL OIL PUMPS AND FEEDER PUMPS IN BOILER ROOM

It is carried through a 14-in. cast-iron suction pipe to a double-suction centrifugal circulating pump, which is direct-driven by an 18-hp 500-volt Bullock motor. The two condensers are of the Wheeler surface condensing type, and have a capacity of 200,000 lbs. of water an hour. Eight-inch inlet and outlet pipes are providing for the circulating water. The air pump, of the triplex Edwards type, is driven through gearing by an 18-hp 500-volt Bullock motor, both motors being controlled by Cutler-Hammer starting boxes. The discharge from the air pump is carried to the hot well through a 9-in. standard pipe. The two boiler-feed pumps are of the Snow center-packed plunger type,

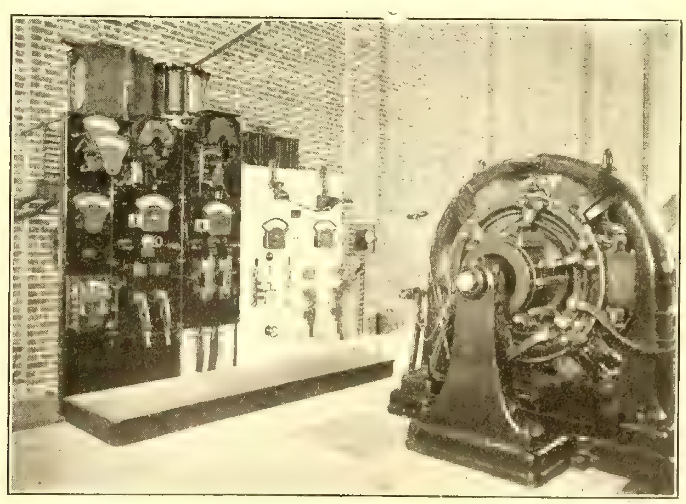


FIG. 33.—STORAGE BATTERY SWITCHBOARD AND BOOSTER IN MAIN POWER HOUSE

8 ins. x 5 ins. x 10 ins. in size, and have a 6-in. delivery to the economizer. The main boiler feed is a 4-in. pipe, and the main steam header is of 12-in. extra heavy pipe, with 6-in. and 12-in. feeders to the engines. An 18-in. free exhaust pipe is provided. The hot well was designed and constructed especially for the company. It is 8 ft. wide, 25 ft. long and 6 ft. 3 ins. high, and

is built of 3-in. x 12-in. redwood, no iron being used in its construction, except for the ½-in. wrought-iron tie-rods. The hot well has a 9-in. inlet and a 7-in. outlet.

All steam pipe fittings about the station are extra heavy, and

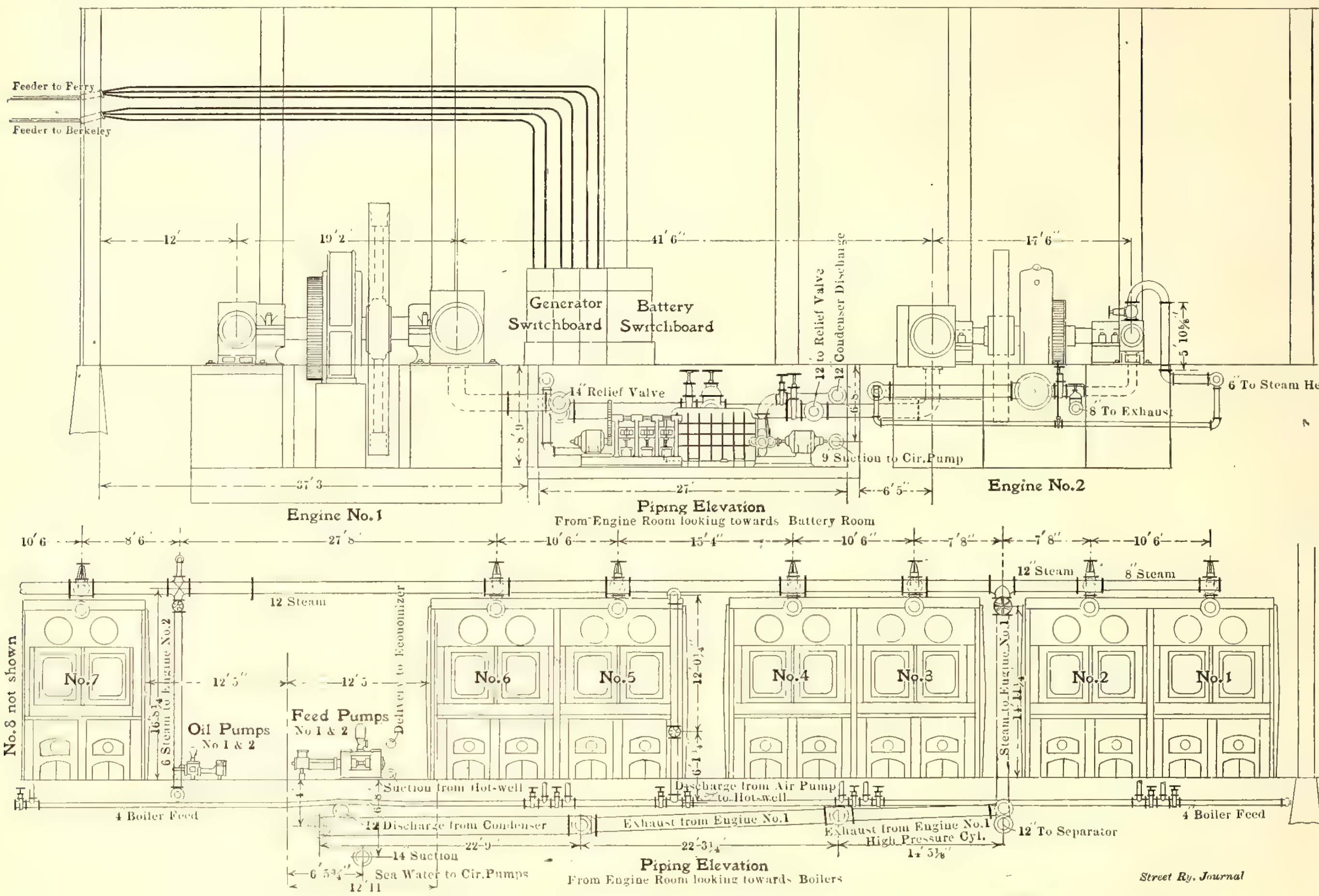


FIG. 27.—ELEVATIONS OF ENGINES AND BOILERS

FIG. 35.—FEEDER WIRE BRIDGE EXTENDING OUT OF MAIN POWER HOUSE

of the Crane manufacture. The piping is encased in Johns-Manville covering, having 85 per cent magnesia. Fig. 30 is a plan of the feed and fuel pumps illustrated in Fig. 31, and Fig. 32 is a piping plan of the station.

ELECTRICAL DETAILS OF STATION

The generators and the station output are controlled from a three-panel enamelled black-slate switchboard, shown at the left in Fig. 33. The first or storage battery panel contains a 750-scale voltmeter, an astatic voltmeter for the battery current, a 5000-scale astatic ammeter, and a 4000-amp. recording wattmeter, all Thomson instruments. Each of the two generator panels is equipped with a G. E. circuit breaker, a 3000-scale Weston ammeter, rheostat and two single-pole single-throw knife switches.

The storage battery, Fig. 34, floats on the system, and carries a fluctuating load with the aid of a differential booster. The battery was furnished by the Electric Storage Battery Company, and consists of 264 G-27 chloride cells in G-41 tanks. The present discharge capacity is 1000 amps. for 1 hour, and the ultimate capacity, with all forty-one plates installed, will be 1600 amps. for 1 hour. Momentary fluctuations, 50 per cent in excess of the normal capacity, can safely be carried. The booster set, Fig. 33, is of the Western Electric make, and consists of an L-5½-7 69-kw booster generator, direct-driven by an L-4 108-hp motor. The storage battery switchboard is of the

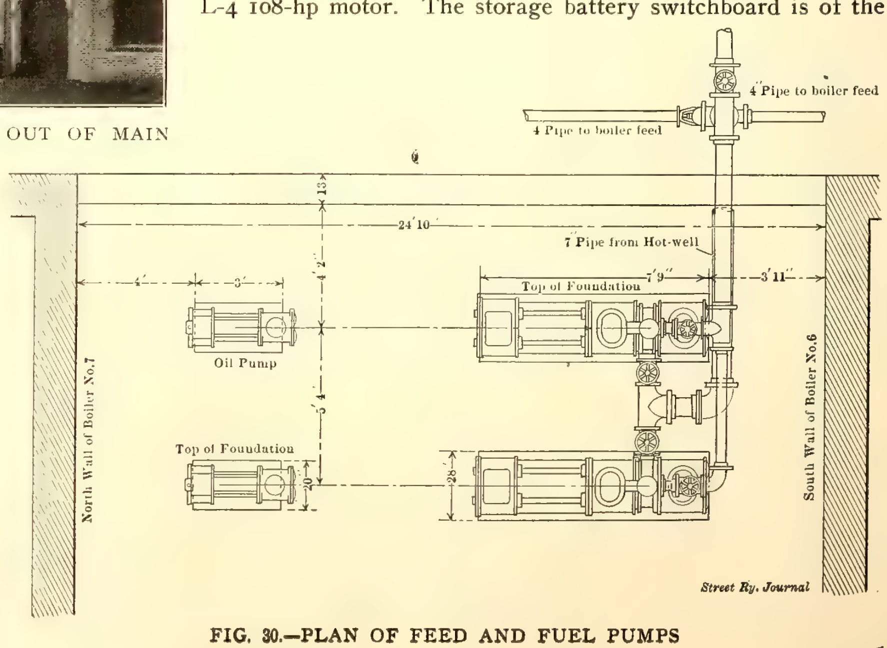


FIG. 30.—PLAN OF FEED AND FUEL PUMPS

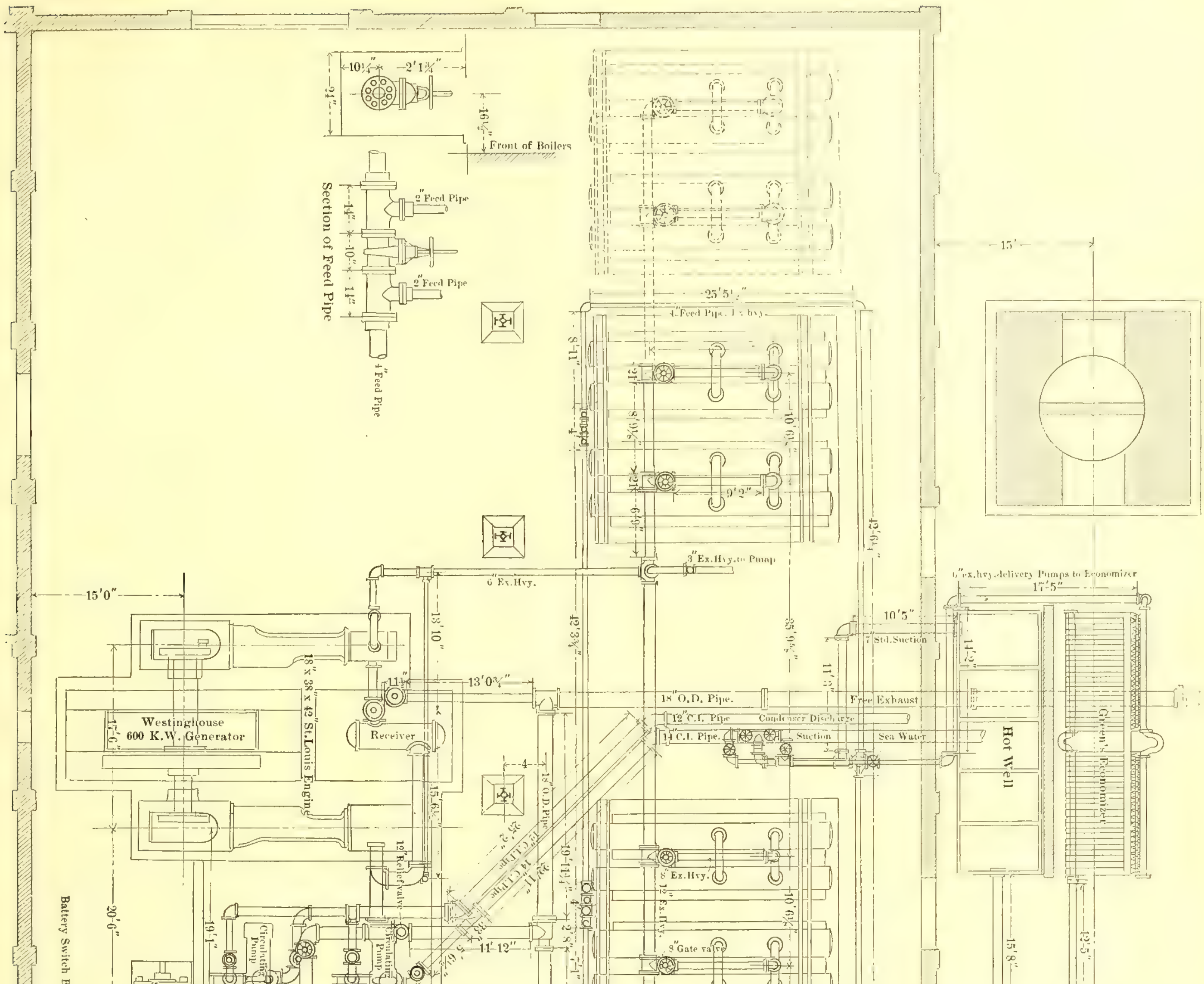


FIG. 32.—PIPING SYSTEM OF THE MAIN POWER PLANT

standard two-panel type, and adjoins the station switchboard.

The six 1,000,000-circ. mil feeder cables from the switchboard are carried up the east wall of the engine room and out through the north wall onto a bridge, which takes them to the regular pole line, three feeders going in each direction. This feeder-wire bridge is illustrated in Fig. 35. The cables are supported on five single eight-pin cross arms, 5 ft. 10 ins. long, which, in turn, are carried on two 2-in. x 12-in. pieces that are

fastened to the poles. At the end, over the track, are double cross-arms, from which the feeders are carried to the center poles.

ROLLING STOCK

The rolling stock at present in service on the Key Route comprises sixteen passenger cars, such as were shown in Figs. 10 and 15 (in the last issue), and Figs. 36 and 36a, which are presented herewith. They are of the light railway passenger type, arranged for carrying passengers only. The cars are operated in trains, under the General Electric type-M multiple-unit train control system. There are four motor cars and four control cars, the remaining eight being ordinary trail coaches. In body construction all the cars are of the same pattern and dimensions, this style having been adopted as the standard for this service. The general dimensions are as follows: Length over body, 44 ft. 11¼ ins.; length over vestibules, 54 ft. 7¼ ins.; width over side sills, 8 ft. 8½ ins.; width over body, 9 ft.; height from bottom of sill to top of deck, 9 ft. 6 ins.; height from top of rail to top of deck, 12 ft. 9⅝ ins. The side, or main sills, are of 5-in. x 8-in. long-leaf yellow pine, reinforced with 6-in. channel. Steel built-up bolsters are used with side bearings, suitable to operate around 100-ft. radius curves. The interior finishing is in mahogany, and the doors and windows are of plate glass, while glazed art glass is used for the deck sashes. The vestibules are 4 ft. 10 ins. long, and are fitted with drop sash in the ends with adjustable catches. In the vestibule ends are swinging doors, and at the right side in each

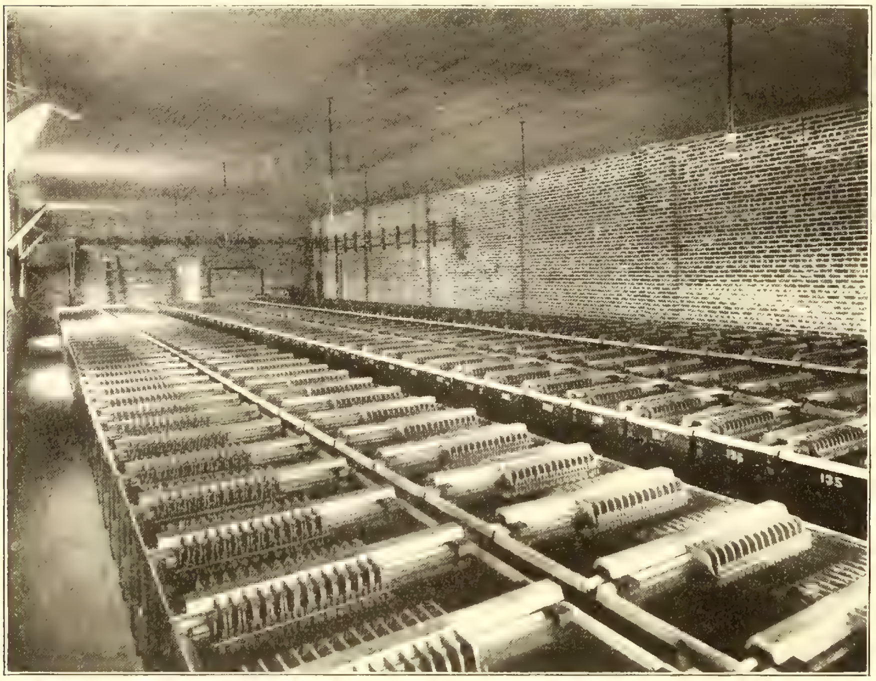
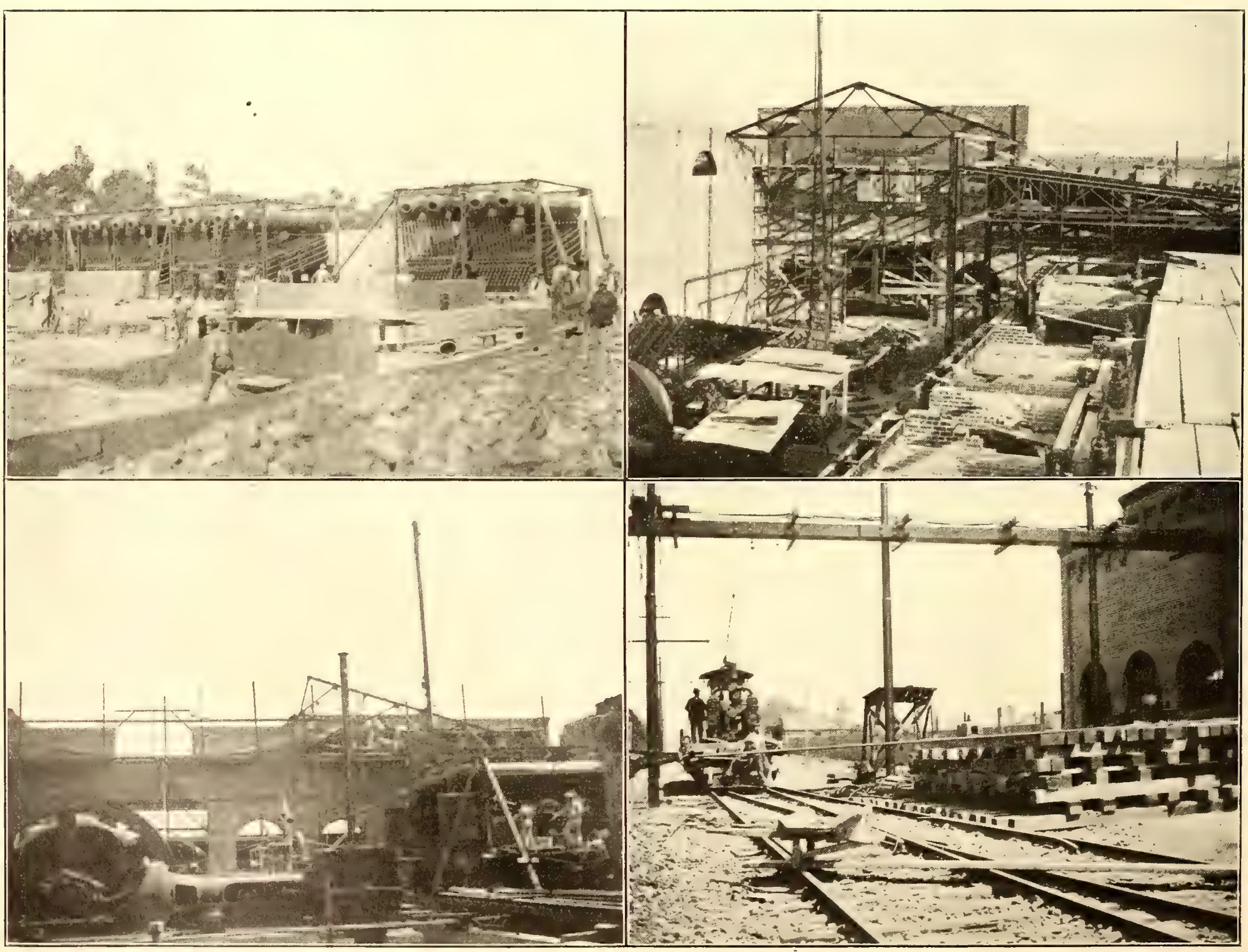


FIG. 34.—STORAGE BATTERY IN KEY ROUTE POWER HOUSE



Installing Boilers and Building Foundation for Stack — Putting on Roof After Machinery was Partly Installed

Engines and Boilers Installed Before Roof was Put On — Unloading Machinery from Trolley Car

VIEWS OF CONSTRUCTIONAL FEATURES

vestibule of the motor and controller cars are single-hinged doors, which, when opened, enclose the controller equipment. Gould trap-doors are also provided in these vestibules over the side steps for the motorman to stand upon. The cabs overhead on the motor and controller cars are cased up with lockers, suitable for personal belongings of the motorman. Oak steps, with 28-in. x 8-in. treads and 10¾-in. rise are used, and all doors are protected by sliding gates of a special design.

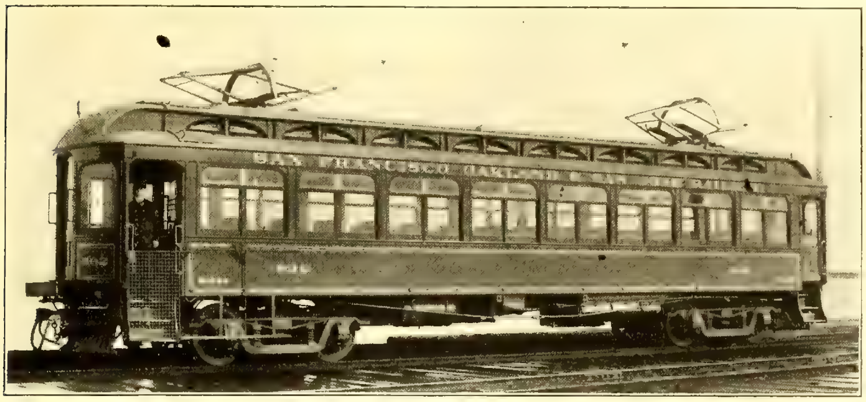


FIG. 36.—STANDARD MOTOR CAR WITH DIAMOND TROLLEY

The cars are provided with Gould continuous buffers, and with M. C. B. couplers of sufficient strength to operate safely in an eight-car train. The cars and trucks were built by the St. Louis Car Company, and are provided with that company's walk-over type rattan seats, thirty-two in number, with nickle corner grab handles. Other furnishings include bell-cord hangers, Smith-Anderson arc headlights and interior lights, incandescent step and platform lights, Nichols Lintern compressed air track sanders, Ohmer fare registers, Pantasote curtains, and cow-catchers of the steam road type. Fig. 37 is an interior view of one of the cars. The wiring diagram for the lighting circuits of a 55-ft. car is reproduced in Fig. 37a.

The bodies of the cars are painted an orange shade of chrome yellow, and the trucks and all iron work below the floor are coated a rich brown. The striping on the ends, sides and letter board is done with silver leaf, edged with tuscan red. The ceilings of the cars are painted in light green, with simple decorations of gold in empire style of finish.

The car bodies are mounted on St. Louis Car Company's No. 23-B trucks, M. C. B. type, each truck on the motor cars being equipped with two G. E.-66 motors. An eight-car train with two motors has been found to require 1800 amps. in starting. Steel-tired, spoke-center 36-in. wheels are used, with 6-ft. 6-in. wheel base. All cars are fitted with Westinghouse straight air-brake apparatus, with 12-in. brake cylinders. On the motor cars are mounted Westinghouse type D-3 motor-driven compressors. Air whistles are provided at the engineer's valve.

The motor and controller cars were fitted up by the company's own shop force, under the supervision of the late George W. Spink, master mechanic. One motor car was equipped with the control and brake equipment in three days, which is considered record-breaking time for that class of work.

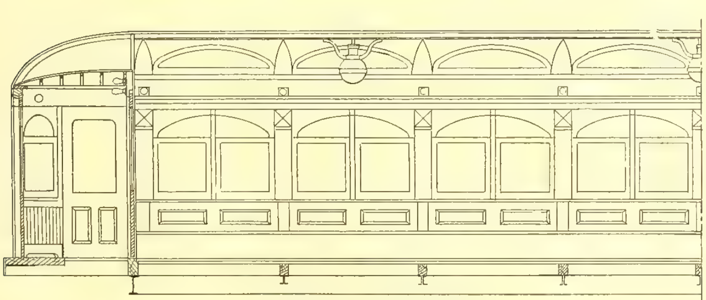
In order to give service on the lines to Piedmont and the center of Oakland, ten new cars have been ordered from the St. Louis Car Company. In most respects they will be identical with the cars now in use. The one important exception is in the platform design. The vestibules and platforms of the new cars will be 6 ft. 6 ins. long, and will have a 1½-in. brass railing in the center of the steps, which will have 54-in. x 8-in. treads. This will give the cars a length over vestibules of 57 ft. 11¼ ins., and a total length over bumpers of about 60 ft. This extra long platform, with double steps, was adopted so as to facilitate more rapid loading and unloading of passengers at stations.

FIG. 37.—INTERIOR OF STANDARD CAR FOR KEY ROUTE

In the rear of the power house the company has erected a temporary car house, 40 ft. x 150 ft., covered with galvanized iron. Plans are now being drawn for permanent buildings, to be located near the power house, which will contain the company's repair shops and car houses.

DIAMOND-SHAPED TROLLEY

One of the most difficult problems the officials of the Key Route had to contend with was the design of a current-collecting device for the cars. The third-rail system could easily have



Longitudinal Section Inside

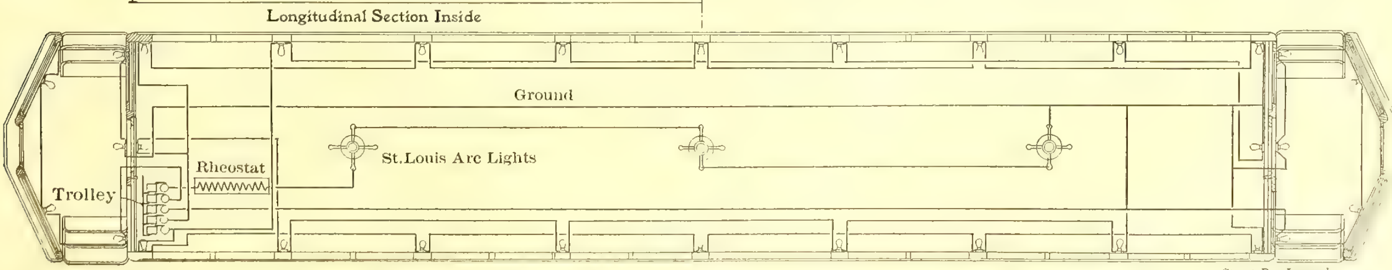


FIG. 37a.—WIRING DIAGRAM FOR LIGHTING 55-FT. CAR

been adopted for operation on the pier, but the fact that the land lines traversed public streets prevented the use of a third rail on that portion of the road. Rather than have the two methods of collecting the current it was deemed advisable to depend entirely upon an overhead construction. The factors met with in the design of a suitable trolley were as follows: It must be capable of taking a heavy current and of operating at high speeds on curves as well as straight track; it must be heavy enough in its construction to stand the wear; on account of the low head room under the Southern Pacific tracks in the subway it was necessary for the trolley to operate from 18 ins. to about 5 ft. above the car roof; it must also be capable of passing under crossings with regular trolley wires. To meet these conditions several designs were prepared, and the one finally adopted is illustrated in the pictures of the cars and in detail in Figs. 38 and 39. J. I. Brown, assistant general manager and engineer of the company, designed the trolley, while the details of construction were worked out by the late George W. Spink, master mechanic, and George St. Pierre, shop foreman.

The trolley consists of a double diamond frame of angle-iron, hinged at all four corners so that the contact-shoe, or roller, which is supported between the two frames across the top, can be raised or lowered to meet the varying heights of the trolley wire. The top part of the frame is built of 1½-in. x ¼-in. angle-iron, 50 ins. in length, and the lower part of 1¾-in. x ⅜-in. angles, 50 ins. long. The upper two legs on each side end

FIG. 38. DIAMOND TROLLEY WHEN IN LOWERED POSITION

in brass gears or lugs, which play into each other at the ends of the roller, and are bolted to special castings, to which are fastened the solid shaft of the roller. From the middle joint of the frame to the center of the top gear the distance is 54 ins.

The bottom arms of the frame end in similar brass gears, that are fastened to two 1⅜-in. shafts, 3 ft. 2 ins. long, spaced on 6-in. centers and supported at the ends in brass-bearing blocks. The center joints of the frame are formed by two ¾-in. cold-rolled rods, the fittings at the joints being of brass. Four cross pieces of 1-in. x 3-16-in. angle-iron serve as stiffeners for the four sides of the frame. The frame is 32 ins. wide.

Considerable trouble was anticipated in designing a contact-shoe or roller which would have good wearing qualities, would not heat at bearings and would be noiseless, but it is believed the problem has been satisfactorily solved, as the roller in use seems to meet all these requirements. The roller consists of a 5-in. brass tube, 24 7-16 ins. long and 5-32 ins. thick, screwed at each end to ordinary brass trolley wheels, which have been turned down to fit the tubing. These wheels turn on a ⅝-in. steel shaft that runs through the tube, and is held stationary at the ends by means of dowel pins in the special castings mentioned above. One of these end castings is illustrated at the right in Fig. 38. The wheels have 1-in. bushings, 2 ins. long, and the bearings are oiled from grooves connected to oil pockets in the wheels. It was found that these rollers made considerable noise in operating on account of the hollow tubing, so a method was adopted to deaden them. Between the bearing wheels at the ends was fitted a fibre roll about 1½ ins. in diameter, and the space between the outside of this roll and the inside of the brass tubing was packed tight with waste. This arrangement very effectually deadens the noise. The object of the fibre roll is to keep the waste away from the stationary shaft when the roller is revolving. The roller complete weighs 27 lbs.

Curved contact-shoes, made of ⅛-in. sheet steel, 6 ins. wide, have been fastened at the ends of the roller, so that the contact may not be lost at curves, as, of course, the trolley has no lateral motion. These shoes give a 4-in. horizontal contact, which, added to the 24 ins. of the roller, gives a total contacting surface of 28 ins.

The trolley ordinarily operates with the roller about 5 ft. above the platform, but it will rise to a height of 7 ft., and can be depressed so that the roller is but 18 ins. above the platform. To hold the contact roller to the wire twenty-four tension trolley springs, 12 ins. long and 1½ ins. round, are used, they being arranged twelve on a side, as shown. The springs are fastened by a ½-in. eye-bolt to the bottom end of one side piece, and to a bracket near the middle joint of the frame on the opposite side. The tension of the springs is taken up by a ⅝-in. eye-bolt.

The entire frame serves as a conductor for the electric current from the roller to copper contact plate, mounted on top of the bottom bushings and connected to the car leads.

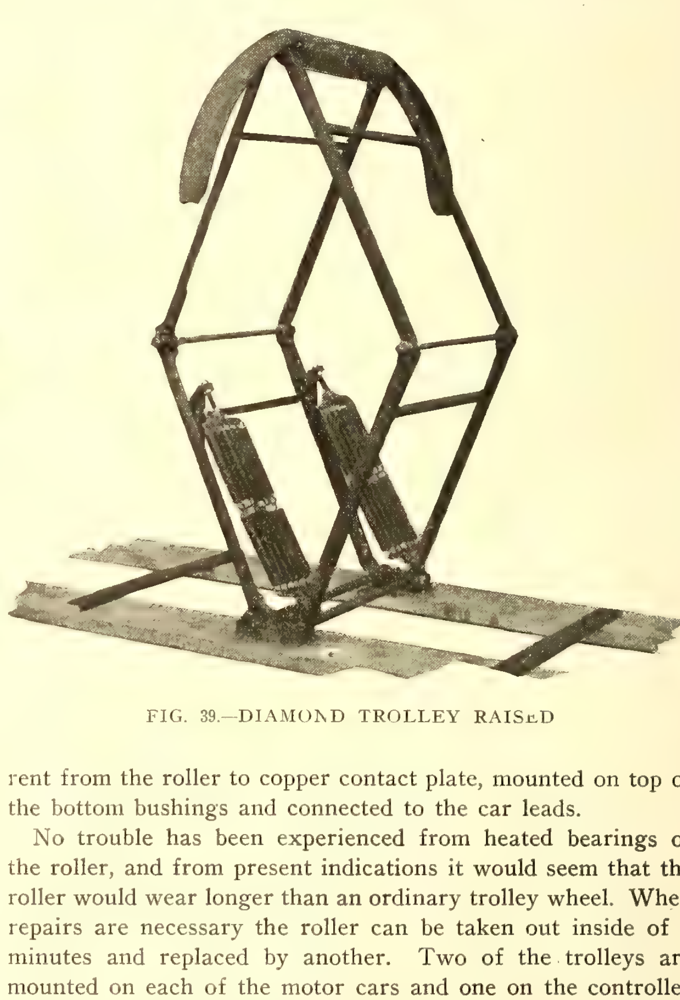


FIG. 39.—DIAMOND TROLLEY RAISED

No trouble has been experienced from heated bearings of the roller, and from present indications it would seem that the roller would wear longer than an ordinary trolley wheel. When repairs are necessary the roller can be taken out inside of 5 minutes and replaced by another. Two of the trolleys are mounted on each of the motor cars and one on the controller cars. The trolleys are being temporarily built in the Piedmont shops of the Oakland Transit Consolidated, pending the erection of the new Key Route shops.

FIRE CAR

In order to afford protection against fire, either in the ferry depot or any portion of the pier, a fire pump car has been constructed, and is in constant readiness in the train shed at the end of the pier. This car was built in the shops of the Oakland Transit Consolidated Company, and is illustrated by exterior and interior views in Figs. 40 and 41. Plan and elevation drawings are shown in Fig. 42. The car body has a total length of 25 ft., and a width of 9 ft.. The main portion of the car, containing the pump, is 16 ft. long, and at each end are

4-ft. square vestibules for the motorman. Platforms, 2 ft. 6 ins. wide and 4 ft. long, are provided at the corners of the car, 18 ins. below the car floor, and from them the hose can be manipulated. There are no doors across the ends of the pump room, it being considered best to leave them open, so that the pump men may not be hampered in handling the apparatus. The fire pump is an 8½-in. x 12-in. machine, with 8-in. suction and 6-in. discharge, and was built by the George E. Dow Pumping Engine Company, of San Francisco. It is driven through gearing by a General Electric-1000 35-hp motor. The car is mounted on a Taylor truck, the motor equipment consisting of two W. P.-50 motors. A heavy suction pipe, long enough to draw water from the bay, is carried along one side of the car. The drawing, Fig. 42, shows the pump set straight with the car, but it was found advisable on installing it to place it at an angle, as shown in Fig. 41. The pump car is also equipped with one of the new diamond trolleys, so that it can operate over the entire system.

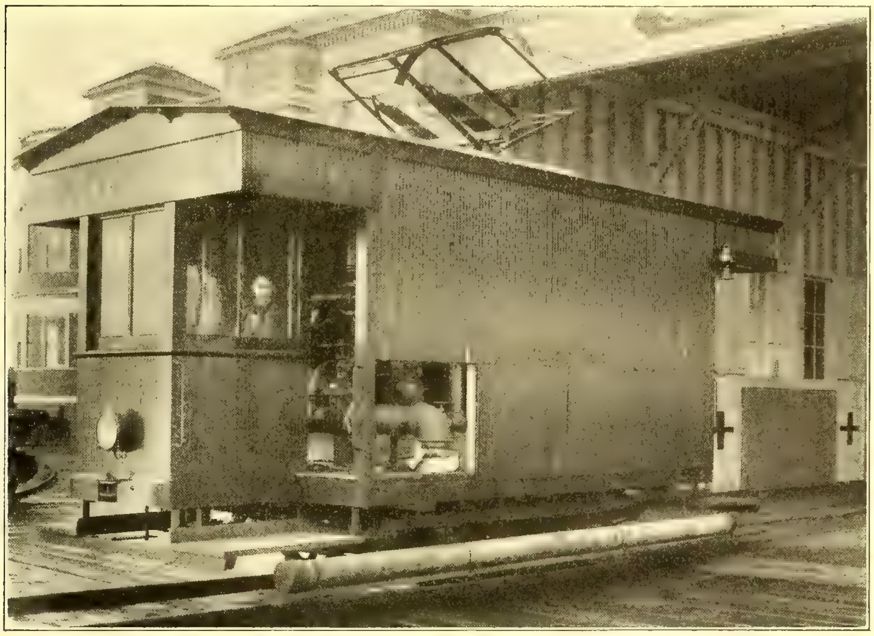


FIG. 40.—FIRE CAR

TRAIN OPERATION

The first regular train service over the Key Route was inaugurated on Oct. 26, when an hourly schedule was put into effect, and one boat was used for the pier connection. A few days after that a half-hourly service was put on with two boats, and on Nov. 28 the schedule was increased to a 20-minute service. The present time card calls for ninety-seven trains during the day, running at 20-minute intervals from 6:20 a. m. to 7:00 p. m., when hourly trains are operated till 1.00 a. m. To follow out the present schedule four trains are required. Six-car trains have been operated, and the equipment has been built to handle safely eight cars in a train. The distance between Berkeley and the pier depot, 6.84 miles, is made regularly, including the four stops, within the schedule time of 18 minutes for the down trip and 19 minutes for the up trip. The motors are geared for 45 m. p. h. Two minutes are allowed for transferring passengers from the train to the boat at the pier depot, and with 15 minutes for the 2.75-mile boat passage the whole trip from Berkeley to San Francisco, a distance of 9.59 miles, is made in 35 minutes. For the return trip 36 minutes is allowed on account of the up grade in Berkeley.

As compared with the new and fast service of the Key Route the Southern Pacific Company operates its Berkeley trains on a 30-minute headway, and about the best time its regular trains and boats can make is 50 minutes between Berkeley and San Francisco, and on its time cards 57 minutes is allowed for the run. The boat lines of the two systems are about equal in length, and the steam line of the Southern Pacific is only a little longer than the electric line of the Key Route, but the steam trains have to make ten stops as against the five stops of the electric line. With new cars, new boats and a faster service the Key Route has naturally drawn heavily upon the patronage of the older system, and now is carrying from 10,000 to 20,000 passengers daily. The number of passengers carried depends largely upon the weather, and on Sundays it quite frequently reaches the higher mark.

To meet the competition of the electric line the Southern Pacific Company is said to be considering changes and improvements in its equipment and service which will enable it effectually to hold its own in the local passenger business. Already two flyers have been put on the Berkeley branch for morning and evening service, these trains leaving Berkeley 10 minutes after the regular trains, stopping at but five or six stations and making close boat connections at the Oakland pier. These flyers, however, cannot make the entire trip in much less than 40 minutes, so the Key Route still continues to enjoy an advantage.

Berkeley is the seat of the University of California, a large and growing educational institution, and the transportation lines running thither depend largely upon the student body. The Key Route terminates within one block of the entrance of the University campus, and the management is painstaking in catering to the needs of the students in running special trains for athletic contests, etc. Fig. 43 is a view of the Berkeley terminal, and shows a regular four-car Key Route train with a Telegraph Avenue car of the Oakland Transit Consolidated in the foreground. At the left is shown a portion of the Southern Pacific depot, and beyond, in the distance, is seen one of the steam freight trains. Excepting the temporary station at San Pablo Avenue, the Key Route has erected no stations or waiting rooms along its line as yet, but a union depot at Berkeley is being advocated.

FARES AND TICKETS

No cuts in fares have been made by the Key Route management, the same rates being charged as on the Southern Pacific. Between any of the stations and San Francisco the rate is 10 cents for a single trip. Between stations in Berkeley and Oakland a fare of 5 cents is charged. Beside the motorman and conductor on each train, each car has a collector, who takes all

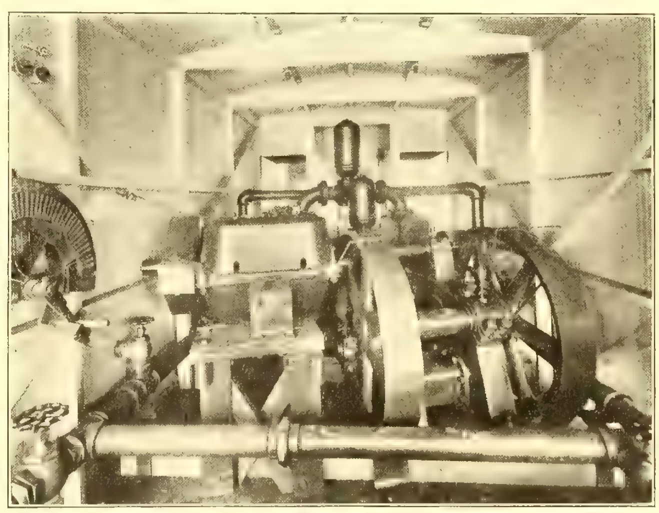


FIG. 41.—MOTOR-DRIVEN PUMP IN FIRE CAR

fares in his car. On boarding a train at Berkeley the passenger pays his cash fare and is given a fare check, which is taken up after San Pablo station is passed. No tickets are required on the boats, as the pier is used exclusively by the company for passengers, and no one is able to reach the station except by boat or train. For the trip from San Francisco the passenger buys a ticket like an ordinary "L" ticket, drops it into a collector's box and passes onto the boat, no ticket being required on the train. These tickets are sold in any number at 10 cents each, and are good for passage in either direction.

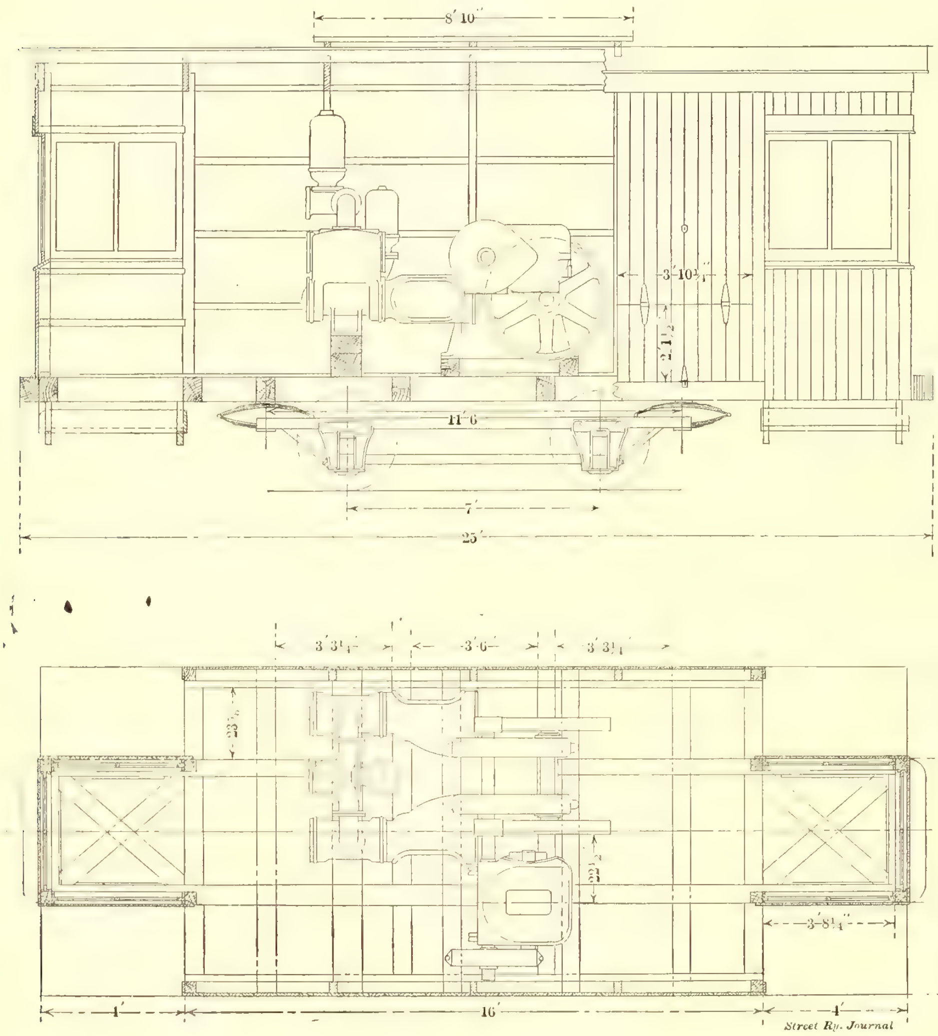
On Dec. 1 a limited number of commutation tickets were put into use. These tickets are issued in book form with two coupons for each day of the month, and the tickets must be used on the dates specified or they become invalid. These books are sold for $3, the same rate as is charged for commutation tickets on the Southern Pacific lines. They are not transferable, so several rides during the month are generally forfeited.

At present transfers are not given between the Key Route trains and the connecting car lines of the Oakland Transit Company, but possibly this concession to the public is being held in reserve until such time as the Southern Pacific meets the present competition.

SPECIAL FEATURES

It is interesting to note some of the special features of the Key Route system as distinguished from similar features of its rival. The most striking of these characteristics, outside of the electric train operation, is the color scheme of yellow that has been adopted throughout for the Key Route. The boats of all the other ferry lines are painted white, and the ferry depots are painted white or drab. In order to give a distinctive appearance to its boats and pier depot the Key Route adopted a pleasing shade of yellow, and all the cars are painted a shade of this color, as already mentioned. The color scheme is carried still farther, in that the tickets, both single fare and commutation, the time cards, signs and notices are all printed on yellow paper.

One of these notices, displayed in all the cars, informs the passengers that no baggage will be carried other than ordinary hand baggage, that no advertising or soliciting of any kind will be allowed on the trains or boats, or in the ferry building, or elsewhere on the company's premises. The effect of the prohibition of baggage is to give the public prompt and quick service, as the carrying of trunks, express and freight boxes, general merchandise, and oftentimes chickens and vegetables on the other line, had a tendency to delay the prompt starting and unloading of the boats, to say nothing of the inconvenience to the passengers. The advertising, which is so prominent and profitable on the steam trains, is conspicuous by its absence on the electric trains, and the plain, clean cars evidently please the passengers. The public had been so long accustomed to the sights and scenes of the old steam line that all the features of the Key Route were examined with interest by the passengers carried on the first few trains, and the impression made was a pleasing one, judging from comments overheard during the first day or two.



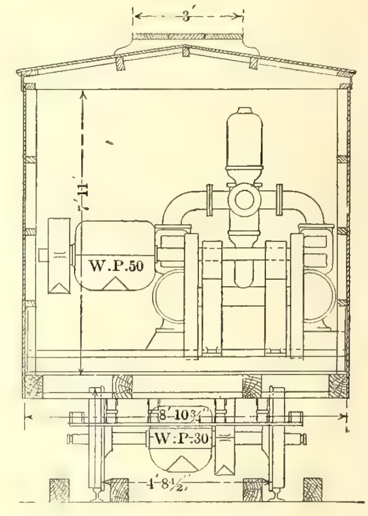


FIG. 42.—PLAN, ELEVATION AND SECTION OF FIRE CAR

OFFICERS AND ORGANIZATION

The San Francisco, Oakland & San Jose Railway Company has an authorized capitalization of $5,000,000, and about $2,300,000 has been issued. A bond issue of $3,000,000 has been authorized, but no bonds have been sold as yet. It is stated that the cost of the railway system, as it is now in operation, including the pier, rolling stock and boats, was about $1,500,000, and the gross earnings show a good percentage on the investment.

The following-named are officers of the company: President, E. A. Heron; vice-president, W. H. Martin; treasurer, F. C. Havens; secretary, S. J. Taylor; general manager, W. F. Kelly; assistant general manager and engineer, J. Q. Brown; superintendent, J. P. Potter; civil engineer, Edward M. Boggs, American Society Civil Engineers. Directors, E. A. Heron, F. C. Havens, W. H. Martin, W. F. Kelly and S. J. Taylor. The position of the late George W. Spink as master mechanic of the company has been filled by the appointment of George St. Pierre, formerly shop foreman, and the position of assistant

superintendent of transportation, held by the late Clark Yerrick, has been filled by Mr. Piper, of the Telegraph Avenue division of the Oakland Transit Consolidated. F. W. Nelson is chief engineer of the power station. Mr. Kelly has had general supervision over the construction and operation of the road, and has been ably assisted by Mr. Brown, who has also had direct charge of the engineering features of the system. Howard C. Holmes, of San Francisco, was the consulting hydraulic engineer on the construction of the pier depot and the pier and subway, and Walter J. Matthews, of Oakland, was architect for the depot.

FIG. 43.—STEAM, LOCAL TROLLEY AND INTERURBAN CARS AT SOUTHERN PACIFIC STATION IN BERKELEY

ARRANGING ROUTES AND SCHEDULES FOR THE FAIR

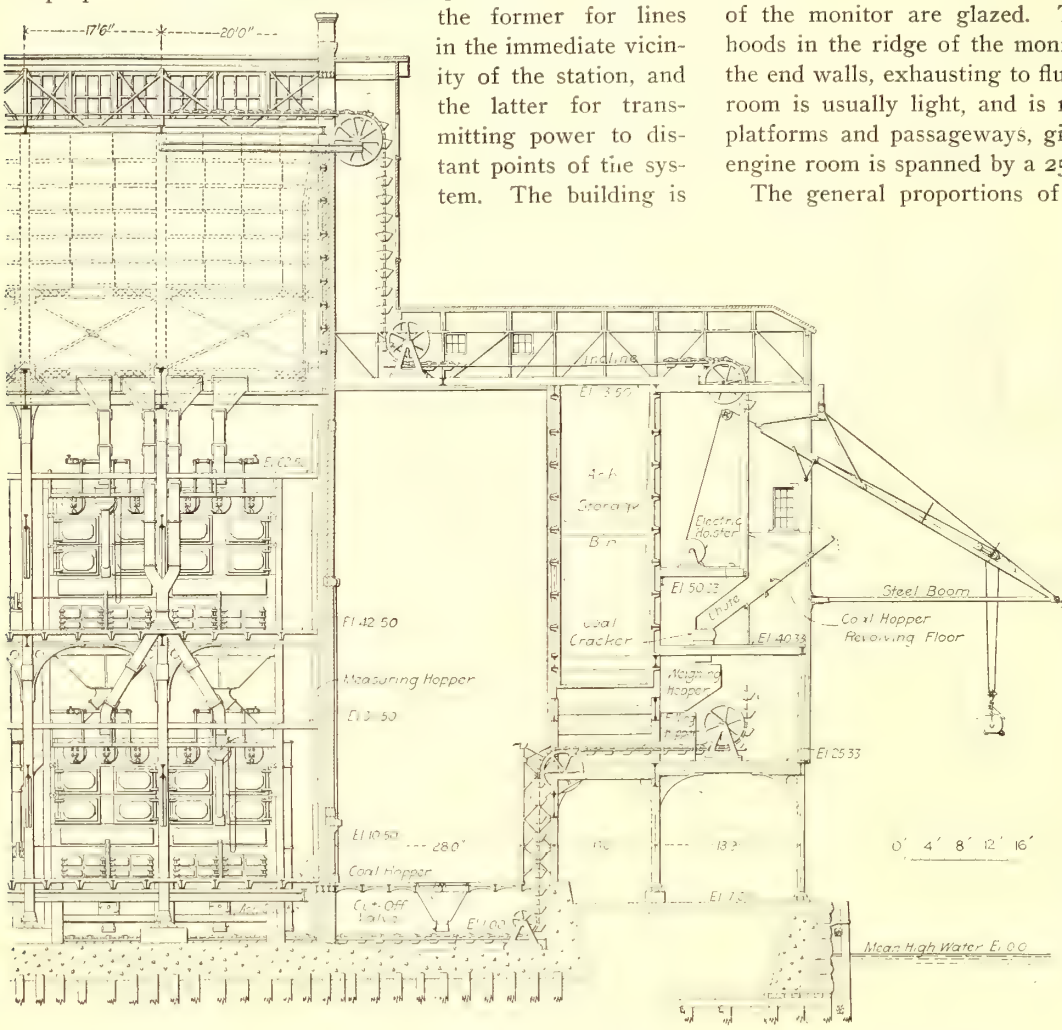
The transportation department of the St. Louis Transit Company, under the supervision of General Superintendent John Grant, is now arranging routes and schedules for World's Fair traffic, which will soon go into effect. All lines passing Union Station on the north will go direct to the World's Fair grounds. This includes the Laclede Avenue and the Market Street lines, which will go direct to the entrances on the south and west of the grounds, either at the State buildings or the west end entrance. The Chouteau Avenue line, which is now routed that way, will take the Market Street line tracks at Manchester and Chouteau Avenues, covering the section now traversed by the Market Street line. Transfers from the Chouteau line to Market Street will be made at that point. Other lines going direct to the Fair Grounds are the Olive Street lines, the Eastern Avenue line, Delmar and Page. The Taylor Avenue line will be routed directly to the World's Fair grounds, taking up passengers from all the lines north of Chouteau Avenue. These lines include the Bellefontaine, Lee Avenue, Cass Avenue, Easton Avenue, Spring Avenue, Page Avenue, Delmar Avenue and Olive Street. All South St. Louis lines will connect with the direct lines to the grounds at their down-town termini. By this arrangement six main lines and nine sub-lines will have direct entrance to the grounds from every part of the city, while connections can be made from both north and south for one fare at any intersecting point.

NEW STREET RAILWAY BILLS IN NEW YORK STATE

Five important bills affecting street railways have been introduced in the New York Legislature by the chairmen of the two railway committees of the Senate and House. The first bill is designed to make it possible for investors to ascertain whether corporate powers have been kept alive that would menace a new road and that such corporations have legal existence. The second bill is to confer upon the State Railroad Commission the right to abolish the giving of transfers at any crossing where there is congestion of traffic. The third does away with the 5 per cent interest payable on arrearages of percentage on gross earnings, and substitutes 10 per cent a year. The fourth allows a company to remove its unused rails, with the consent of the Mayor, without impairing its franchise, and to relocate its route with the consent of local authorities. The fifth gives to a city's financial board the power to make contracts with street railway companies for the payment of street improvement assessments.

RAILWAY POWER PLANT AT PROVIDENCE, R. I.

An excellent example of a modern power plant is furnished in the new station of the Rhode Island Suburban Railway Company at Providence, a company which, by ownership of stock, is associated with the United Traction & Electric Company, of Providence, R. I. The company's new power station, the subject of this article, will have a capacity of 10,500 kw, and will supply current to the Cumberland Street Railway and the Pawtuxet Valley Electric Street Railway, which it owns. The station is located at the foot of Manchester Street on the Providence River, and the site is admirably adapted for the purpose. Both direct and alternating current is furnished, the former for lines in the immediate vicinity of the station, and the latter for transmitting power to distant points of the system. The building is an imposing fire-proof structure, and is a model plant both in architectural and construction features. It is well lighted, and the arrangement of the machinery is admirable from the point of convenience and economy of operation.



PORTION OF LONGITUDINAL SECTION OF STATION, SHOWING COAL CONVEYOR

The plant is operated condensing, with an independent jet condenser for each unit, and the fresh feed water constantly required is warmed by auxiliary feed heaters and by economizers. The boiler plant is arranged on two decks, and is equipped with mechanical stokers, an extensive coal and ash-handling plant, and is served by natural draft. Among the details of especial interest are the condensing water system, including the in-take chamber, several patterns of pipe supports, an oiling system and the feed piping system.

The building has a steel frame structure with red brick enclosing walls, trimmed with heavy granite cap-stones, water table and window sills. The steel columns and walls are carried by concrete footings on the top of piles. These are driven all over the site, and concrete spread over them, forming the floor of engine and boiler room basements. The other floors, the sides and bottom of the coal pocket, and also the roofs, are all of expanded metal construction in Portland cement concrete; the windows are glazed with wired glass, the window casings are sheathed with copper, and all doors are likewise enclosed in sheet metal, in the interest of fire-proof construction, the outside doors in copper, and the inside in tinned sheet iron, painted. The metal concrete roofs are covered with tar and gravel roofing rolled into hot pitch on the concrete. The end walls are carried up in parapets. In the interior, the floors are finished in granolithic, blocked off in large squares, as usual, and the walls have been coated with a white enamel paint, except the lower 8 ft. or 9 ft., which are of a dark green. Besides the large amount of window area in the side walls the verticals of the clere story over the engine room and the top of the monitor are glazed. There are five large ventilator hoods in the ridge of the monitor and ventilating registers in the end walls, exhausting to flues within the walls. The boiler room is usually light, and is noteworthy for the longitudinal platforms and passageways, giving access to apparatus. The engine room is spanned by a 25-ton Niles crane.

The general proportions of the building are given in the accompanying engravings. The engine and boiler rooms are separated by a partition wall built with air spaces, and at one end of the engine room is an extension containing an office, oil room, stock room and lavatories on the basement and main floor levels. The building stands 55 ft. back of the bulkhead line, and between it and the wharf is a combined coal tower and ash pocket. The ground space occupied by the main building is about 29,580 sq. ft., or 2.8 sq. ft. per kilowatt of the rated output of the main generating units. In the engine room there are 1.5 sq. ft. of ground area per boiler horse-power. On the basis of the cubic contents above the foundations there are, roughly, 260 cu. ft. per kilowatt.

COAL HANDLING

Coal is ordinarily brought to the station by water, and is transferred to the station coal bunker by means of a continuous Hunt bucket chain conveying system. A bucket of ½-ton capacity, hoisted by a 25-hp electric motor, lifts the coal from the barge into a timber pocket in the coal-hoist tower, and thence the coal passes through a coal cracker to a weighing hopper, and into a hopper delivering into the conveyor buckets. One man in the tower controls the hoist, which handles, under ordinary circumstances, ½ ton per minute. The conveyor is electrically driven from a 15-hp motor above the coal pocket, and is utilized also to carry ashes. In the usual way it travels longitudinally over the coal pocket, down the far end of the boiler room, underneath ash hoppers in the basement and back to the hoist tower. Its passage from tower to main building is through a covered truss bridge, and from building to tower through a short tunnel. Through a covered opening in the roof of the latter it can receive coal delivered by wagons. The conveyor chain has eight changes of direction, and is 630 ft. in total length, containing about 270 buckets. The tower is 16 ft. x 32 ft. in plan, and is supported 18 ft. above ground by steel columns and rises 66½ ft. above grade to the bottom of the

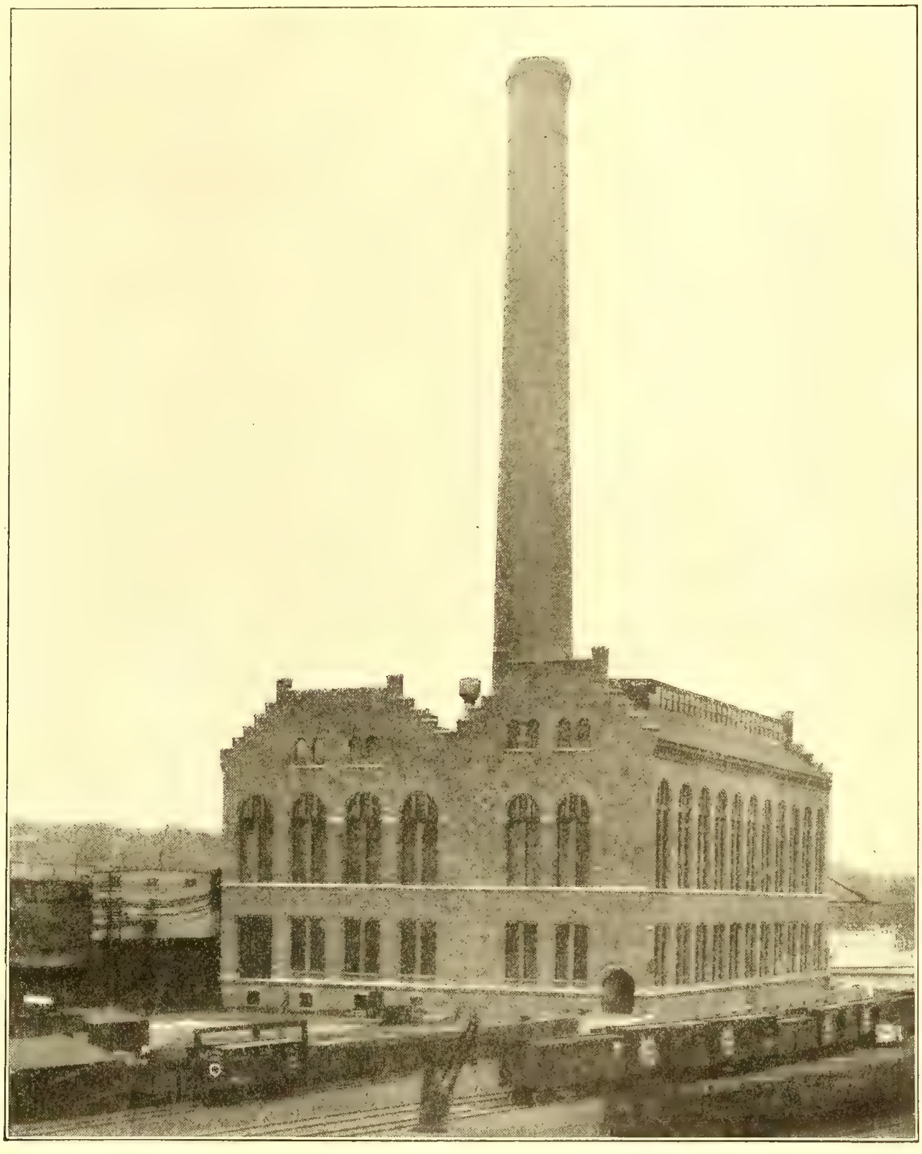
conveyor bridge. It also houses the ash bin, which is built of expanded metal and concrete, with vertical sides and delivery spout to wagons hauled underneath it.

The coal storage bin is a single bunker, 156 ft. long, with vertical sides 30 ft. apart, and a V-shaped bottom with the slopes at an angle of 45 degs. It has a capacity of 3000 tons. Extending longitudinally through the boiler room are two rows of columns, which, with the wall columns, constitute the main members of the boiler room structure, and by means of these interior columns and plate girders carried by them the coal bin structure is supported. The bin itself is formed of concrete, reinforced with expanded metal, and the surfaces are plastered smooth. From the bottom of the bin a chute, 256 sq. ins. in inside area, is taken for each boiler, and the run of these is shown in the drawing. The chutes are cast-iron, in sections bolted together, and at various points are provided with sight soles by which a slicing rod can be inserted in case the coal should, for any reason, get wedged or blocked. Each chute ends in a gate valve, from which coal can be delivered at will into a measuring chute. This is a traveling spout, hung by small wheels on double tracking extending across the boiler fronts. One is furnished for every battery or pair of boilers, so that coal for both boilers can be supplied from either chute, and the spout commands the entire width of the feed hopper of the mechanical stoker. The weight of the coal that the chute will hold affords a measure of the coal consumption of each boiler, and the traveling carriage allows it to be hauled out of the way when tubes have to be drawn from the setting. Arrangements are under consideration, however, looking to its replacement by a traveling weighing hopper, in case it seems desirable to secure a more positive record of coal consumption. The stokers are of the Roney type, and dump into ash hoppers, which are fitted with gates for discharging on the coal conveyor at night or at such times as coal is not being handled. The ash hoppers are lined with concrete, and those for the upper deck of boilers are of boiler plate.

BOILERS AND ECONOMIZERS

The boiler plant comprises sixteen 515-hp Babcock & Wilcox water-tube boilers, arranged in four batteries on each deck, two boilers per battery. At present three pairs of boilers have not yet been installed in the second story. Each boiler has 5159 sq. ft. heating surface, with 252 tubes, 4 ins. in diameter and 18 ft. long, arranged twenty-one sections wide and twelve tubes high. Each boiler has also three 36-in. steam and water drums, and in addition the boilers of the second deck are provided with superheating surface, which is to be given a trial before the boilers below are equipped. The boiler settings are faced with white glazed brick.

The products of combustion are carried off by natural draft, but economizers are employed, as already stated. These are of the Green pattern, and are arranged in an interesting manner, according to the so-called unit system, one for each battery of boilers. Each group comprises 280 tubes, and presents 3360 sq. ft. of heating surface. The economizer cleaners are driven by electric motors. As shown in the drawings, the gases from the boilers flow into a passage between the economizer setting and the corresponding battery, and the passage opens at one end so as to cause the gases to pass through the economizer or at the other to by-pass the economizer. The main flow passage is located underneath the economizer, increasing in depth toward the stack where the horizontal breeching is 8 ft. x 15 ft. in size, of 3-16-in. steel plate, reinforced with angle bars. The walls and bottom of the smoke passage underneath the economizer settings are of brick, while the top is of terra-cotta book tiles, 8 ins. thick, plastered top and bottom with Portland cement mortar. The chimney is of the Custodis radial perforated brick construction, 312 ft. 7½ ins. high above the foundation, and 16 ft. in inside diameter at the top. There are, of course, dampers in the passages to and around the economizers, and there is a main damper in the breeching near the stack in both decks, these under the control of Locke damper regulators.



POWER STATION OF THE RHODE ISLAND SUBURBAN RAILWAY COMPANY

STEAM PIPING

The high-pressure steam piping from the two decks of boilers is all brought to one steam header, which is noteworthy from the fact that though nearly 160 ft. long it is provided with but two valves, as will be explained. The steam pipe from each boiler is 10 ins. in diameter, and the two pipes from the boilers vertically in line are united in a special connection before joining into the header. The usual long radius bends are employed in the pipes to and from the header, as shown, and the gate valves, which are of the Chapman pattern with bronze valves,

seats and stems, are placed in them in the boiler room. The valves in the boiler leads are accessible from an iron slat walk located over the smoke duct, in the case of both tiers of boilers, and the valves in the supply pipes to the engines are close to the header.

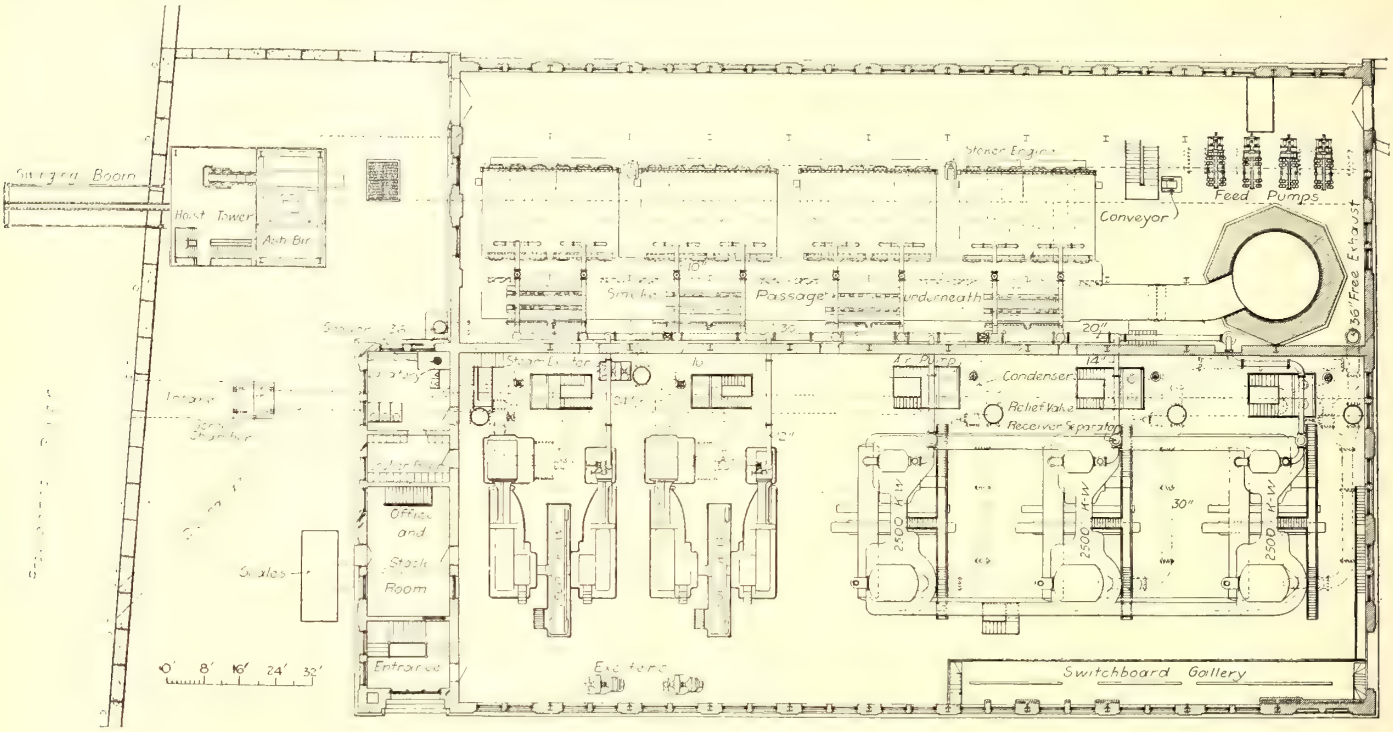
Wherever possible, providing there is no chance of receiving oil, the condensation in the high-pressure lines is returned to the boilers by means of the Holly gravity return system. In that connection an alarm whistle set against the partition wall in the engine room is connected to blow should the system fail to act, allowing water to accumulate. On each side of the whistle is a brass hand wheel; if the alarm is given, one is turned to cut out the regular connections, and the other turned on to blow off the water, and thus prevent its reaching the engine cylinders in any way. The live steam piping is lap-welded Bessemer steel pipe, ⅜ in. thick, with flanges welded on, and having rebated joints with corrugated copper gaskets. The fittings are open-hearth steel castings.

Expansion in the steam header is allowed for by the long, curved lateral pipes, as usual, and the header is anchored at a center point, so that the amount of movement at the ends is reduced to a minimum. Besides the anchor the pipe rests on three roller-bearing saddles to accommodate the movement, and the bases of supports and anchor are bolted to short cross I-beams. In the case of the expansion bearings the tee sets in a saddle, and this in turn on three 1½-in. steel rollers between the saddle and the roll-plate, which roll-plate is brought into position for the proper alignment of the pipe by means of four screws in the base attached to the I-beams. In the case of the anchor the saddle bears directly on the base, with finished mating surfaces, and the saddle has a lateral tongue with finished sliding surfaces fitted into a groove in the base to allow for lateral but not for longitudinal movements of the pipe. To lock the tee to the anchor a wedge piece at each end is fitted between the saddle and a block held against the flange of the tee, and, as shown, each wedge contains a screw by which it is tightened. The tees, it may be noted, are provided with drain taps, which are brought sidewise from the bottom through an opening which had to be left in the saddles for that purpose.

The steam pipes to the main units enter the room through the partition wall, as shown, and immediately within the engine room, each is tapped for the supply of the corresponding condenser air pump, and in the case of the horizontal units also for a live steam pipe, by which high-pressure steam can be delivered to the receiver when necessary, and in one instance also for the steam-driven exciter. With regard to the subdivision of the high-pressure steam header, it will be seen that by the location of the two valves provided in it, the center section of the header can supply one direct-current and one alternating-current machine, if either end has to be cut out, and similarly in the event of an accident to the center section or to the boilers connected thereto, an alternating unit can be run from one end of the header, and the direct-current supply can be maintained from the other, pending repairs. The header is located close to the partition wall, and to facilitate handling connections, whenever the necessity may arise, there is an opening 2 ft. x 4 ft. or so in the wall opposite the tee joints. These are closed with easily removable sheet metal covers, to minimize the number of openings in the wall.

ENGINE ROOM

The engine room plan shows five direct-connected units, two with horizontal and three with vertical engines and all cross compound. The vertical unit at the end of the room is not yet installed, and the third is at present occupied by a horizontal set which it is shortly to replace. The horizontal units are Filer & Stowell engines, 32 ins. and 64 ins. x 54 ins. in cylinder size, with General Electric generators, two giving an alternating-current output of 1500 kw at rated load, and the other a direct-current output of 1600 kw. The vertical unit consists of a Westinghouse engine, of 42-in. and 86-in. cylinders, with 60-in. stroke, and a General Electric railway unit of 2500-kw capacity. The alternators are operated at about 94 r. p. m., and give current in three phases at 25 cycles and 11,000 volts, and the engines, which, it may be noted, are operated with automatic cut-off for both cylinders, are equipped with a ⅛-hp Browning motor, by which the generators can be brought into synchronism by controlling the engine governors from the switchboard. The present horizontal railway unit runs at 90 revolutions and the vertical unit at 75 revolutions. The steam pressure is 150 lbs., and the vacuum, normally, 26 ins. For the alternators there are two motor-driven and one steam-exciter unit, the last for use when no alternating current is available, as the motor-generators employ induction motors. The steam



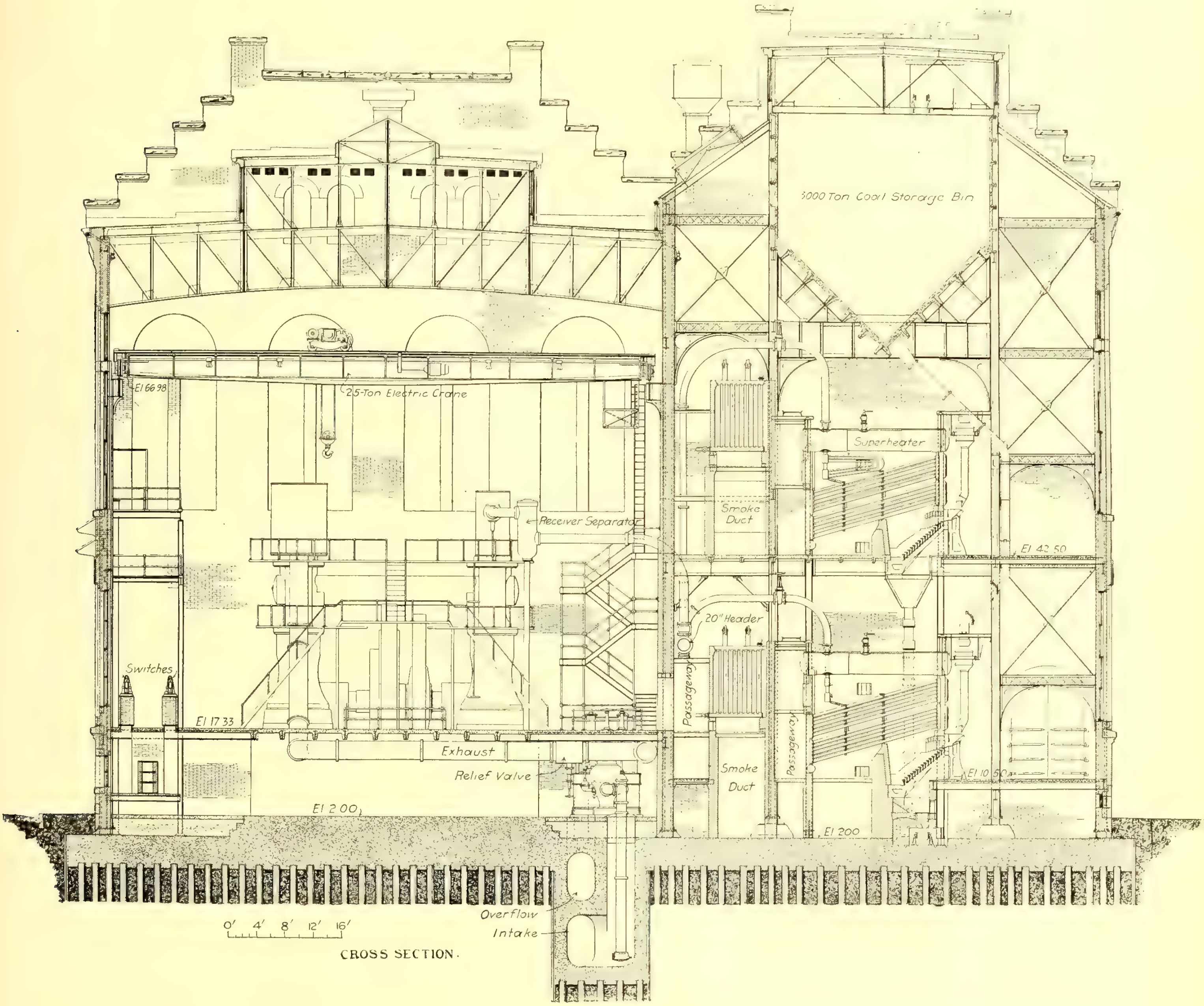
PLAN OF POWER STATION

unit is a General Electric marine set with an 11-in. x 8-in. engine, and a 30-kw, 125-volt dynamo, while the others consist of 440-volt, 75-hp motors and 125-volt, 55-kw dynamos, each set capable of exciting both alternators.

CONDENSERS

The condensing plant consists of four jet condensers, one for each unit, with vertical twin pumps drawing from one and discharging into a second of two concrete conduits, extending lengthwise of the building under the basement floor. The pumps, which are of the Blake pattern, are 16 ins. x 40 ins. x 24 ins. in size for the horizontal engines, and 16 ins. x 48 ins. x 24 ins. for the vertical unit. Relief valves are furnished near each condenser unit, and the exhaust piping is of cast-iron, except beyond the relief valves, where it is of spiral riveted pipe. There are two 36-in. free exhaust risers, one at each end of the building, the run of pipes being shown in the plan. The two straight horizontal lines leading to the risers are each provided with a Wainwright corrugated copper expansion joint. The risers, which are capped with exhaust heads, are some 100 ft. high, and the braces used allow for expansion. The rods have a fork at each end, making a hinge joint, one at a bracket fixed to the building wall and the other to a plate bolted to the flange of the exhaust riser. There are three sets of these braces for each pipe.

Salt water from the Providence River is used for condensing. It is admitted into a flume, 7½ ft. wide and 8 ft. high, lined with 6-in. sheet piling and having a floor of 4 ft. of concrete. The bottom of the suction flume is 16½ ft. below mean high water, and leads to a screen chamber, beyond which the flume takes the form of a flattened ellipsoidal concrete conduit with axes 7½ ft. and 4 ft. The discharge conduit within the building is similar to the suction passage, except that it is 7 ft. high. Outside the building it is also of the timber wall and concrete floor construction, with its bottom 7 ft. below mean high water, or about 2 ft. below low water, and it is 4 ft. x 7.5 ft. in cross-section. The concrete discharge conduit is vertically over the suction passage, but a short distance outside the building line it diverges from the line of direction of the suction flume, emptying at the wharf line 46 ft. from the in-take. Under each condenser the suction conduit can be reached by a well, in which is placed the pump suction pipe with strainer foot valve. The screen chamber at the end of the suction flume contains two 5-ft. x 8-ft. screens, of brass wire, one of 1½-in. mesh and the other of 1-in. mesh, through which the water



CROSS SECTION OF POWER STATION

passes in succession. This chamber is at the foot of a timber-lined shaft through which the screens may be removed. Hinged covers of heavy planking at grade level give entrance to the shaft, and immediately above the screen chamber proper is a 6-in. splined plank roof, through which the screens may be lifted in wooden guide posts extending from the bottom of the shaft to the ground surface.

BOILER FEED SYSTEM

The boiler-feed system is one of the specially interesting features of the plant. Owing to the use of jet condensers operated with salt water, fresh water for the boilers is constantly required, taken from the city mains. Normally, the water is passed through feed-water heaters, to which is brought the exhaust steam from the feed and condenser pumps and the marine-type exciter set, and is then taken by the feed pumps, at a temperature of about 170 degs. F., so that the pumps thus handle hot water, and is delivered through the economizers into the boilers at a temperature of 220 degs. to 230 degs. The heaters, pumps and economizers are all provided with by-passes, and there are also duplicate feed mains to the boilers.

The scheme of piping and connection is indicated in the accompanying diagram. Water is admitted from the public service through either one or both of two 6-in. pipes, and is passed through a meter, provided with the usual by-pass. The city pressure is sufficient to force the water through the feed heaters and to the pumps, which are located on the lower boiler floor, while the heaters are in the basement directly underneath. The delivery pipes from the heaters feed into opposite ends of of a suction header, into which also two 6-in. heater by-passes connect as shown. Each heater is the Gleaner type, made by Messrs. I. B. Davis & Sons, of Hartford, consisting of groups of U-tubes, through which the exhaust steam is led successively from steam inlet to drain outlet. Each heater has some 375 sq. ft. of heating surface, and is 4¾ ft. in diameter and 12½ ft. long. An interesting point is that all oil-laden drips are discharged into the lower row of tubes, and, it is stated, that the condensed steam is discharged at a temperature of only 4 degs. higher than the inflowing cold water.

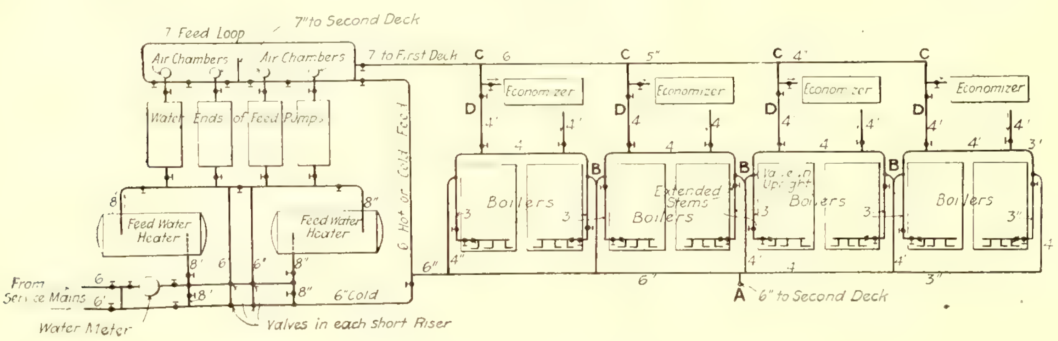


DIAGRAM OF FEED PIPING

There are four feed pumps, of the Worthington 14-in. x 8½-in. x 15-in. duplex, double-acting plunger pattern, all delivering to the same discharge header, but ordinarily connected two to the feed system of the lower deck of boilers and two to that of the upper deck. There are two steam mains run across the pumps, with a branch from each to each pump, and the steam valve to the pumps for the upper deck have extended stems rising through the second boiler floor so that they can be controlled from that point.

Opposite each pump discharge into the pressure header is a large air chamber, and in addition each pump carries a relief valve discharging into the suction. The header is formed into a loop in a vertical plane with the lower run in the cellar. From it are carried two 7-in. connections, these being the regularly employed feed mains for the two decks of boilers, and also a 6-in. connection, this leading to an auxiliary feed main, to which is also brought a 6-in. pipe direct from the city meter connections. The last pipe provides for filling the boilers with cold water, the other 6-in. main for forcing water in the boilers either hot or cold. A study of the diagram will show that any of the pumps can draw from either heater or direct from the cold supply, and that any pump can be used to supply either deck of boilers, by means of the delivery loop and the arrangement of valves.

The diagram also shows the distribution of the feed piping for one deck of boilers, the arrangement for the other being similar. The main, starting 7 ins. in diameter, is carried overhead behind the boilers, suspended from I-beams, and the branches of each battery, for the length C to D, are taken vertically upward from it, with a connection for the economizer, as well as direct to the boilers. The auxiliary main, starting 6 ins. in size, is run in the cellar, and at the point A supplies a vertical to a similar horizontal main in the upper part of the lower story of boilers for the second deck installation. The branches from this main, at the points B in each deck, bifurcate into two vertical pipes for the two adjacent boilers, with a valve in each vertical. At the top the verticals connect into the branches from the main feed system. The valve in the supply pipe to each boiler has an extended stem dropping toward the floor within reach of the firemen.

ELECTRICAL EQUIPMENT

The handling of current at 11,000 volts has resulted in an interesting equipment of electrical apparatus grouped around a two-gallery switchboard, 31 ft. above the engine room floor. The various electrical conductors from the generators are carried overhead on the underside of the ceiling in a spacious, well-lighted gangway in the basement. Here the high-tension bus-bars are located, each enclosed in separate brick housings supported on a slate platform, and connections to and from them are made in oil-break, brick-housed switches on the engine room floor. These are of the pattern operated by relay switches on the switchboard, the switches actuating the main switches through worm and wheel gearing driven by small direct-current motors, one mounted on the brick enclosure of each switch. There are five alternating-current feeders, and the conductors pass out of the building opposite the second story of the switchboard, where there are cut-out copper bar switches mounted on marble panels, with branches to the lightning arresters, grouped underneath the first gallery.

A feature of the switchboard construction is the provision of 3½-in. pipe conduits, built in pilasters against the outside building wall, for the passage of the conductors. At the bottoms the pipes are set into special cast-iron sockets, giving smooth, rounded surfaces into the conduit, and at the top they are fitted into the marble cap of the pilaster. The high-tension feeders are carried horizontally through the building wall in the center of an 8-in. x 8-in. opening in it, and outside, under the cover of heavy slate hoods, are located the tension insulators and the beginning of the transmission line.

The alternating-current feeder panels have each a recording wattmeter and three ammeters, the latter showing the state of balance of the load on each phase. The generator panels have only one alternating-current ammeter, but have both an indicating and recording wattmeter, together with an ammeter for field current. For the motors of the electric-driven exciters there are two banks of three delto-connected transformers on the slate platform in the basement. These step down to 460 volts, and the motor panel of the switchboard contains the relay

switches for cutting in and out the high-tension current of the transformers, the switches being the motor-operated oil-break type.

The direct-current board at present provides for thirty feeders in fifteen panels. Each panel carries two ammeters for the two feeders, but only one circuit breaker. The generator panels have one switch on the switchboards in the negative side, and one circuit breaker in the negative side, while on a pedestal at each machine there is a positive switch and the equalizing switch. The total direct-current output is measured in a large recording wattmeter on a panel between generator and feeder panels, and this panel also carries a totalizing indicating ammeter. The positive feeders are 500,000 circ. mils, and the negative returns 1,000,000 circ. mils. The switchboards are, generally speaking, equipped with standard General Electric instruments; they are of Vermont marble, 2 ins. thick, mounted on 3-in. longitudinal timber stringers. The switchboard structure is of steel framing with slate floors.

OPERATING DETAILS

The plant is equipped with an interesting oiling system, and is piped for compressed air throughout engine and boiler rooms. A large clock on the partition wall is set to strike a gong every 20 minutes, when the oilers are required to make a circuit of the engine room to ascertain the condition of all bearings, and once a day the machinery is cleaned by compressed air. For the latter there is a Westinghouse locomotive-type compressor, automatically controlled to maintain 70 lbs. pressure, and the system distributes from an air reservoir about 18 ins. in diameter and 7 ft. long. For signaling between operating engineer and switchboard attendant the system in vogue on shipboard is in use, consisting of two dials, one in the switchboard gallery and the other on the engine room floor, these connected together with chains and actuating pointers to stop opposite various legends on the dials, to which attention is drawn by the ringing of a gong. The system is patented by Charles Cory & Sons, of New York.

The oiling system referred to comprises a duplicate set of storage, separating and filtering tanks, all located in an oil room in the basement of the extension or L; a fifteen-barrel reservoir, 35 ft. or 40 ft. above the engine room floor on the partition wall, two small Mason pumps for lifting the oil from the storage tanks to the reservoir, and a system of brass distributing piping. The separating tanks to which the oil is brought by gravity from the engines are 36 ins. in diameter and 7½ ft. high above the base. They are partly full of water and the oil is introduced at the bottom through a central pipe, and passes upward through the water and through a circular plate perforated with ⅛-in. holes for catching foreign matter. Near the top is the overflow for the separated oil, which flows to the filters. In these the oil falls on a flat conical plate or shedder, perforated with ¼-in. holes, from which the oil passes by gravity through alternate layers of woolen waste and charcoal. These layers of filtering material are held between brass wire screens, five layers of waste, each about 4 ins. thick, and four layers of charcoal, each about 3 ins. thick. This filtering material is enclosed in a 30-in. shell, in the bottom of which are ½-in. holes, by which the filtered oil reaches the outer chamber of the filter, and thence through an outflow pipe to the storage tanks, to be used again. This is for the engine oil. For cylinder oil, a good-sized vertical tank is located in the engine room, from which distribution to the cylinder oil pumps is to be effected by compressed air.

The station was designed by the engineering department of the Rhode Island Suburban Railway Company. The building was erected by Messrs. Horton & Hemenway, and the piping work by the General Fire Extinguisher Company, both of Providence. Plans for the station had been completed for horizontal units and a single floor of boilers, when, in August, 1902, it was decided to double the capacity of the plant without an increase in ground area. The pile and concrete foundation work had, fortunately, been planned heavy, and it was necessary only to redesign the superstructure. The steel was rolled and erected, the chimney was built, the brickwork completed and the four engines and the boiler plant installed in a year and four months.

TRAFFIC CONDITIONS ON THE BROOKLYN RAPID TRANSIT SYSTEM*

BY C. R. BARNES

The average number of passengers carried daily on all lines of this company's system, including the elevated, in both directions, is 942,107. Of this number, 301,408 are carried on the elevated system, and 640,699 on the surface lines. A majority of these passengers are carried during the morning and evening rush hours, the greater number being carried during the evening rush hours. The conditions of traffic during these hours are such that passengers cannot ride with any degree of comfort or convenience. The consideration of traffic conditions in this report is confined to the period of maximum traffic during the evening rush hours, namely, from 5 to 6:30.

From 5 p. m. to 6:30 p. m. there is an average of 121,295 passengers carried on the system, from the New York terminus of the Brooklyn Bridge, the ferries and local points in Brooklyn, to the suburban section and the towns and villages adjacent to the city of Brooklyn. Of these, 46,808 passengers are carried on the elevated system and 74,487 on the surface lines. Of the number carried on the elevated lines "out" during that period, 27,544 are carried from the Brooklyn end of the Brooklyn Bridge, 2065 from the ferries, and 12,228 from local points in Brooklyn. In addition, there is an average of 4911 passengers carried over the bridge during this hour and a half from New York to Brooklyn, which can be considered as local bridge travel, not continuing a through trip on either the surface or the elevated lines. Of the number carried on the surface lines "out" during that period, 17,495 are carried from the New York end of the bridge, 8750 from the ferries, and 48,242 from local points in Brooklyn.

There are fourteen lines of surface cars operated from the New York end of the Brooklyn Bridge to different points in Brooklyn and the surrounding territory. The cars on two of these lines run through Fulton Street, between the City Hall and Flatbush Avenue.

There are nine lines of surface cars operated from Fulton Ferry. Eight of these lines are operated through Fulton Street, between Sands Street and the City Hall, and six of them run through Fulton Street between the City Hall and Flatbush Avenue.

There is one line of cars operated from Wall Street Ferry; these cars do not pass through Fulton Street.

There are five lines of cars operated from South Ferry. One of these lines is operated through Fulton Street from City Hall to Flatbush Avenue.

There are three lines of cars operated from Hamilton Ferry, none of which runs through Fulton Street.

There are four lines of cars operated from Thirty-Ninth Street Ferry, none of which passes through Fulton Street.

There are twelve lines of cars operated from Broadway ferries, none of which runs through Fulton Street.

There are three lines of cars operated from Grand Street Ferry, none of which passes through Fulton Street.

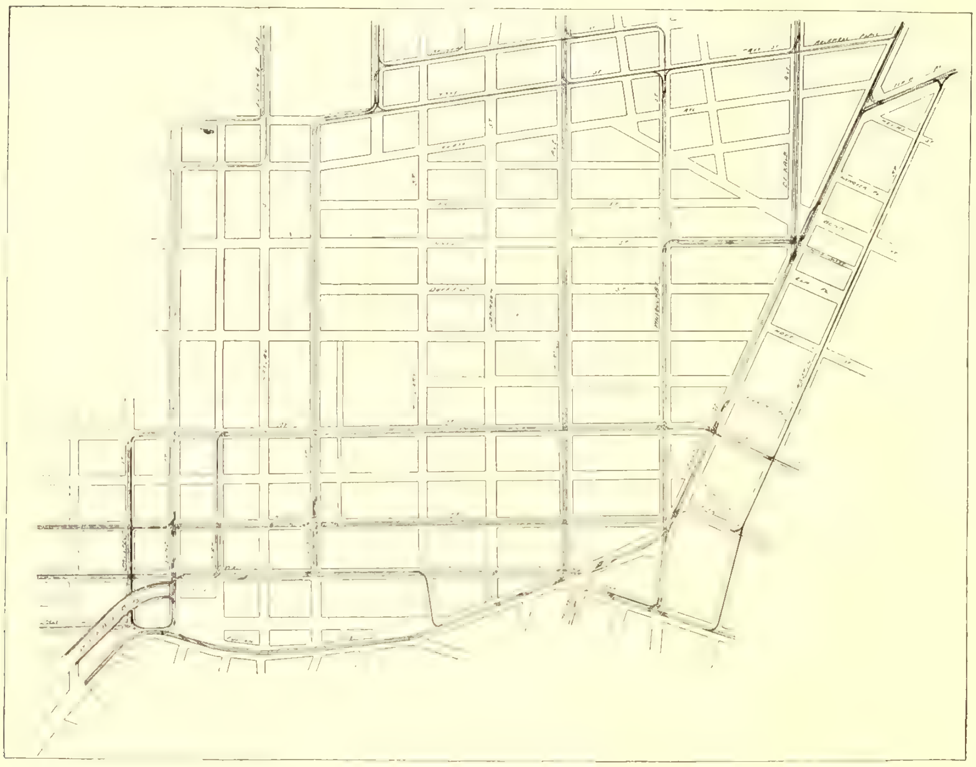
There are four lines of cars operated from Greenpoint Ferry, none of which passes through Fulton Street.

*Abstract of report of the electrical expert of the Railroad Commissioners of the State of New York, at Albany, Feb. 3, 1904.

Several of the lines mentioned run over the bridge and to some of the ferries.

The number of trips operated from the New York terminus over the bridge during 1 hour—from 5 p. m. to 6 p. m.—varies from 220 to 280, including cars operated by the Coney Island & Brooklyn Railroad Company.

The larger portion of the volume of traffic originating in Brooklyn and moving from the center of the borough to the outlying districts during the evening rush hours, originates in a section within a radius of half a mile of the City Hall. The greater part of this travel starts from the vicinity of the City Hall and on Fulton Street, between the City Hall and Flatbush Avenue. Cars operated from New York during the evening rush hours furnish practically no facilities for this traffic, as these cars are loaded when leaving the New York terminus of the bridge. This travel depends on local cars, which are operated from points in the territory and the ferry cars which pass through it; as the latter are not at all times during the evening rush hours fully loaded when leaving the ferry, they furnish some facilities for the local travel.



MAP SHOWING PROPOSED CAR ROUTES NEAR BROOKLYN END OF BRIDGE

From actual count made at the ferries of passengers carried and number of cars run, it is determined that the ferry cars passing through the district of local travel mentioned, in addition to carrying the ferry passengers would leave room for a number of local passengers equal to 271 trips on the different lines between 5 and 6:30 o'clock each evening.

The total number of surface car trips operated "out" on the system between 5 p. m. and 6:30 p. m., is 1291, of which 271 are available for local traffic in the territory mentioned. The number of passengers carried locally on the surface lines "out" during the hour and a half mentioned in the evening, from the territory within a radius of a half-mile of City Hall is 24,000, which is 32 per cent of the total passengers carried "out" on the surface lines. There is operated available for this traffic 21 per cent of the total trips run on the surface system.

CONGESTED POINTS ON THE SURFACE SYSTEM

There are several points on the surface lines at which the movement of cars is delayed by congestion of traffic. The most serious delays from this cause occur at the following points: On the bridge; the Brooklyn terminus of the bridge; Fulton Street, between Court Street and Flatbush Avenue, and at the Broadway ferries.

The number of cars operated over the bridge during 1 hour of the evening rush, varies from 220 to 280. The distance traveled by cars running over the bridge is 1.1 miles; the average running time of cars over the bridge is about 9 minutes, which is at a speed of about 7.3 m. p. h. Serious delays to traffic occur on the bridge. These and the fluctuation in the number of cars operated per hour, result largely from interference with car traffic by vehicles moving over the bridge.

The delay to traffic at the Brooklyn end of the bridge is caused by running outbound cars from the bridge through Sands Street across the inbound traffic on Washington Street, going on to the bridge. During the rush hours this is a very congested point, and the delays to movement are very frequent and serious. There are ninety cars per hour which leave the bridge and run through Sands Street, crossing the movement of 190 cars on Washington Street going on to the bridge between 5 p. m. and 6 p. m. In addition, during this hour there are twenty-nine cars operated from Fulton Ferry up Washington Street which cross the movement of the ninety cars coming from the bridge through Sands Street; also crossing the movement of the ninety cars which run through Sands Street to the bridge. At the intersection of the tracks on Washington Street and the out-bound track on Sands Street there are 304 cars operated during the hour mentioned, making about five cars per minute. The congestion near this point is still further increased by the fact that 116 cars are run from Sands Street over a connecting curve to the out-bound track on Washington Street, joining the twenty-nine Fulton Ferry cars operated through that street. These cars, moving in the same direction, come together at a junction which is located within a car's length of the Sands Street track.

The number of cars operated over the bridge during the hour from 5 p. m. to 6 p. m., with the present physical conditions and present regulations of vehicular traffic over it, cannot be increased to any great extent. There is an average of 17,495 passengers carried on the surface lines over the bridge in one hour and a half in the evening. A broken or stalled truck, which would delay the movement of cars for half an hour during this period (which is not an unusual occurrence), would delay the movement of 6770 persons. With due consideration for the commercial interests whose business requires traffic by trucks between Manhattan and Brooklyn, justice to the large number of people inconvenienced by such traffic demands that stringent methods be adopted to prevent the delays to car traffic caused by it.

Several plans have been suggested to relieve the congestion and delay to traffic at the Brooklyn end of the bridge, caused by the operation of cars from the bridge through Sands Street, none of which, however, has been executed. If any appreciable increase is to be made in the number of cars operated over the bridge there must be some relief from the congestion at this point.

The congested condition of traffic on Fulton Street between

the City Hall and Flatbush Avenue is worse than at any other point in the State of New York. The number of cars operated is such that any additional cars would decrease the traffic facilities rather than add to them. There are more cars operated over the Boerum Place crossing than over any other in this State. Movement of cars on the system would be facilitated if this number were reduced. As a large majority of the traffic from Brooklyn to the suburban territory originates on and in the vicinity of Fulton Street, cars to properly serve this traffic should be operated through that street. With the present physical conditions no more cars can be run through Fulton Street, and any additions to the facilities for local travel must be made by removing through cars from New York from that street, or running additional cars through streets near to and parallel with it.

The delay to car traffic on the bridge can be prevented by the regulation of the vehicular traffic passing over it; the passage of heavy trucks or other vehicles which might interfere with the free movement of vehicles in a single line over the bridge between the hours of 5 p. m. and 6:30 p. m., should be prohibited. All vehicles passing over the bridge should be confined to a single line and not allowed to approach near enough to the tracks to prevent the movement of cars.

The congestion on Sands Street could be avoided by running all cars from the bridge that are now operated through Sands Street, through Fulton Street to Prospect Street, passing under the arch of the bridge and continuing on Prospect to Adams or Jay Streets. The track for this operation is at present constructed, but would require reconstruction. This route would add 590 ft. to the distance traveled by the cars at present which pass through Sands Street. This change would result in a free movement of cars at the intersection of Sands and Washington Streets, and prevent the frequent and serious delays at that point. If these changes were made and the vehicular traffic on the bridge regulated as suggested, the speed of cars across the bridge could be increased so that the number of cars operated over it could be increased from an average of 250 to about 300 per hour.

In reference to the congestion on Fulton Street—Livingston Street extends nearly parallel with Fulton Street and one short block from it. The rears of the retail stores facing on Fulton Street abut Livingston Street on one side of it, and there are dwelling houses on the other. There are no tracks constructed in this street; it is not wide enough to accommodate double tracks, and the street traffic at present passes through it. This street extends from Court Street to Flatbush Avenue, a distance of about one-half a mile. To relieve the congestion on Fulton Street and facilitate the movement of cars on a large portion of the system, double tracks should be constructed through Livingston Street between these points. This would necessitate the widening of the street. A single track could be constructed through this street, which could be done by placing it on one side of the street, in such a manner that the operation of cars over it would not seriously interfere with the street traffic. If this were done the congestion on Fulton Street could be materially relieved, as about one-half of the cars that are at present run "out" on Fulton Street could be operated through Livingston Street and return over other routes not running through Fulton Street.

In addition to the delays caused from the above reasons, the operation of cars during the present winter has been seriously delayed by vehicular movement in the business portions of the Borough of Brooklyn. While there was a decided improvement in the regulation of street traffic during the past summer season, the regulation of this traffic during the present winter has been very poor. One of the causes of the obstruction of car movements by vehicles during the present winter season has been the heavy fall of snow and the manner in which it has been removed from the streets. In most cases it has been allowed to remain on the streets for a considerable period, in such a position as to force the vehicles on to the car tracks.

The conditions of travel in the Borough of Brooklyn and to and from the Borough of Manhattan, are such that nothing should be left undone to improve them. If the above suggestions were carried out the present conditions would be greatly improved, but they would not furnish adequate facilities for the present travel or the probable increase of traffic in the near future. What this increase will be is indicated by the fact that during the year ending June 30, 1903, there were 15,000,000 more people carried on this company's system than the year previous. Some commercial or private interests might be unfavorably affected by the adoption of the above suggestions, but the benefit to the large number of people carried daily is of such vast importance that the impairment of any interest, private or otherwise, should not prevent it. The people living in the suburbs and doing business in Brooklyn, an average of 48,000 of which leave Brooklyn in one hour and a half for their homes, via the surface lines, are entitled to and should receive better transportation facilities than they have at present. The number of passengers carried from the vicinity of the City Hall constitute 32 per cent of the total number of passengers carried on the surface lines, and are only given 21 per cent of the traffic facilities; but, with the present physical conditions, no additional cars can be furnished them. If a track were constructed through Livingston Street and some minor changes made in the present track connections at other points, including the construction of a short piece of track through Tillary Street, connecting tracks in Washington and Fulton Streets, the present facilities for local travel from the section at and near the City Hall—which at present consist of 271 trips between 5 p. m. and 6:30 p. m., could be nearly doubled.

If the suggestions in reference to change of routes at the Brooklyn terminus of the bridge and in regard to the regulation of traffic on the bridge were adopted, the facilities for through traffic from New York could be increased 20 per cent, as since the four additional loops on the New York end of the bridge have been in use there has been no delay to the movement of cars caused by loading and unloading of passengers at that point. The number of cars operated over the bridge during the rush hours is controlled by the number which can be passed the intersection of Sands and Washington Streets on the Brooklyn end. If these suggestions were adopted the number of passengers carried on the surface cars over the bridge during the maximum period of travel, between 5 and 6:30 in the evening, could be increased from 17,495 to about 21,000.

The consideration of the traffic conditions and the suggestions for improving them is confined to the surface lines and to the present physical conditions and possible changes which might be made by the addition of new tracks and reconstruction of existing ones. The possibilities of increased facilities in connection with the new bridges in course of construction, or of the new tunnels contemplated, have not been considered.

No suggestion is made in reference to the improvement of traffic conditions on the elevated system in the Borough of Brooklyn, and very little, if any, can be made with the present limited terminal facilities. It is possible that a few more trains and a few additional cars could be operated on some of the different lines, but no improvement of this service, such as the present and probable increase in traffic demands, can be made at present or in the near future, with the restrictions caused by the present physical conditions.

To sum up:

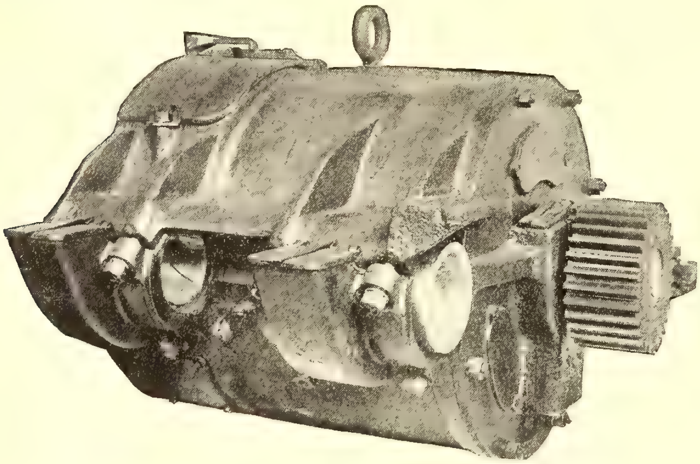
(1) I suggest that vehicular traffic over the bridge be regulated as suggested in this report.

(2) I recommend that the changes in the route of cars at the Brooklyn end of the bridge be made as stated in this report.

(3) I recommend that the company take the proper legal steps for the construction of the Livingston Street line.

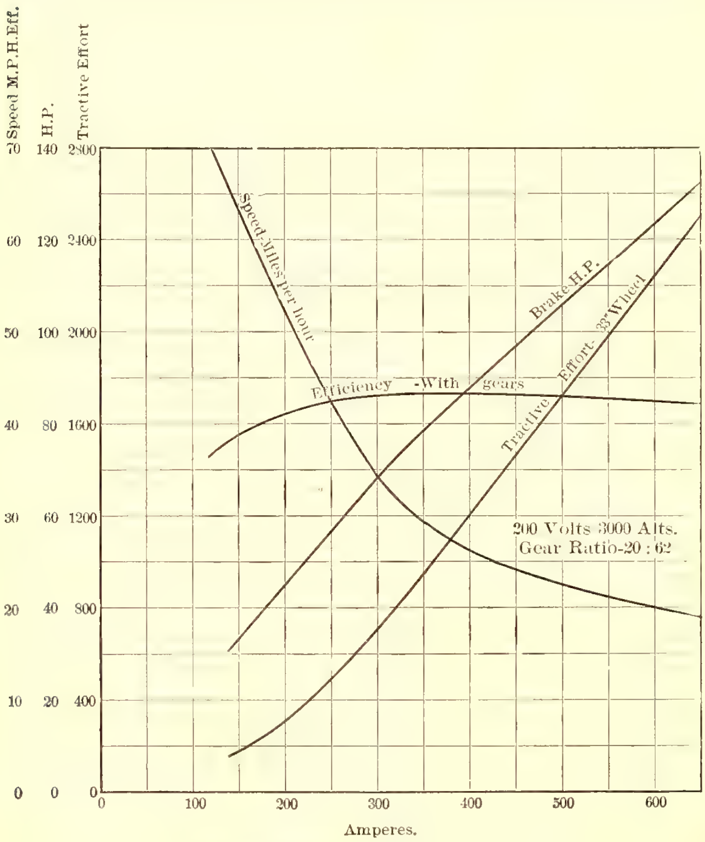
WESTINGHOUSE NO. 91 SINGLE-PHASE RAILWAY MOTOR

The alternating-current single-phase railway system recently placed upon the market by the Westinghouse Electric & Manufacturing Company is attracting so much attention and presents so many possibilities that a description of one of the motors which makes this system practicable cannot fail to be of interest.



MOTOR, FRONT VIEW

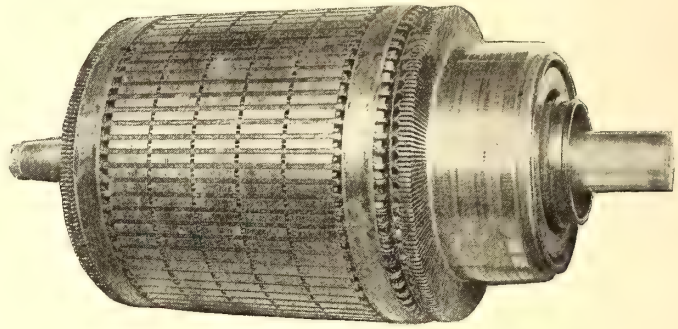
The No. 91 motor has a nominal rating of 125 hp, on the basis of a 1-hour run at full load with rise of temperature not exceeding 75 degs. C. Mechanically it follows the general lines now regarded as standard for direct-current railway motors. The principal features peculiar to the new type are found in the construction of the magnetic field and in the winding of the armature and field coils. The motor is series wound and of the commutator type.



TEST CURVES OF NO. 91 MOTOR

The field frame consists of a cylindrical shell of cast-steel, to which are bolted solid end brackets of the same material. These end brackets contain supports for the armature bearings. The upper caps of the axle bearings are cast solid with the frame. The lower caps are rigidly held in place by heavy bolts. The axle bearings consist of cast-iron shells lined with babbit and divided into two parts. Solid shells, also babbit lined, are used for the armature bearings, and ample wearing surface is provided. Oil lubrication is used throughout, and the bearing boxes are large and are packed with waste. The extensions which carry the axle bearings are especially strong and heavy. An eye-bolt in the top of the casting provides for easy handling. There is a large opening in the upper frame which permits access to commutator and brushes. Numerous hand holes are provided both in the end brackets and at the bottom of the motor. The lugs for "nose" suspension and for the support of the gear case are cast solid with the frame.

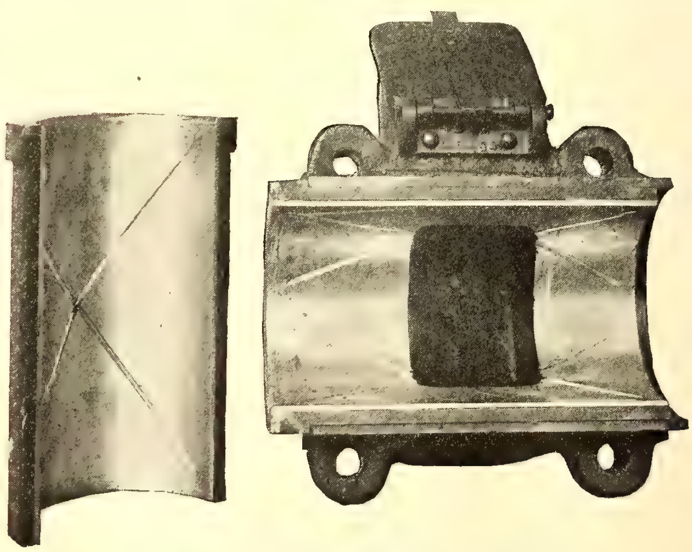
The field core is made up of circular punchings of soft laminated steel, and the poles are rectangular in section and project inward. A magnetic circuit is thus formed which is wholly laminated and without break from pole face to pole face. As the armature core is correspondingly constructed there is no mechanical joint in the whole magnetic circuit. The construction, as will be seen, is in general the same as that used for alternating-current induction motors.



ARMATURE

The field coils are wound with copper strap bent on edge, and are held firmly in place by adjustable hangers of improved design. They are connected in series. Brush holders of the sliding shunt type are used, and are supported inside the end bracket. The brushes are of carbon.

The armature is of the slotted drum type with machine-formed coils, and the core, as stated, is composed of laminated punchings of soft steel built up upon a spider. As in d. c. motors numerous ventilating spaces are provided, permitting air to circulate through the core and between core and coils. The slots in the core for the coils are of the open type. The coils, themselves, are made of copper strap without joint, and are held in place by retaining wedges of hard fibre. The winding is of the multiple type, and there are no band wires over the core. The commutator is built up of cold rolled copper segments with long necks.



AXLE BEARINGS, BABBIT LINED

The No. 91 motor is wound for 225 volts and a frequency of 25 cycles or lower. Its general performance is shown by the curves in the diagram on page 294. These curves indicate the similarity in performance to the direct-current, series-wound railway motors now standard.

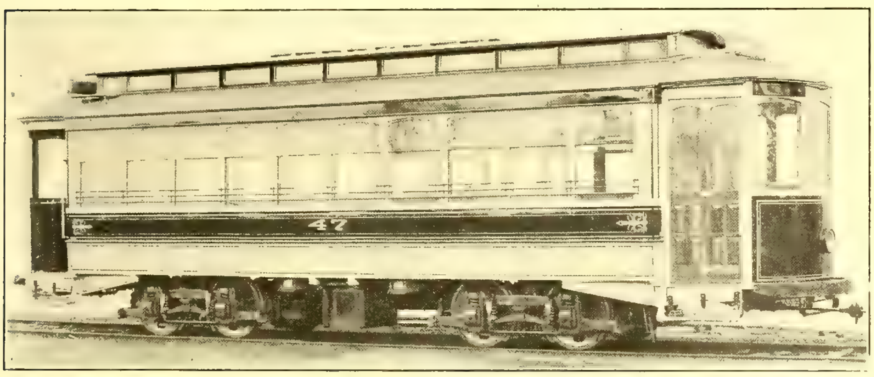
The No. 91 motor though designed primarily for operation on alternating-current, single-phase, circuits may also be operated by direct current. For this purpose a modification of the controlling apparatus is required.

A complete line of motors of this type has been designed by the Westinghouse Company and may now be obtained for railway service of any class.

HANDSOME SEMI-CONVERTIBLE CARS FOR SYRACUSE

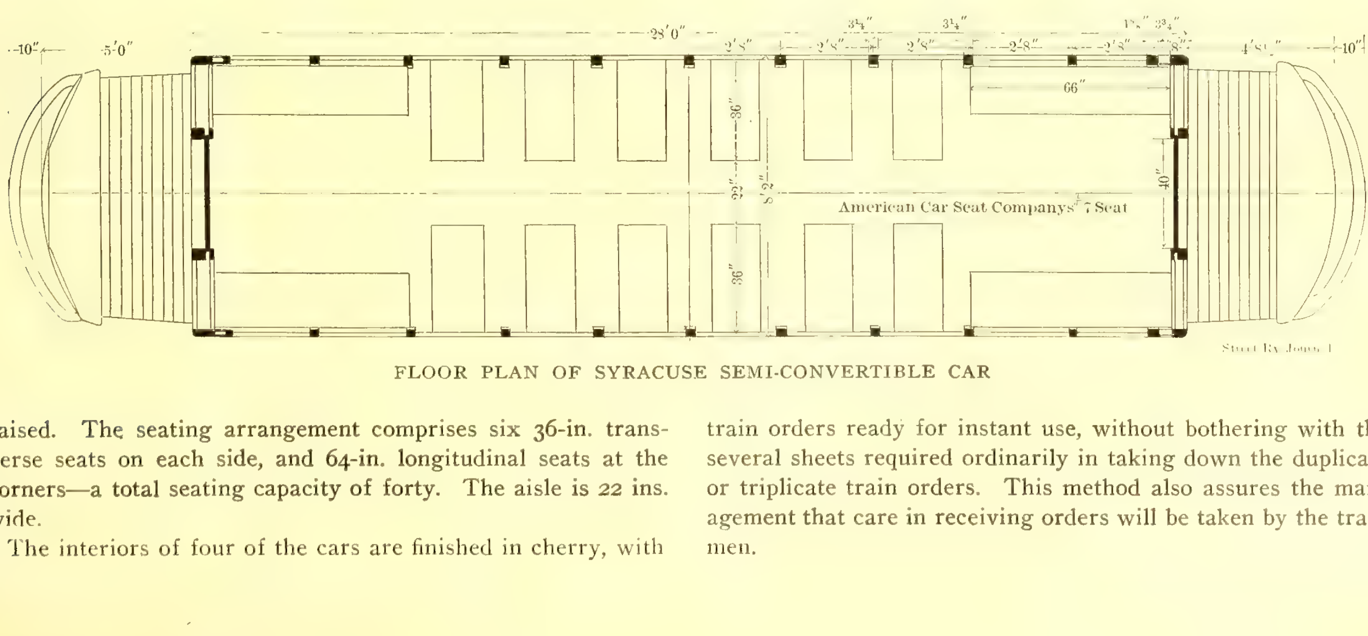
Within the last week or so the Syracuse Rapid Transit Company, of Syracuse, N. Y., has added to its equipment five new semi-convertible cars, built by the J. G. Brill Company. The new cars are to run from Syracuse to East Syracuse, a suburb about 6 miles from the city, connected by one of the branches of the 70-mile system owned by the company. The passenger traffic in this section has grown rapidly since the lines were constructed, and most of the business which formerly went to the steam road has been diverted by the trolley extension. These new cars, with the fast service that they are capable of giving, will materially aid in further developing the locality.

The car dimensions are: Length, 28 ft.; length over end panels, 37 ft. 5 ins.; over vestibules, 4 ft. 8½ ins.; width over sills, 7 ft. 10½ ins.; over posts at belt, 8 ft. 2 ins.; centers of posts, 2 ft. 8 ins.; sweep, 1¾ ins. The side sills are 4 ins. x 7¾ ins., and end sills, 5¼ ins. x 6⅞ ins.; sill plates, 12 ins. x ⅜ ins. Thickness of corner posts, 3¾ ins.; side posts, 3¼ ins.



SEMI-CONVERTIBLE CAR FOR SYRACUSE

The windows of the car shown in the accompanying illustration are all in their lowered position, but, as is well known, this type of car has roof pockets into which the sashes may be raised. The seating arrangement comprises six 36-in. transverse seats on each side, and 64-in. longitudinal seats at the corners—a total seating capacity of forty. The aisle is 22 ins. wide.

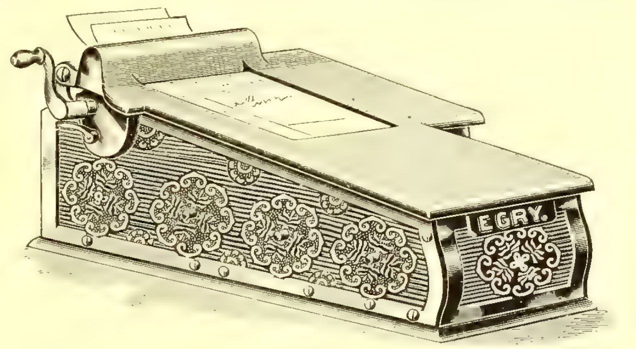


FLOOR PLAN OF SYRACUSE SEMI-CONVERTIBLE CAR

The interiors of four of the cars are finished in cherry, with decorated birch ceilings, and one car in sycamore, including doors and vestibule wainscoting, etc. The platform timbers are reinforced with angle-iron, and angle-iron bumpers protect the ends. All the cars are furnished with specialties of the builder's make, such as draw-bars, brake handles, sand-boxes, alarm and conductor gongs. The cars are mounted on Brill 27-G trucks with 4-ft. wheel base, 33-in. wheels, 4½-in. axles, and equipped with four 38-hp motors per car.

AUTOGRAPHIC REGISTRATION OF TRAIN ORDERS

Although autographic registers are used extensively in stores, offices and factories for issuing triplicate bills, orders, requisitions, shipping receipts and the like, it may not be known generally how well a specially constructed device of this kind



AUTOGRAPHIC REGISTER FOR TRAIN ORDERS

fits into the telephone despatching system of an interurban railway. The Egry Autographic Register Company, of Dayton, Ohio, has constructed for this work a register which it terms the "Despatcher." By using this register the conductor or motorman is provided with a train order blank ready for instant use. The device, which is shown in the accompanying illustration, is constructed of finely finished metal and is of excellent workmanship. It is arranged to carry the orders in triplicate, so that one may be given to the conductor, another to the motorman, and the third retained under lock and key. This last copy is not accessible to anyone save the authorized official of the railway who takes the record for auditing purposes from the receptacle. After the order has been written the conductor obtains a duplicate and triplicate by simply turning a crank. Thus the company is made acquainted with every train order as written by one of the train crew, who, in turn, is always provided with triplicate train orders ready for instant use, without bothering with the several sheets required ordinarily in taking down the duplicate or triplicate train orders. This method also assures the management that care in receiving orders will be taken by the train men.

The method of placing these registers is determined by the operating conditions. Where companies are equipped with portable telephone outfits in the cars, the despatcher's office and each car is provided with a register. On lines where pole boxes are used a register is placed in each box, that the train crew may receive orders and report along the route. Where orders are given only at way stations, located at short intervals, registers are placed in all such stations. In all instances, however, a register is placed in the despatcher's office, over which he writes the orders given, producing triplicate copies at one writing, placing one copy on file for his own reference, sending another to the general office with the despatch sheet, and leaving the third in the receptacle, from which it is taken whenever all orders are to be compared and checked.

It will be seen that this system is planned to produce despatch, yet command accuracy and protection for all car movements requiring written orders, except, of course, where cars move according to the schedule. Its use overcomes shifting of blame, confusion of orders, unnecessary messages and the like. Order forms of various sizes can be issued, depending upon the size of the register. Any form of train order blank, however, can be outlined according to the requirements.

MOTORMAN'S SANDAL

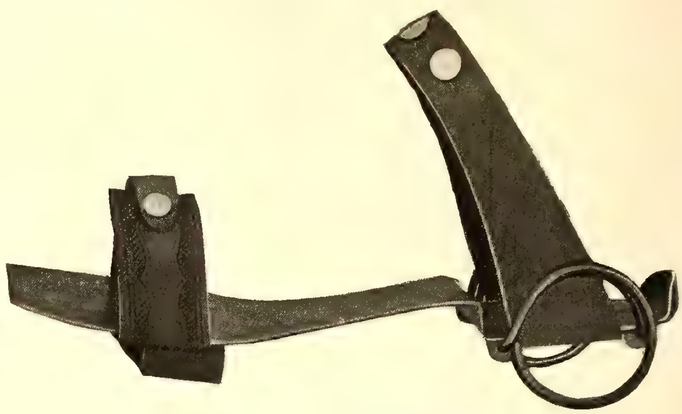
A spring sandal, to be worn by motormen for relieving them from the constant vibration of the car, has recently been invented by B. R. Bonney, of Pasadena, Cal. Mr. Bonney is an old motorman, having been employed by the Pacific Electric Railway Company, of Los Angeles, and his invention is the result of personal investigations, which had as their aim the relief to motormen of the jar and vibration which the men receive from the car. Physicians are said to testify to the bad effects that frequently result from this continual vibration, such as varicose veins and kidney trouble, and motormen often have to

SANDAL ATTACHED TO SHOE

leave the service on this account. Where the men are provided with stools, which they use during a part or all of the trip, the results are not so bad.

The Bonney sandal is constructed to fit over the shoe, as shown. As may be noticed from the accompanying illustrions the sandal consists of a thin sole, formed to fit the bottom of a shoe, and raised from the floor by a hard-rubber piece under the toe and by coil springs at the heel. The rubber piece is ½ in. x 1½ ins. x 4 ins., and is riveted to the metal sole. The springs are made out of a single piece of the best spring steel, and the design is such that the tension of the spring increases with the weight, so a heavy man gets the same protection as one of average or light weight. The sole is insulated with rubber, and is held to the foot by two leather straps, which are secured by glove fasteners. A pair of the sandals weigh about 15 ounces, and it is said that the wearing of them causes no inconvenience, as the motorman can walk with them easily. It is stated that officials of the Pacific Electric Railway Company, as well as several physicians, have given their endorsement to the sandal.

For use in winter in the Eastern States it is proposed to manufacture an overshoe on the same principle which will

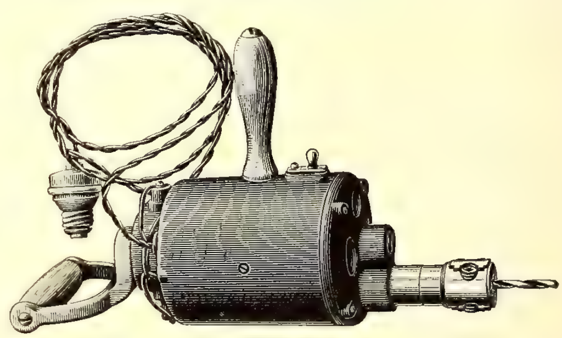


ATTACHMENT FOR MOTORMAN'S SHOE

have an insulated spring sole, and a warm top to cover the entire shoe. If desired, such a shoe could be worn over an ordinary light rubber or overshoe. The Bonney Manufacturing Company, of 621 South Los Angeles Street, Los Angeles, Cal., has been incorporated to manufacture the sandals, and it is expected that they will soon be placed on the market.

ELECTRIC HAND DRILL

The accompanying cut illustrates the "Hisey" electrically-driven hand drill, sold by the W. R. Garton Company, of Chicago, Ill. It is made to operate at 110 volts and 220 volts direct current, but can also be operated in series with lamps



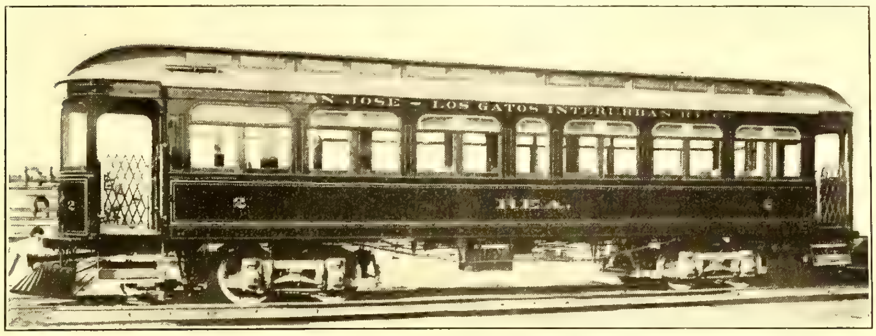
ELECTRICALLY DRIVEN HAND DRILL

on 500 volts. The required operating current is obtained by plugging the drill terminal into the socket of an ordinary incandescent lamp in series with the regular circuit. This drill is extensively used in wood and metal-working shops, as it saves much time and labor. It should find extensive application wherever direct current may be obtained conveniently.

A revised schedule of rates of fare has been adopted by the Indiana Union Traction Company on its interurban lines between Indianapolis and Muncie, Anderson and Marion and Alexandria and Elwood. Single trip fares are on the basis of 1½ cents per mile, while the minimum cash fare is 10 cents. Round-trip fares are on the basis of 10 per cent reduction from single-trip fares. Two hundred and fifty-mile mileage books, good on all lines of the company, are sold for $3.25. One thousand-mile mileage books, good on all lines of the company, are sold for $12.50. Mileage books are sold only by company cashiers at passenger waiting rooms. An additional seat fare is charged on limited cars.

NEW CARS FOR SAN JOSE-LOS GATOS RAILWAY

A short distance from the lower end of San Francisco Bay, and about 40 miles south of San Francisco, is the city of San Jose, having a population of about 25,000, and situated in the heart of a large and populous fruit-growing district. Between San Jose and Los Gatos are the high-speed lines of the San Jose-Los Gatos Interurban Railway Company.



CAR FOR SAN JOSE-LOS GATOS INTERURBAN RAILWAY

This company has lately added to its equipment twelve fine cars, like the one shown herewith, which were built by the American Car Company, of St. Louis. The cars present an attractive and imposing appearance with their steam car roofs, twin windows, vestibules and pilots, and have very pleasing interiors finished in handsomely carved cherry. They are seated for fifty-two passengers, the seats being of the walk-over type, 33 ins. in length, and the aisles 22 ins. wide. Over the crown-pieces the cars measure 45 ft. in length, and over the end panels 36 ft. The width over sills is 8 ft. 3 ins.; from center to center of posts, 2 ft. 5½ ins.; thickness of corner posts, 3¾ ins., and side posts, 2¼ ins. The side sills are 5 ins. x 7¾ ins., with 8-in. x ⅝-in. plates on the outside. The end sills are 5¾ ins. x 7⅞ ins. From the end panels over the vestibules is 4 ft. 6 ins. The step heights from the rail are respectively 16¼ ins., 12½ ins. and 12½ ins. The entrances have folding gates hinged to the corner posts. The cars are equipped with sand-boxes of the American Car Company's make, and Brill angle-iron bumpers, Dedenda gongs and folding gates. The trucks are 27-G with 4-ft. wheel base and 33-in. wheels. The motors used have a capacity of 45 hp.

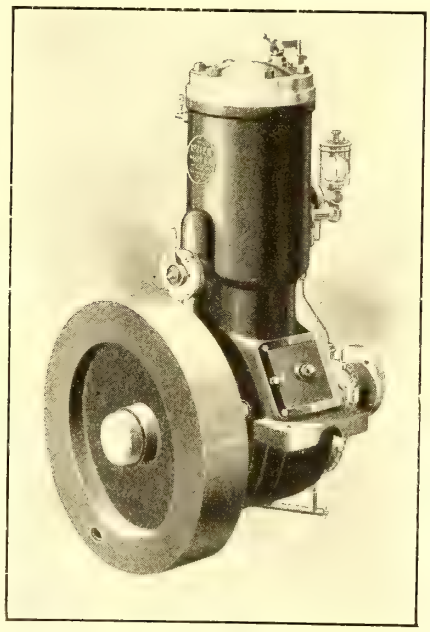
GASOLINE MOTOR BOATS FOR RAILWAY PARKS

A gasoline motor boat is rapidly becoming looked upon as an almost invaluable adjunct of pleasure resorts where boating is one of the possibilities. Traction companies are alive to the fact that a boat of this kind not only proves in itself a good paying investment, but adds much to the popularity of the resort reached by suburban lines as well as serving to increase traffic in the direction of these resorts. An excursion boat of this type propelled by a gasoline engine has one decided advantage over an electric launch, as it can be used continually for a considerable time, as the gasoline tank has a sufficient fuel-carrying capacity for a run of 200 miles to 400 miles, and can be refilled quickly, whereas, an electric launch, after 5 hours of running, requires practically an equal length of time for recharging, during which time the boat is out of commission.

GASOLINE MOTOR BOAT, USED BY THE COLUMBUS, BUCKEYE LAKE & NEWARK TRACTION COMPANY

The first cost of a boat with a gasoline motor is considerably less than the first cost of an electric boat, and there is no expense for storage batteries and recharging. The only current required in a gasoline boat is furnished by an ordinary set of primary dry cells, which can be purchased at a cost of $4 to $5. These gasoline motor boats require no licensed engineer, pilot or Government inspection. A man of ordinary intelligence cannot only operate and care for one of these gasoline motors, but, if found desirable, can steer the boat also. No fire or flame is necessary to operate the engine. The gasoline tank is carried in a water-tight compartment under the forward deck, separated from the balance of the boat, and the gasoline conveyed to the engine in pipes outside of the hull and under the water. Hence, there is no danger of fire or explosion.

The boat shown in the accompanying cut was built by the Lozier Motor Company, of New York, for the Columbus, Buckeye Lake & Newark Traction Company, of Newark, Ohio. It is 41 ft. long, equipped with a 7½-hp Lozier engine, occupying a space of but 2 ft. x 4 ft. It seats forty-six passengers, but will carry a crowd of seventy people if necessary. The expense of operating the engine, aside from the wages of the motorman, is said to be only 13 cents per hour, including the cost of fuel, oil and all incidentals. The moment the engine is stopped the expense ceases.



GASOLINE MOTOR

The life of a gasoline engine of the type built by the Lozier Motor Company is estimated at from twenty years to twenty-five years, and a well-built hull will, with proper care, give good service for from fifteen years to twenty years.

The Cincinnati Traction Company has resumed registering transfers. They are recorded on separate registers and turned in at the end of each trip.

FINANCIAL INTELLIGENCE

The Money Market

No important change has occurred in the money market during the past week. Rates, both on call and time loans, remain as they were a week ago. Borrowers are still able to obtain all the six months funds they want at 4½ per cent, but there is not much demand even at this moderate figure. For the shorter time accomodations—sixty to ninety days—3½ per cent is still the ruling rate. While a fair business is being done in call money, the quotation has kept between 1½ and 2 per cent, with most of the renewals made at 1¾. The immediate outlook is somewhat more reassuring than it was a fortnight ago, because of the evidence that the enormous corporation borrowing which so inflated the loan account in December and January, has ceased. The bank statement of Feb. 6 showed an addition of only $4,000,000, and that of last Saturday an addition of only $719,000 to the outstanding credits at the local Clearing-House. On the other hand, while cash holdings have declined $4,200,000 from their high level two weeks ago, the regular spring movement of currency away from this city has not yet set in. Had it not been for transfers of money to Baltimore occasioned by the fire losses and the abnormal demand for currency at the cotton-distributing points in the South, the item of specie and legal tenders would not have fallen at all during the past fortnight. In other words, the routine operations of interior and Sub-Treasury exchanges are neither adding nor subtracting from the local cash supply just at the moment. Surplus reserve has fallen from $26,000,000—its high-water mark of Jan. 23—to $20,400,000, but it compares favorably with the surplus of $15,500,000 a year ago this date, and the surplus of $13,500,000 in 1902. The comparative weakness of the foreign exchanges has for the present effectually allayed apprehension lest the government payments on the Panama Canal will call for export of gold to Europe. While, for the next few weeks, it is hard to foresee any serious change in this satisfactory situation, the danger of an unconvertible bank loan account still remains, and it keeps alive the uncertainty of what will happen when the outflow of currency to the interior, usually witnessed in March and April, sets in.

The Stock Market

The feverish market of a week ago, when the Baltimore fire catastrophe and the outbreak of the Russo-Japanese war severely taxed the speculative structure, has given place this week to a dull trading market, in which the general tendency has been toward recovery. It was quickly discovered that not only were the first estimates of the Baltimore losses greatly exaggerated, but that they were so widely distributed that few insurance companies would be forced to suspend, and that there was little, if any, danger of investment security holdings being pressed to sale. The beginning of hostilities in the Far East had been so long expected and so amply prepared for, that the markets, both at home and abroad, were not seriously disturbed by the news. On the contrary, the usual tendency of every "war market" to recover when the long-waited blow has finally fallen, has been exhibited universally during the week. Unless it develops that the contest is likely to be prolonged over a much greater period than now expected, or unless some unforeseen complications draw other powers into the struggle, the war has probably exhausted its influence upon the financial markets. The two main obstacles in the path of the local stock market are the uncertainty of the money position, and the admitted fact that investment capital is inactive and unwilling to contribute toward improvement in prices. Stocks have advanced during the last few days chiefly because the short interest had become over-extended, and there was no pressure from real holders of securities t sell. Nevertheless, the immediate future seems to hold little in store beyond the usual narrow fluctuations and dull trading of a professional speculator's market.

Brooklyn Rapid Transit has been one of the leaders in the week's recovery on the Stock Exchange. No attempt has been made to explain its advance by any outside reasons; attention has been devoted entirely to conjectures upon the speculative position of the stock. The prevailing idea is that the so-called political pool which managed the rise in December, realized on their holdings above 50, and have been accumulating the stock at the recent low figures. Rapid Transit is a general favorite among semi-professional operators, and is one of the few stocks in which there is now any outside following. Neither Manhattan or Metropolitan have shown any particular activity, and attempts to advance them in sympathy with the movement in the Brooklyn specialty have been more or less perfunctory. Nevertheless, the old contention that the traction stocks are less concerned than any other group, with the popular causes of uncertainty in the financial situation, is again being urged, and apparently with some success in creating bullish sentiment.

Philadelphia

Prices have moved with considerable irregularity during the week in Philadelphia, and have left few net changes of importance. American Railways has been stronger and more active, selling up to 44¾. Philadelphia Rapid Transit, on sales of a few hundred shares, gained a half-point from 14 to 14½. On the other hand, Union Traction, on a few scattered transactions, hung around 47. Philadelphia Electric lost an eighth from 6 to 5⅞, Philadelphia Company common, after advancing to 40¼, fell back to 39½, and the preferred dropped from 46 to 44⅛. There was no news or gossip in connection with any of these movements. One hundred shares of Indianapolis Street Railway sold at 84—the first transaction in some time. A hundred shares of Union Traction of Indiana went at 34¾.

Chicago

The recent strength of South Side Elevated appears to be due to market support intended to keep the quotation above the subscription price of the new stock issue. The new stock is offered to the public at 93, and the old stock was advanced during the week to 93½. No further developments have occurred in the interminable franchise controversy, but a general feeling of disgust and uneasiness is spreading, and is reflected in the market. Union Traction common has sold down this week to 4⅞, which is the lowest reached in a long while. The preferred stock declined a half-point to 29. North and West Chicago securities have apparently ceased for the time being to be pressed for sale, and no dealings in them are reported on the week. City Railway, on sales of odd lots, lost a point from 166 to 165. Lake Street Elevated receipts are barely steady around 2, and weakness continues in Metropolitan preferred, 60 shares of which sold this week at 48½.

Other Traction Securities

There are few changes to be noted in the traction specialties in Boston. Some liquidation appeared in Massachusetts Electric common, carrying the quotation down from 21⅛ to 20¼. But the stock rallied quickly to 21⅝. Massachusetts Electric preferred, after a further decline to 75¾, rallied sharply to 78. West End common sold between 91 and 90½, and the preferred between 108 and 109. The Baltimore Exchange has been closed since the fire, and no business has been transacted during the past week. Recoveries were made by North American and Twin City Rapid Transit on the New York Stock Exchange, but dealings in both stocks have been too light to attract attention. On the New York curb Interborough Rapid Transit rallied from 101½ to 103½, then eased to 103¼. Washington Traction preferred lost a half-point on the sale of 100 shares, from 47 to 46½, Nassau Electric 4s sold at 79½, Washington Traction 4s at 76, and Brooklyn Rapid Transit 4s at 75, the weakness on the last-named being due to the announcement that the company is about to issue new bonds. The Cleveland market was very quiet, only fifty-five street railway shares being sold during the week.

Iron and Steel

The only important news connected with the iron trade during the past week is the report of a large order for steel rails for some of the Western roads. No prices were given on the transaction, but it was assumed that the quotation of $28 a ton was paid and the incident was accounted an important victory for the producing interests. On the other hand, several of the leading Eastern roads have taken pains to publicly declare that rather than come to the exorbitant terms demanded by the manufacturers, they will defer all works of improvement and maintenance which would require laying new rails this season. The situation as regards the rail industry, is therefore extremely confused, and, in fact, there has scarcely been a time during the last six months when the state of the iron trade has been a matter of such great uncertainty. Unquestionably, some improvement has occurred; the figures of pig

iron production and stocks on hand at the end of January establish this fact conclusively. But on the great question whether demand for the finished products will keep up without further concessions in prices there is still ground for wide difference of opinion. Quotations are as follows: Bessemer pig iron $13.50 to $13.75, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 12⅜ cents, tin 28⅛ cents, lead 4 7-16 cents, and spelter 4⅞ cents.

Security Quotations.

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid Feb. 9	Feb. 16
American Railways	44	44
Aurora, Elgin & Chicago (preferred)	a55	a55
Boston Elevated	*136	137½
Brooklyn Rapid Transit	41	43⅝
Chicago City	166	162
Chicago Union Traction (common)	5	4½
Chicago Union Traction (preferred)	29	28
Cleveland Electric	70½	71
Consolidated Traction of New Jersey	63	63
Consolidated Traction of New Jersey 5s	105	105½
Detroit United	59¾	62½
Elgin, Aurora & Southern	a30	—
Interborough Rapid Transit	104½	103
Lake Shore Electric (preferred)	—	a45
Lake Street Elevated	2¼	2
Manhattan Railway	141½	142⅞
Massachusetts Electric Cos. (common)	20½	20½
Massachusetts Electric Cos. (preferred)	77	77
Metropolitan Elevated, Chicago (common)	17	17
Metropolitan Elevated, Chicago (preferred)	49	48
Metropolitan Street	117⅝	118
Metropolitan Securities	84½	88½
New Orleans Railways (common)	9	8
New Orleans Railways (preferred)	30	30
New Orleans Railways 4½s	80	79
North American	83	85¼
Northern Ohio Traction & Light	14	14¾
Philadelphia Company (common)	39¼	39½
Philadelphia Rapid Transit	13½	14¼
Philadelphia Traction	97½	97⅝
St. Louis Transit (common)	5¾	8
South Side Elevated (Chicago)	92½	92
Third Avenue	115	120
Twin City, Minneapolis (common)	89	90
Union Traction (Philadelphia)	46¼	47
United Railways, St. Louis (preferred)	50	52
West End (common)	90½	90
West End (preferred)	108½	108

a Asked. † Includes new $5 assessment.

IMPROVEMENTS IN KANSAS CITY, KAN.

The improvements planned by the Metropolitan Street Railway Company in Kansas City, Kan., are to be pushed to early completion as soon as the weather moderates sufficiently to permit of uninterrupted outdoor work. Work on the new Tenth Street line will soon be resumed. The contract for the Tenth Street viaduct has been let and the preliminary work on it is progressing satisfactorily. Work on the extension of the James Street line to the stock yards will also begin soon. The company is negotiating with railroad companies for the right to build elevated tracks over steam railway tracks, and expects to close the arrangements soon.

The construction of the Seventh Street viaduct and Central Avenue elevated structure and bridge is now progressing at a gratifying rate. Owing to the failure of the firms having the contract to supply the steel to be used on the Seventh Street structure in accordance with the terms of the contract, a great many vexatious delays have resulted. Steel is now arriving almost daily and the company expects to complete the structure within thirty days. The Central Avenue "L" road structure may be ready for traffic by March 1. The plan is to have the structure completed before the ice in the Kaw breaks and menaces the safety of the temporary bridges now used in giving service between the two cities. The elevated road can then be put in commission in a short time.

The new Tenth Street line and the James Street extension will give direct communication with the stock yards and other districts and the "L" road and Fifth Street lines will again restore the communication facilities of the two cities to what they were before the flood.

CHANGE IN CONTROL OF KNOXVILLE COMPANY

The property of the Knoxville Traction Company and the Knoxville Electric Light & Power Company, of Knoxville, Tenn., has lately been sold to Ford, Bacon & Davis, of New York. This was one of the most valuable and profitable properties owned by the Railways & Light Company, of America, which is controlled by John L. Williams & Sons, bankers, of Richmond, and J. William Middendorf & Company, of Baltimore, and from whom the purchase was made. The sale of the Knoxville properties, it is understood, is the outcome of the recent Williams-Middendorf financial troubles.

The new owners have taken active charge of the properties, and, it is stated, will make extensive improvements in the power plant and also in extensions of the street railway lines; also that they will connect the system with the new passenger entrance into Knoxville of the Louisville & Nashville Railroad Company at its new terminal, now in course of construction. The new management has elected the following officials and directors for the Traction Company: C. H. Harvey, president; W. S. Shields, vice-president; Leon Fender, secretary; H. T. Bunn, treasurer and auditor; C. H. Harvey, W. S. Shields, E. F. McMillan, J. K. Newman, A. H. Ford, C. F. Uebelacker, G. H. Davis, directors.

For the Electric Light & Power Company the following officials and directors have been elected: C. H. Harvey, president; G. H. Davis, vice-president; Leon Fender, secretary; H. T. Bunn, treasurer and auditor; C. H. Harvey, F. L. Fisher, J. K. Newman, G. H. Davis, W. B. Brockway, directors.

It is understood that no changes other than those indicated in the above selections will be made in the officials. C. H. Harvey, as president, will have full charge of the local properties and all matters connected therewith. It is understood that Superintendent W. G. Woolfolk, whose operation under Mr. Harvey has been so very satisfactory, will continue in office.

REPORT OF THE INTERBOROUGH COMPANY'S EARNINGS

The Interborough Rapid Transit Company, of New York, reports earnings as follows:

Quarter ending Dec. 31—	1903
Gross receipts	$3,657,709
Operating expenses	1,396,395
Net earnings	$2,261,314
Receipts from other sources	85,599
Total income	$2,346,913
Fixed charges	1,596,579
Surplus	$750,334
Cash on hand	6,245,225
Profit and loss (surplus)	$1,512,601
Nine months ended Dec. 31, 1903—	
Gross receipts	$9,868,249
Operating expenses	4,006,105
Net earnings	$5,862,144
Receipts from other sources	256,074
Total income	$6,118,218
Fixed charges	2,949,617
Surplus	$3,168,601

The general balance sheet of the company as of Dec. 31, 1903, shows as follows:

Assets—Cost of lease and equipment of subway, $10,608,620; stocks and bonds of other companies, $15,537,451; other permanent investments, real estate, $1,394,257; supplies on hand, $690,056; due by agents of this company, $76; due by others than agents, $11,492; due by companies and individuals (open accounts), $504,465; cash on hand, $6,245,225; prepaid taxes, $82,585; Manhattan guarantee fund, $4,018,812; sundries, $16,880; total, $39,109,920.

Liabilities—Capital stock, $35,000,000; interest and premiums on capital stock, $546,002; interest on funded debt of New York Metropolitan and Manhattan Railway Companies, due and accrued, $300,000; sundries, $53,991; Manhattan Railway Company lease account, $401,790; taxes in litigation, $578,129; due for wages, $57,253; due for supplies and taxes, $633,850; due companies and individuals (open account), $26,250; profit and loss (surplus), $1,512,601; total, $39,109,920.

THE STREET RAILWAYS OF CONNECTICUT IN 1903

Heretofore the annual reports of the street railways of Connecticut, as made to the Railroad Commissioners, have comprised only the operation of lines located wholly within the State, but the report of the present year includes the operations of the Worcester & Connecticut Eastern Railway Company, which consists of 30.540 miles in Connecticut and 20.574 miles in Massachusetts; also the Providence & Danielson Railway Company, comprising 1.980 miles in Connecticut and 24.110 miles in Rhode Island. In addition to the two companies named above, the Cheshire Street Railway and the Somers & Enfield Electric Railway have been placed in operation, the line from Ansonia to Seymour has been completed and opened for business by the Connecticut Railway & Lighting Company, the Bristol & Plainville Tramway has been extended from Bristol to Terryville Station, the Willimantic Traction Company's line has been completed and opened from Willimantic southerly to a connection with the Norwich Street Railway at Baltic. In addition a direct connection has been made between the Greenwich Tramway and the Stamford Street Railroad by an extension of each of those lines to a junction point at the boundary line between Stamford and Greenwich, and the line between New Haven and Derby has been completed and opened by an extension of the lines of the Fair Haven & Westville Railroad and the Connecticut Railway & Lighting Company to a junction point about midway between New Haven and Derby. Other unimportant extensions of existing lines have also been made in various parts of the State.

The mileage of the street railways in operation on June 30, 1903, was 611.261 of main tracks, exclusive of sidings and turnouts, and 642.383 miles of single track, including same, showing a total increase of main track for the year of 93.807 miles. However, the lines of the Worcester & Connecticut Eastern Railway Company, reported to be 51.114 miles in length, comprise 20.574 miles of road located in the State of Massachusetts not heretofore reported in Connecticut, and 30.540 miles in the latter State; also the Providence & Danielson Railway Company reports 26.090 miles of road, of which only 1.980 miles are in Connecticut. Excluding, therefore, the mileage located outside of the State, it will be seen that the mileage of main line wholly within the State is 566.577, showing an increase for the year of 49.123 miles.

The Connecticut Railway & Lighting Company, owning the systems in Bridgeport and Waterbury, operates 169.894 miles; the Fair Haven & Westville Railway Company, owning the lines in New Haven, operates 104.139 miles, and the Hartford Street Railway Company, owning the lines in Hartford, operates 85.678 miles. These are the principal urban systems of the State.

The capital stock of all of the companies authorized by their charters is $33,482,000, and the amount actually issued $26,653,548, showing an issue of $45,122.96 per mile of main line.

The total bonded debt of the companies is $20,633,500, being $34,931.36 per mile of road owned. The floating indebtedness is $2,714,030.82, which is $4,440.05 per mile of road. The total stock, bonds and floating indebtedness per mile of road owned, including sidings, is $71,728.50.

The cost of the construction and equipment of the roads is reported as $47,711,830.14, being $80,773.45 per mile of road.

The gross earnings for the past year were $4,503,571.29, being $6,798.45 per mile of road operated and $0.214 per mile run. The largest earnings per mile of road operated were $9,917.99, by the New London Street Railway; the second, $9,816.32, by the Winchester Avenue Railroad; and the third, $9,732.59, by the Fair Haven & Westville Railroad. The largest earnings per mile run were $0.402, by the Montville Street Railway; the second, $0.298, by the New London Street Railway, and the third, $0.278, by the Norwich Street Railway and the Hartford, Manchester & Rockville Tramway, both of which companies earned the same amount per mile run. The three companies having the largest earnings were the Fair Haven & Westville Railroad Company (including the Winchester Avenue line, which it operates), with gross earnings of $1,290,667.21, the Connecticut Railway & Lighting Company (including the Meriden, Southington & Compounce and the Cheshire lines, owned by it), earning $1,110,599.55, and the Hartford Street Railway Company, earning $807,856.53.

The operating expenses of the companies for the year were $3,164,599.07, which are $4,777.18 per mile of road operated and $0.151 per mile run.

The net earnings for the year have been $1,338,972.22, being $2,021.27 per mile of road operated and $0.063 per mile run.

Dividends amounting to $369,816.24 have been paid by ten companies upon $6,702,300 of capital stock, while no dividends are reported paid on $19,951,248 of capital stock.

The sum of $860,903.94 has been paid for interest by twenty-two companies upon a total bonded and floating debt of $23,347,530, and the total amount of taxes paid to the State by the various companies is reported as $267,708.

Number of miles run	21,029,889
Gross earnings per mile run	$0.214
Operating expenses per mile run	0.151
Net earnings per mile run	0.063

The number of miles run is 1,654,159 more than last year. The gross earnings per mile run about 1 cent per mile more, and the net earnings about 1 cent per mile run less than for the preceding year.

The total number of passengers carried was 96,857,782, as compared with 91,554,028 for the previous year. The number of paying passengers per mile operated has been 146,213, the number of paying passengers per mile run 4.606.

INTERURBANS AN ADDITIONAL BURDEN, SAYS WISCONSIN SUPREME COURT

The Supreme Court of Wisconsin has decided in the case of a number of property owners of Lincoln Avenue, in Waukesha, against the Milwaukee Light, Heat & Traction Company that the running of interurban trains and cars over streets within the city limits is an "additional burden" upon property abutting on such streets, and the owners of such abutting property can recover compensation.

Chief Justice Cassoday, who wrote the opinion, says that, while authorities agree that a street railway strictly for the purpose of transporting persons from place to place on the streets of a city is not an additional burden upon such streets, they also agree that a railway for the carriage of persons between cities, which is constructed and operated upon a country highway, is an "additional burden" upon such highway. The court holds that the entire line of railway from the city of Milwaukee to Waukesha Beach is an interurban railway, and that owners of property abutting on the streets over which it passes are entitled to compensation.

PROPOSED AMENDMENTS TO NEW YORK RAPID TRANSIT ACT

A. B. Boardman, of counsel to the Rapid Transit Commission, of New York, at last week's meeting of that body, made known the proposed amendments to the rapid transit act which the Legislature is to be asked to enact at the present session. At least two of these amendments directly concern Brooklyn. One gives the Rapid Transit Commission power to include the bridges over the East River in its rapid transit routes, and the other empowers the Board of Estimate, without the approval of the Legislature, to spend as much in excess of $55,000,000 for rapid transit construction as the needs of the city require.

There was more or less discussion of the first mentioned amendment at the meeting. There seemed to be a notion that the proposed amendment would give the Rapid Transit Commission entire control in the matter of letting franchises on the East River bridges, but this idea was dispelled by Comptroller Grout, who said that the power which would be conferred on the commission if the amendment is enacted would be merely co-ordinate and not exclusive. The Comptroller said that it would not deprive the Board of Aldermen or the Commissioner of Bridges of any power they now possess in the matter of awarding transit privileges on the bridges over the East River.

Mayor McClellan wanted to know whether the amendment in question would prevent the laying of a route across the Williamsburg Bridge, including an elevated line in Delancey and Elm Streets, Manhattan, and the counsel to the Rapid Transit Commission replied that he did not believe it would.

The second amendment referred to, if it becomes effective, will remove the restriction which prohibits the spending by the city in rapid transit construction of more than $55,000,000 without the approval of the Legislature. That is the sum which, under the rapid transit act, the city was allowed to lay out in the building of rapid transit subways, and until this restraint is removed it will be impossible for the city to go on with the various extensions of the subway system which have been proposed in the last year.

On the enactment of this amendment will depend whether or not there are to be any further rapid transit extensions in Brooklyn Borough other than the tunnel connecting Brooklyn and Manhattan. The Rapid Transit Commission at the present time has before it a comprehensive plan for extending the Brooklyn tunnel out to Eastern Parkway prepared by Chief Engineer William Barclay Parsons.

HITCH IN THE CLEVELAND LOW FARE PROCEEDINGS

Open rebellion in the ranks of the partisans of Mayor Tom L. Johnson, of Cleveland, has defeated for the time being any prospects a trial of the zone plan of fares for the Cleveland Electric Railway Company. An ordinance embodying the plan, outlined in a recent issue of the Street Railway Journal, had been drawn up after a long contest between the Mayor and the Cleveland Electric Railway Company, and was to have been introduced at a recent meeting of the City Council. Seventeen Democratic Councilmen called at Mayor Johnson's home just previous to the meeting, and informed him that they proposed to stand by the platform on which they had been elected—a straight 3-cent fare. They stated that under no circumstances would they vote for an extension ordinance which prescribed a fare of 5 cents for certain people and practically 7 cents for others, no matter how small the percentage in the higher classes might be. Mayor Johnson pleaded that any ordinance passed at this time would be merely a tentative agreement, with the stipulation that it would not become binding on either the city or the company if found unsatisfactory. The Mayor was unable to convince the Councilmen on this point, and as a result the ordinance was not introduced.

The Mayor now admits that he does not know what the next step will be. Councilman Thompson, a Republican member, has determined to present to the Council an ordinance providing for franchise extensions on the basis of seven tickets for 25 cents, with limited transfers. His plan is to give but one transfer, except on crosstown lines, where transfers on transfers shall be given. Mr. Thompson believes the proposition would be considered by the company and that it would be acceptable to the public. He claims that a number of the Democratic Councilmen have expressed their willingness to support this measure, as they believe it more equitable than the zone plan. There is little doubt that this franchise extension matter will soon be settled. The public, the Council and the compan yare thoroughly tired of the controversy, and every effort is being made to bring the matter to a focus.

MORE DELAY FOR THE NINETY-NINE YEAR CASE IN CHICAGO

The hearing of the famous ninety-nine-year act case in Chicago has been postponed from time to time, and the latter part of February is now named as the date when the city of Chicago and the representatives of the Chicago Union Traction Company will be ready to present the case before Judge Grosscup. A controversy between the Chicago Union Traction Company and its underlying companies is being heard by Master-in-Chancery Bishop.

BALTIMORE POWER HOUSE SAVED

One of the remarkable features of the great Baltimore fire was the saving of the Pratt Street power house of the United Railways & Electric Company with all of its valuable electrical machinery, although the building was in the midst of the conflagration and was first reported as having been totally destroyed. The saving of the house and its contents was a piece of great good luck for the whole city as well as for the company, as it permitted the starting of the railway service within twenty-four hours after the fire was under control and a resumption of service which otherwise might have been delayed for weeks. This power house consisted of three sections, the first section being the old power house, in which was installed direct-current apparatus; the second section was the boiler room; the third section was the new plant, in which were installled four 2000-kw, 13,200-volt, three-phase, fly-wheel type, a. c. Westinghouse generators. The bus-bar structure is in the basement, and over this are installed the oil switches, three for each generator and three for each feeder. The control of these switches is in a gallery built at the end of the generator room.

The old part of the power house was destroyed, and in the new part, where the generators are located, the basement was flooded with water nearly up to the bottom high-tension bus-bar. The building in which this machinery was installed, however, is absolutely fireproof, the window casings and frames being of copper and the glass provided with wire netting. While the flames raged all around, the building did not suffer, and, in fact, a cat which was in this power house came through alive. The old power house burned early Monday morning; by Tuesday afternoon at 5 o'clock the water had been removed from the basement of the new section, test had been made of the apparatus, and the result was that the machines were placed in operation at this hour, started in to furnish current to the sub-stations, and have been running ever since without difficulty.

POWER BRAKES IN CLEVELAND

The Cleveland Electric Railway Company has agreed with the city authorities on an ordinance requiring the company to equip all double-truck cars with some form of power brake within one year. The company has agreed to equip ten of its summer cars with power brakes at once, in order that it be given opportunity to try out several different types of brakes now on the market. President Andrews states that he is watching with considerable interest the results obtained from the storage air system adopted by the St. Louis Company for the World's Fair traffic. This system was thoroughly described in a recent issue of the Street Railway Journal.

MEETING OF PHILADELPHIA BRANCH OF A. I. E. E.

A meeting of the Philadelphia Branch of the American Institute of Electrical Engineers was held at the Engineers' Club, of Philadelphia, on the evening of February 8. C. E. Bonine gave a talk on "The Principles of Alternating Current Motors," which was followed by an abstract by E. P. Coles, of Walter I. Slichter's paper on "Speed-Torque Characteristics of the Single-Phase Repulsion Motor," and Charles P. Steinmetz's paper on "The AlternatingCurrent Railway Motor," which were presented at the New York meeting.

C. E. Renshaw, of the Westinghouse Company, Pittsburg, read a paper on "Alternating Current Railway Motors." Mr. Renshaw dwelt upon the manay advantages the alternating-current motor has over the direct for railway purposes, and went into details as to the principles governing the single-phase alternating-current motor. The discussion was participated in by Messrs. Cutler, Thomas Spencer, and Breed.

ACCIDENT FAKIRS RUN DOWN IN NEW JERSEY AND PHILADELPHIA

Mainly through the efforts of John P. Feeney, claim adjuster for the Public Service Corporation, of New Jersey, a gang of accident fakirs has recently been run down. The specific charge on which the members of the gang are held for appearance in court is an attempt to defraud the company by a claim for injuries said to have been received by one of their number on an Erie Street car from Pavonia Ferry. The bell of the car was rung at Jersey Avenue and First Street while the conductor was inside, and a member of the gang had a fall. Two male passengers ran out and raised him and informed the alarmed conductor that the company was at fault, as the car had started while the passenger was leaving. The conductor took the names of these two passengers, who later proved to be accomplices of the man who said he had been injured.

The "accident" was reported at headquarters by the conductor. Adjuster Feeney says he anticipated it, as he had heard that such a fall was expected. The next heard of it was a letter from Paterson by a lawyer that his client was confined to bed in his (the lawyer's) flat; that he had a claim for heavy damages, as the client is a busy broker and his confinement had subjected him to a severe financial loss. He was willing, however, to settle without suing. The physician of the company was sent over to see the "injured" man. He found him abed with a red mark, suspected to have been made by caustic, on the shoulder, but no other evidence of injury. Negotiations were carried on and when the "injured" man and his lawyer called at the company's office expecting the settlement would be made they were arrested.

Sworn confessions in the hands of Philadelphia Rapid Transit Company officials mark the collapse of one of the most sensational of the many attempts to swindle that company by means of false claims for damages. One of the principals is a New York stock broker and athlete, and the other is a young actress.

On Jan. 19 the company received a letter from Francis Irwin John Harte, a young stock broker, living in New York City, and having offices in the same city. Harte alleged that his wife had been on a trolley car which ran into a train here, on Jan. 16, and that her ankle had been broken and she had sustained internal injuries. Harte claimed $5,000 damages.

Investigation proved, however, that, while the woman had been injured, the injuries were due to a fall on an icy pavement in New York on Jan. 8. It was also found that Harte had read an account of the accident in a newspaper, and that he had plotted with the woman to sue for damages, and that he had come to Philadelphia and carried out his plot. After a futile attempt to escape he confessed. A confession had also been secured from the woman.

ANNUAL DINNER OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The annual dinner of the American Institute of Electrical Engineers was held at the Waldorf-Astoria in New York on the evening of Feb. 11. Thomas A. Edison was the guest of honor, and the speakers included gentlemen who had been associated with Mr. Edison in his early work, and who since have risen to high positions of honor and authority in the electrical business. The introductory address was made by the president of the Institute, B. J. Arnold, and T. C. Martin acted as toastmaster. About 600 guests were present, including about 100 ladies.

LAKE SHORE RESUMES SERVICE BETWEEN NORWALK AND TOLEDO

The Lake Shore Electric Railway Company has resumed its service between Norwalk and Toledo after suffering a tie-up of ten days, due to a flood in the Sandusky River, which submerged half the town of Fremont. The fires were put out under the boilers and the paint and repair shops were submerged. The company was obliged to cut through 4 ins. of solid ice for a distance of ½ a mile in order to open the line through the main street of Fremont. This is the second time this winter that the road has been tied up through floods, and the earnings have, of course, been affected.

The Toledo, Bowling Green & Southern Railway has just resumed its service between Toledo and Findlay, part of the line having been tied up since the January thaw. The Toledo, Waterville & Southern Railway had not operated a car since Jan. 28 up to a few days ago. In addition to being submerged for several miles, the overhead wires were down for a considerable distance, caused by floating ice dislodging poles. The Detroit, Monroe & Toledo Short line has resumed service to Monroe after a tie-up of several days.

MAYOR VETOES THE WESTCHESTER BILL

Mayor McClellan of New York, on Wednesday, Feb. 17, after hearing arguments against his signing the grant of franchise rights to the New York, Westchester & Boston Railway Company, vetoed the bill passed by the Aldermen of New York which gave the company the right to cross a number of streets in the Bronx. This action by the Mayor was a step in the struggle for franchises between the New York, Westchester & Boston Company and the New York & Portchester Railway Company which has lasted for several months. Both companies plan to build four-track, third-rail electric railways from New York to Portchester, and the New York & Portchester Company had already secured the consent of the Railroad Commissioners to the construction of its line and had proved its financial ability to the satisfaction of the Supreme Court of the State, when the New York, Westchester & Boston Company appeared on the scene and applied for the very grants which the New York & Portchester Company had been struggling to obtain for some months.

The question of the New York, Westchester & Boston Railroad being a legitimate enterprise was often raised, but was dispelled at times by the fact that the names of prominent New York financiers were connected with it. On the other hand, the checkered career of the company had much to do with the raising of doubts in the minds of the people of the territory to be served by its lines as to the sincerity of its latest move. It seems that the company was incorporated in 1872 under the railroad law of 1850, and that it was placed in the hands of a receiver in 1875, where it remained until Jan. 4, 1904. The company made application to the Board of Aldermen on Jan. 12, 1904, for the franchise that has just been vetoed by the Mayor.

On the other hand, the New York & Portchester Company was incorporated in 1901 under the railroad law of 1900, and, as previously stated, received a certificate from the State Railroad Commission in 1902 and proved its financial ability to the satisfaction of the Supreme Court. It has already received permits from Mt. Vernon for crossing some thirty streets in that place, and has also received permits for building through New Rochelle. In addition it has received permits from the Supreme Court at White Plains to cross some forty streets in Westchester County. Its application for franchise rights in the Bronx was made to the Board of Aldermen on May 5, 1903, and the first hearing on the application was called on Oct. 12, 1903, after an overwhelming public demand. The second hearing was called Dec. 14, 1903. The Fusion administration was then soon to go out of office and no action was taken on the application. Practically the entire population of the Bronx and Westchester supported the application of the company and demanded the Aldermen to pass the resolution favoring this company. Now that the Mayor has vetoed the grant of the New York, Westchester & Boston Company, and as it is not likely that an attempt will be made to pass the bill over his veto, it is announced that the New York & Portchester Company will again make application for a franchise from the aldermanic railroad committee, and that this application will be presented at once.

ANNUAL REPORT OF FRANKFORT-ON-MAIN MUNICIPAL POWER PLANT AND RAILWAY

The report for 1902, recently issued by the municipality of Frankfort-on-Main, Germany, contains some interesting figures relative to the city power plant and railway system. The power plant consists of two power houses and one sub-station.

POWER HOUSE NO. 1

In August, 1902, the city installed in power house No. 1 a 5000-hp steam turbine built by Brown, Boveri & Company. This turbine is operated seventeen hours a day regularly, and, although guaranteed for 2600-kw single-phase current, it frequently gives 3200-kw.

The boilers in this power house consist of six Cornwall boilers, each of 929 sq. ft. (86 sq. m.) heating surface, twelve water-tube boilers, each of 3364 sq. ft. (311.5 sq. m.) heating surface, and three water-tube boilers, each of 4320 sq. ft. (400 sq. m.) heating surface, making in all about 58,900 sq. ft. Nine of the water-tube boilers are furnished with superheaters. Two feed-water heaters having a total heating surface of 7193 sq. ft. (666 sq. m.) are also employed.

The generating apparatus includes four 552-kw turbines, four 1033-kw turbines, and the aforementioned 3200-kw turbine, making the total capacity of the station 9540 kw.

Compared with the preceding year, the coal required per kw-hour decreased from 3.79 lbs. (1.72 kg.) to 3.59 lbs. (1.63 kg.), or over 5 per cent. The total number of kw-hours was 15,773,781, as against 15,039,620, or an increase of 4.9 per cent. The number of kw-hours used was 14,004,421, compared with 13,104,779, an increase of 6.8 per cent. The waste in power was also reduced from 12.9 per cent to 11.2 per cent.

The cost of coal per kw-hour was reduced from .878 cents (3.66 pfgs.) to .722 cents (3.01 pfgs.) The other operating expenses were also lowered, making the net cost per kw-hour 1.49 cents (6.21 pfgs.), instead of 1.57 cents (6.54 pfgs.).

POWER HOUSE NO. 2

The second power house contains four Simonis & Lanz water-tube boilers having a total capacity of 8640 sq. ft. (800 sq. m.), and two Babcock & Wilcox water-tube boilers, each having a heating ing surface of 7171 sq. ft. (332 sq. m.), making a total heating surface of 15,811 sq. ft. The B. & W. boilers are fitted with chain-grate stokers and superheaters. The normal capacity of this station is 402-kw direct-current and 1000-kw polyphase current. The kw-hours generated increased .1 per cent over the preceding year, while the coal per kw-hour decreased from 4.52 lbs. (2.05 kg.) to 3.75 lbs. (1.70 kg.), fully 17 per cent. This difference is ascribed partly to the economizer, which heats the feed-water to about 100 degs. C., but mainly to the chain-grate stokers with which the B. & W. boilers are equipped. The favorable results at this station have led the authorities to equip power station No. 1 with chain-grate stokers also.

SUB-STATION

The sub-station contains a 112.5-kw rotary converter and a storage battery having a capacity of 486 amp.-hours.

RAILWAY SYSTEM

The traffic on the railway system suffered quite severely during 1902, owing to unusually inclement weather. It is notable, however, that while the increase in traffic on single-fare tickets was but 1.7 per cent, it was fully 12 per cent on commutation tickets, the latter costing considerably less. The number of trips made on single-fare tickets was 39,094,403, and on commutation tickets 12,120,480. The authorities are of the opinion that the commutation rates are too low, and have recommended that they be increased. The net earnings decreased from $121,610 (506,709 marks) to $117,303 (488,763 marks). The system employed 1279 men, and paid out $33,265 (138,607 marks) for employees' pensions and sick and death benefit funds. During the year the management sold to the employees 20,000 tons of coal at exceptionally low prices.

The following monthly dues are paid by the employees for the account of the death benefit fund: For $72 (300 marks), 12 cents (50 pfgs.) up to thirty years; 15.6 cents (65 pfgs.), from thirty to forty years; .192 cents (80 pfgs.), from forty to forty-five years, the last year being the maximum age; for $36 (150 marks) the dues are about one-half of the foregoing. The funds are in charge of a municipal board elected by the society members, and all clerical work is performed gratis by the railway officials.

THE OHIO & MIAMI CANAL BILLS

Two bills have been introduced in the Ohio Legislature to give the Miami & Erie Canal Transportation Company, which is now hauling canal-boats by electricity between Cincinnati and Dayton, the right to operate a steam railroad on the canal bank it now occupies. Ever since the "electric mule" system was first proposed, it has been generally predicted that this would be the outcome of the proposition. The first bill gives the canal company the right to operate steam freight and passenger trains, and the second bill provides for the leasing of the canal banks to the canal company for railroad purposes for a period of ninety-nine years. It provides for an annual rental to the State, the rental to be decided by a special commission. The railroad is to be constructed and operated so as not to interfere with the operation of ordinary canal-boats, and the bills are drawn so as to prevent competition. Mention is not made of the part of the canal not now occuped by the "electric mule" company, but it is understood that bills bearing on this portion will be introduced later.

The bondholders of the company met in Cleveland a few days ago for the purpose of discussing with the Cuyahoga Legislative delegation, the bills mentioned. The bondholders gave the Legislators to understand that they did not wish to be considered as standing, in a sense, back of a "steal." They claimed that they had invested their money in good faith, and that the original proposition might have proved successful had the State maintained a depth of 4 feet, as required by law. They stated that if the State would increase the depth of the canal, the electric mules would work admirably. The bondholders will take a party of legislators over the canal in order to convince them as to the facts. Although the canal company people have strong backing, it is the general opinion that the bills will not pass.

THE NEW YORK CITY RAILWAY COMPANY

On February 10, the Interurban Street Railway Company, of New York, changed its corporate name to the New York City Railway Company, by which it will hereafter be known. The preliminary steps taken to make this change have already been mentioned in these columns. The new name is much more appropriate than the old one, and the company acted wisely in adopting it.

AN IMPORTANT DECISION IN CHICAGO

Judge Tuley rendered an important decision in Chicago, Feb. 8, in which he has decided that the Northwestern Elevated Railroad Company has no right to extend its platforms without a franchise. The court further advanced the opinion that the city is without power, even by the joint action of the Mayor and Aldermen, to sell or barter away any franchise in the public streets for a compensation to be paid into the city treasury. This is thought, and indeed is stated by Judge Tuley himself, to have an important bearing on the proposed compensation clause in the ordinance of the Chicago City Railway Company, now pending. It is a well-established principle in the State of Illinois that a city holds the title to its streets as a trustee, not for its own citizens alone, but for all the citizens of the State, no matter where they reside. On this point the Judge says:

> While the city has the fee, it does not own the street as an individual owns his own property. It holds the fee and the control of the streets as a trustee for the public, and in its control of the streets its ownership is subordinate to its duties as a trustee. It is not a trustee for the inhabitants of the city, but it is a trustee for the public use. By the public use is meant the people of the whole State.
>
> The city as a public trustee is subject to the rule applied to all trustees, whether individuals or corporations, and that is, that a trustee cannot control trust property for his or its own benefit. The city has power to exact a reasonable license fee for compensation for the extra cost it may be put to, and the supervision and use of its police made necessary by such use of the street, but it cannot speculate or make money for its treasury or its taxpayers out of its exercise of the power to control the public streets as a trustee of the public.

According to this decision, the city cannot grant a franchise for a cash compensation to the Chicago City Railway Company, and if there is any remuneration to be paid for the franchise it must be in the shape of reduced fares, rather than in a percentage of the gross receipts. In summing up his decision, the court says:

> The only question decided is that the elevated railroads in question have no right, under the respective ordinances granted them, to extend the platforms upon their respective lines without some further grant by the City Council.

PAMPHLET ON THE STANDARD SYSTEM OF ACCOUNTING

Following up the publication in pamphlet form of the standard form of report mentioned in a recent issue of this paper, Secretary Brockway, of the Street Railway Accountants' Association of America, has issued another pamphlet, which will be of great convenience to members of the association. It contains a reprint of the report of the committee of a standard system of electric railway accounting adopted by the association in 1889, the report of a similar committee of the National Commission of Railroad Commissioners, and the standard classification of accounts as adopted conjointly by the two associations in 1889 and in 1902. The pamphlet, which contains seventy pages and two blank pages for memoranda, is printed uniform in size with the annual proceedings of the association, and is intended to give members in handy form for reference the standard classification of the association.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED FEB. 9, 1904

751,456. Surface-Cleaning Device for Third-Rails of Electric Railways; Milton C. Canfield, Cleveland, Ohio. App. filed Jan. 14, 1903. A device for removing ice from third-rails, consisting of a roller having a corrugated face, and connected to a piston working in a cylinder which communicates with the air pressure for the brakes.

751,477. Brake Shoe; Frank T. Dickinson, Chicago, Ill. App. filed May 27, 1903. Comprises a cast metal body and a frame or band open at its top and bottom and surrounding both the sides and ends of the cast metal body of the shoe and united thereto in the casting operation.

751,547. Motor Controller; Francis V. Nicholls, Pittsfield, Mass. App. filed June 13, 1903. The object of this invention is to provide a simple and compact form of controller.

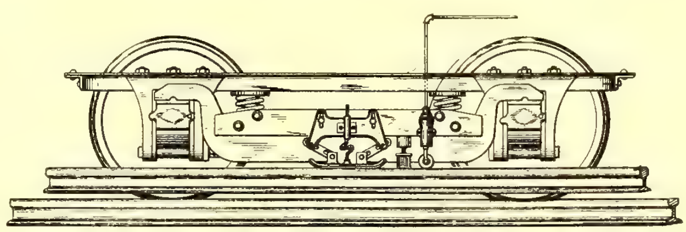
751,749. Trolley Wheel; John E. Palmer, Somerville, Mass. App. filed Nov. 14, 1903. A device for retaining the wheel on the wire.

751,760. Electric Signalling Apparatus; John E. Stannard, Springfield, Mass. App. filed Feb. 2, 1903. Details of a block signaling system.

751,780. Electric Signal; Harold E. Bradley, Warwick, R. I. App. filed Oct. 3, 1903. Improvements in a block signaling device directed toward the specific device whereby a signal set by one car as it enters a block, is not returned until the last of any number of cars which may also have entered, has passed out.

751,868. Automatic Railway Switch; William R. Murphy, St. Louis, Mo. App. filed June 23, 1903. Details.

751,900. Trolley Road Crossing; James M. Collins, Byesville, Ohio. App. filed Feb. 2, 1901. The trolley wire is sufficiently elevated at the crossings to prevent interference with crossing traffic, and a traveling trolley carriage is suspended from the elevated section adapted to engage with the trolley wheel while the car moves over the crossing.



PATENT NO. 751,456

751,932. Automatic Switch for Tramways; George A. Meighan, Providence, R. I. App. filed July 29, 1903. Details of construction of a switch adapted to be thrown from a moving car.

751,949. Road Crossing Device; Frank L. Sessions, Columbus, Ohio. App. filed Aug. 8, 1902. A modification of 751,900.

751,974. Rail Contact-Shoe and Support Therefor; George W. Brady and Lawrence R. Jones, Wheaton, Ill. App. filed April 13, 1903. A straddling shoe, the lips of which bear against the opposite sides of a third rail, and are hinged and spring-supported, to yield when passing around curves.

752,015. Switch; George Zimmermann, Pittsburg, Pa., and Otto Langos, Alliance, Ohio. App. filed Oct. 5, 1903. A rack-bar is depressed by the car wheel and rotates a gear wheel which throws the switch tongue through a system of ropes and pulleys.

PERSONAL MENTION

ALDERMAN WILLIAM MAVOR, of Chicago, a prominent member of the local transportation committee of the Chicago City Council, died Feb. 12.

MR. F. E. WILKINS, for the past two years auditor of the Dayton, Springfield & Urbana Railway at Springfield, Ohio, has resigned to become traveling auditor for the Pere Marquette Railroad (steam).

MR. GEORGE H. FOWLER, a master mechanic, who has had thirty years' experience in car construction, has entered the employ of the Southern Car Company, of High Point, N. C., as general superintendent.

MR. JOHN J. BYERS, general paymaster of the Brooklyn Rapid Transit Company, who went into the employ of the Brooklyn City Railroad Company forty years ago, died from pneumonia at his home in Brooklyn, on Tuesday, Feb. 9.

MR. P. LETHEULE, of the French Thomson-Houston Company, has been appointed, by the French Government, engineer of the French department of electricity at the St. Louis Exposition. Mr. Letheule will visit this country at an early date in connection with his mission.

MR. JOHN L. BUSHNELL has been elected president of the Springfield, Troy & Piqua Railway, of Springfield, Ohio, succeeding his father, the late General Asa S. Bushnell, whose death was announced in a recent issue of this paper. Mr. Bushnell announces that work on the road will be resumed as soon as weather permits.

MR. A. B. CLEAVELAND has been appointed general manager of the Cleveland, Painesville & Ashtabula Railway Company, of Painesville, Ohio. Mr. F. G. Daniell and Mr. H. C. Reagan, superintendent and chief engineer, respectively, have resigned. Mr. Cleaveland is a director of the company, and was one of the promotors.

MR. G. W. TALBOT has been elected general manager of the Peoria & Pekin Terminal Railway Company, with headquarters at Peoria, Ill., vice Mr. L. E. Myers. He will continue in direct charge of all traffic matters. Mr. E. A. Burrill has been appointed superintendent of the company, with headquarters at Peoria, Ill. The office of assistant superintendent has been abolished.

MR. M. MACDONALD, formerly with the Ohmer Fare Register Company, of Dayton, Ohio, has formed the Macdonald Ticket & Ticket Box Company, of Cleveland, which will shortly commence the manufacture of a new form of ticket and automatic cash fare register for interurban use. The device has been tested on several interurban roads and has been commended by the interurban managers to whom it has been shown.

MR. PUTNAM A. BATES, assistant secretary and sales manager of the Crocker-Wheeler Company, announces that he has resigned his position, and will retire from that company on March 1, next. Mr. Bates has formed a partnership with Mr. John Neilson, who was until recently assistant secretary and assistant treasurer of the New York & Stamford Electric Railway, and under the firm name of Bates & Neilson, will conduct a general practice of consulting electrical engineering, with offices in New York city.

MR. W. H. SMITH has resigned as superintendent at Pasadena, Cal., of the Pacific Electric Railway Company, and Mr. J. B. Rowray has been appointed to the vacancy. Mr. Rowray has been in charge of the Pacific Electric's Los Angeles lines since the system absorbed the Temple Street Cable Company. He has not been relieved from his former duties, the Pasadena lines inside that city, as well as the Pacific Electric main lines to and from there, and the Mount Lowe and Altadena feeders, being added to his jurisdiction. Mr. Smith says he will retire permanently from railway duties and will go into private business.

MR. J. B. McCLARY, formerly manager of the railway department of the Birmingham Railway, Light & Power Company, has formed the firm of J. B. McClary & Company, which will establish a supply business in the South. The firm will handle railroad, mining and furnace supplies, and in the former will be included electric railway supplies. There are very few companies in the South which have engaged in this business, and the standing of Mr. McClary, as well as the central position of Birmingham, which he will make his headquarters, should place the firm in an excellent position to handle electric railway business. The high price of cotton during the last three years has brought prosperous times to the South, and the outlook for considerable electric railway construction in the early future is excellent.

MR. E. T. WAGENHALS, superintendent of the Trenton & New Brunswick Railroad, extending from Trenton to Milltown, N. J., has resigned his position, and will go to Cincinnati, Ohio, where he will act as general manager of the Wagenhals Construction Company, of which he is vice-president. Mr. Wagenhals came to the Trenton & New Brunswick Railroad from Cincinnati, in the fall of 1902, and has been in charge of the operation of the road ever since it was opened. The Wagenhals Construction Company is headed by W. G. Wagenhals, inventor of the Wagenhals arc electric headlight, and has a contract for the construction of 70 miles of railway between Dayton, Ohio, and Greenville, Ind. Mr. Wagenhals' successor with the Trenton & New Brunswick Company has not yet been named.

SENATOR MARCUS ALONZO HANNA died Monday evening, Feb. 15, at his apartments in the Arlington Hotel, Washington, after an illness extending over nearly two months, filled with apparent recoveries, followed by relapses, and finally drifting into typhoid fever, which, in his weakened condition, he was unable to withstand. Mr. Hanna was prominently identified with street railway development in Cleveland, and also was active in interurban railway developments throughout the State. At one time he was president of the Cleveland City Railway Company, now part of the Cleveland Electric Railway Company, and at the time of his death was a director of the latter company. He was born in New Lisbon, in Columbian County, Ohio, Sept. 24, 1837. From a clerkship in a grocery store, he rose through successive stages of personal achievement to the command of great wealth, to the leadership of his party, and to be a Senator of the United States.

MR. G. J. SMITH has resigned his position as assistant superintendent of the St. Louis Car Company to take that of master mechanic of the Metropolitan Street Railway Company, of Kansas City, Mo. Mr. Smith has for some time occupied a prominent place among the electric railway master mechanics of the country. For a number of years he was master mechanic of the Cincinnati, Covington & Newport Street Railway, at Covington, Ky. He left Covington to take charge of the shops and power house of the St. Louis & Suburban Railway Company at St. Louis. While there his ability became so well recognized by the management of the St. Louis Car Company that he was offered the position of assistant superintendent for that company, where for the past two and a half years he has done important work in connection with truck design and methods of truck manufacture. He was one of the first to advocate an association of electric railway master mechanics, although his position with a manufacturing company recently has prevented his taking active part in the new master mechanics' association.

MR. WILLIAM BARCLAY PARSONS, chief engineer of the Rapid Transit Commission, of New York, is to sever his connection temporarily with the practical work of the Commission on or about April 1, to accept an appointment to the Royal Commission on London Traffic. It is expected that his labors in London will cover about three months, after which he expects to return to New York. It is understood that Assistant Chief Engineer George S. Rice will assume Mr. Parsons' duties for the time. Mr. Parsons' colleagues on the Royal Commission are Sir John Wolfe-Barry and Sir Benjamin Baker. The functions of the Commission are to make a detailed report on the surface and underground London traffic, and the possibilities of its improvement and development, with the idea of unifying the systems as far as possible, and getting better results for the traveling public. The Royal Commission was in New York in September of last year, and made a three weeks' study of the rapid transit subway. Mr. Parsons took much pains to show the visitors around and furnished them with valuable data.

MR. F. E. FISHER, for the past six years general manager of the Chicago & Joliet Electric Railway Company, has resigned his position with the company and will devote his time to the completion and the business interests of the new Joliet, Plainfield & Aurora Electric Company. Mr. J. R. Blackhall, who came to Joliet from Philadelphia to take the superintendency of overhead construction for the Chicago & Joliet Company, is being trained in the duties of Mr. Fisher's position, and will assume full charge April 1, when Mr. Fisher retires. Mr. Fisher is president of the Joliet, Plainfield & Aurora Company, and is also general manager of the Fisher Construction Company. Mr. H. A. Fisher, a brother, is the manager of the Joliet, Plainfield & Aurora Electric Company, and president of the Fisher Construction Company, and Mr. L. D. Fisher, a nephew of the president, is chief engineer. Mr. Fisher came to Joliet from the East six years ago next April, and succeeded the late Mr. Rush as general manager of the local company. During his administration he has rebult the entire Chicago & Joliet Electric Railway Company's system, and also added many new lines in the city.

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, FEBRUARY 27, 1904 No. 9.

Published Every Saturday by the

McGRAW PUBLISHING COMPANY

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York,"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Canada and Mexico.......................$4.00 per annum
Single copies, first issue of each month, 25 cents; other issues, 10 cents.

To all Countries outside of the United States, Canada and Mexico.... { $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.
Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Announcement

Beginning March 1, 1904, all American subscribers to the Street Railway Journal, paying $4 per annum, will receive without additional charge the Electric Railway Directory and Buyers' Manual, published in February, August and November. The combination subscription price for the Street Railway Journal, the Directory and our annual Red Book, "American Street Railway Investments," will be $6.50 per annum instead of $7.50 as heretofore. To subscribers desiring the Street Railway Journal alone, the rate will hereafter be $3 per annum for the fifty-two issues. There will be no change in the present subscription rates to foreign subscribers.

With 1904 the Street Railway Journal completes the twentieth year of its existence. During these years the paper has constantly increased in number of subscribers, influence and prestige, so that it is now regarded throughout the world as the unquestioned authority on all matters relating to street railways, tramways and high-speed electric traction in all its forms. The growth of the paper and the rapid development of the field whose events have been recorded in its pages have been accompanied by equal, if not greater, changes in the organization and character of the operating force required in street railway service. The large technical force which forms a necessary part of the electric railway of the present day had no counterpart in the horse railway of twenty years ago. Our patrons have often told us that a subscription to the Street Railway Journal was one of the most essential factors to success in their business, and the greatest assistance to them in solving the many problems in construction and operation which are constantly arising in their work. We feel, therefore, that it is our duty to place the paper within the means of every member of the operating department who wishes to work to the best possible advantage, to advance in his chosen profession, and to give his company the most efficient service possible. Whether he is manager, superintendent, master mechanic or car-house foreman, we want him to feel that he need not be dependent on the one or more office copies taken by the company in whose employ he is, but that he can have the Street Railway Journal sent individually to himself and can keep and bind his copies for future reference.

We ought to state in this connection that the change in subscription price will involve absolutely no deterioration in either the quality or character of the matter published, the typographical appearance of the paper or the number of reading pages. On the contrary, the larger clientele which the reduction in price will give and the personal pride which we believe many of our readers who have not heretofore received the paper in their own names will take in possessing copies of their own, will act as a greater stimulus to us than ever before to produce the very best technical paper possible, and one worthy in every respect of the important field which it represents.

A Hard Winter

The past winter has been one which has served to bring out all the defects and weaknesses of old motor equipments. From all over the country come reports of an unusually large number of disabled cars. In some cities this has been caused by an extra heavy fall of snow where snow has been almost unknown for several years. On two of the best managed railway systems of the Middle West a very sudden thaw resulted in so much water on the streets as to aid in disabling a large number of cars. In all parts of the country the snow-fighting equipment has been in almost constant use, and with very satisfactory results on the whole.

Two letters in our correspondence department indicate the methods followed in two widely distant sections, and will prove of great interest to those who have this difficulty to contend with. These letters are particularly interesting from the fact that Schenectady, and the Mohawk Valley in general, constitute one of the districts in the Eastern States where the fall of snow is particularly heavy during winter, while Duluth represents, perhaps, as typical a snow-fighting battle-ground in the Northwest. An essential feature of the practice of both companies, as outlined, is the use of long winged plows. The object, of course, is not directly to improve the condition of the track itself but to remove the piled up snow from the immediate neighborhood of the tracks to close to the curb line. This clears the center of the highway from hummocks, and gives an open space for sleighs and other vehicles which would otherwise tend to follow the track and obstruct the movement of the cars.

The Electric Railways in Southern California

We have already described several important electric railway installations in the vicinity of San Francisco, and have commented on the advancement that has been made in that section of late. It is now appropriate to direct attention to another field, equally interesting and important, in which one of the most comprehensive systems of trolley lines in this country has been established. We refer to the electric railway system of the Pacific Electric Railway Company, certain features of which are described this week. This article, with others which will appear in the immediately following issues, will be found especially instructive by those engaged in large transportation properties.

Electric railway development in Southern California has received a strong impetus recently through the entrance into this field of experienced steam railroad men, backed by ample and ready capital. In practically every city, improvements and extensions are being made, but the greatest work is being carried out in and around Los Angeles. The interurban roads radiating from that city reach every important town and farming community within a radius of 20 miles, and in several cases there are two or three different routes to the same point. Including the city systems there are over 540 miles of single track tributary to Los Angeles. In Santa Barbara, Ventura, Ontario, Pomona, San Bernardino, Redlands, Riverside and San Diego are local railways aggregating 109 miles in length, making the combined operating mileage of the street railways in Southern California 650 miles, by no means a small mileage when it is considered that the population of the entire section is not much over 250,000. Around Los Angeles over 200 miles of new lines are now under construction, the most extensive project being the Bakersfield & Ventura Railway, which is to be a 123-mile road, extending from Hueneme on the coast through Oxnard, Ventura, Saticoy, Santa Paulo and Sunset to Bakersfield. This road will be electrically operated from the east to Sunset (83 miles), where, for the present, connection is to be made with a branch of the Santa Fe Railroad running to Bakersfield. Including the new work now under way the mileage in Southern California figures up over 850 miles. Add to this between 200 miles and 300 miles of projected lines, many of which will probably be built this year, and it is seen that electric railways are occupying no small place in the industrial progress of that section of the State.

The central figure in the Los Angeles traction development at present is Henry E. Huntington, who, by large investments and personal supervision of the details of operation and construction of his properties, has shown that he has great faith, not only in the results of his own expenditures, but in the entire electric railway future of Southern California. Of what are known as the Huntington railways, the Pacific Electric Railway Company's system has been brought to a high state of development, when it is considered that this company has been in operating existence less than two years, and that all but two of its seven lines have been built within that period. In order to operate at high speeds the track and overhead construction have been built according to the latest and most approved standards, and the best of rolling stock and equipment is used. The extensions of the system have created a heavy demand for power, necessitating recent additions to the central power house and the building of new sub-stations, to say nothing of a large water-power development, which will soon be available. The repair shops have been erected on the same broad lines that mark the other constructions, and are equipped for making all classes of repairs, and, if desired, for building complete cars. It is of some of these features of the Pacific Electric Railway system that the series of articles, begun on another page of this issue, will treat, leaving interesting points of the other Los Angeles railway system for future description.

Maintenance of Equipment

The maintenance of a street railway property is a difficult problem at best, and an additional element of a perplexing nature is introduced in the determination of the question as to how far economies may be practiced to swell the profits without impairing the value of the equipment and the reliability of its operation. The question that should be uppermost at all times in the mind of the manager or superintendent, is whether these practices are true economies or of the "penny wise and pound foolish" order. Anything that will affect the reliability and efficiency of the system adversely is detrimental to the value and development of the property, and should be avoided. But it would seem that the importance of this subject is not fully appreciated by all managers, as many of those who have enjoyed wide experience continue to be governed in making the selection of their material and supplies principally, if not entirely, by low initial cost. This is particularly true of those articles which are used continuously in the operation of the road, including babbitt metal, grease, oil and trolley wheels. A low price is often obtained where a large order is placed, and a high quality secured at the same time, but often the buyer loses sight of the fact that an inferior article is dear at any price, and he is governed solely by the figures quoted. This is done, too, in spite of the fact that material thus purchased often fails to perform properly the functions for which it is intended, and that the same service cannot be gotten out of cheap articles as those produced by more experienced houses which command higher prices. This policy results in frequent break-downs, interruption of service and a derangement of the schedule at a price vastly exceeding the saving effected by the lower cost of the article which was the cause of the trouble.

A scored axle, due to poor grease, a broken-down commutator, due to poor brushes, the breaking of the trolley wire and the wearing out of trolley wheels are all vexatious enough, and they cause delays and congestion of traffic, but even these results, annoying as they are, are really not as far-reaching in their influence and effect as the secondary troubles resulting therefrom, which are even more expensive, and which, if considered in their true light, ought to impress the management with the absurdity of continuing such a policy.

One of the best means of correcting this evil is the adoption of a system of keeping records of the troubles on equipments and plant, which is gradually being introduced in electric railways throughout the country. Where reports of this kind are intelligently made and systematically compiled the manager can almost immediately put his finger on that part of the equipment which requires an abnormal expense to maintain, and by a little investigation he can ascertain the reasons for the troubles. Sometimes a change in the character of the supplies or material employed is found to be the cause; at other times negligence on the part of the inspector, and very frequently imperfect workmanship in the repair department. A combination of these elements is very apt to be found where it has not been the practice to keep systematic records, as one fault very naturally leads to the other, and soon laxity is found in all departments. By keeping the records of repair work done on each car separately, and noting the character and extent of each repair, the cause of the trouble can be very readily ascer-

tained, consequently, it is very important, indeed, that a thorough system of repair reports should be established, and that they should be sufficiently comprehensive to indicate clearly the condition of every equipment which passes through the shop.

A brief trial of this kind would open the eyes of many managers to the actual records made by the apparatus on their roads, and would point the way to real economies and improvement of service at the same time.

The Railway Company and the Daily Papers

The popularity or unpopularity of a street railway company in the city in which it operates depends to a large extent upon the relations which exist between the company and the daily papers of that same city. It is true that the local press in any community does not entirely mould public opinion. Its representatives probably could not, if they would, make any important issue or measure popular which for some reason had incurred the hostility of the public, nor can they successfully incite serious opposition to a railway which is furnishing a perfectly satisfactory service. But no railway company can please everybody, especially those who, with no appreciation of practical conditions, expect the impossible, and it is very easy for a local newspaper to acquire cheap applause by championing the cause of the public as against "the grinding monopoly" of the local street railway company.

There is, perhaps, no subject which at times has given many managers more concern than the proper attitude to take toward the newspapers. Those who have affected to disregard the influence of the papers entirely have been able to maintain this attitude for a longer or shorter time, but in the end have usually been obliged to surrender and make a change of policy.

Now, it is not our intention to justify any or all of the press attacks on public service corporations, the policies followed by the daily papers in many cities or the motives which lie behind them. Nevertheless, we believe that in a great many cases where street railway companies have been assailed the condition might have been alleviated, and in some instances entirely obviated by the adoption of diplomacy and certain simple rules of policy on the part of the defendant concern. Some companies believe that newspaper support can be secured only by a liberal and regular distribution of passes, accompanied by occasional favors in the way of advertising contracts. With this we do not agree. There are cases, of course, where this course of argument is more potent than any other, but, as a rule, in justice to our newspaper brethren, be it said, a different course is quite as effective, as well as very much cheaper in the long run.

Many managers who complain that they have not been treated fairly by the daily press do not know how many times reporters from the very papers of whose actions they complain, have waited in vain in the company's outer offices for an interview on some subject and to learn the company' side of the story. The manager may have had a good excuse for not seeing them, but no other person has been authorized to give out any information, and the newspaper man, after waiting a reasonable time, has gone off disgusted. Even where some other official has been ready to give the information sought, the reporter, being refused an interview with the chief executive officer, and not knowing to whom to apply, does not make further effort to learn what the company has to say. Now this may be all wrong, but the blame is not fully chargeable to the paper if the facts become twisted, or if a little venom is injected into the story in the editorial sanctum. Seeing and hearing both sides of the story, we could cite numerous instances where, by a little diplomacy on the part of railway officials, coupled with a simple explanation of certain railroad principles, well known to them but not to the general public, the attitude of the papers as regards certain criticisms would have been entirely changed. On the other hand, we know of at least one city where the relations between the company and the press are exceedingly amicable, in spite of the fact that no newspaper man receives a pass.

If the newspapers know that a request for information as to any event of public interest in connection with the railway will be honored promptly and intelligently and as fully as the policy of the company will permit, they will soon acquire the habit of taking advantage of this opportunity. To do this properly it is not necessary for the president himself to be interviewed on all occasions. Let some official be regularly designated for the purpose, one who will be recognized as speaking with authority, and who will have the confidence of the press that they are securing all the facts available so far as the company is concerned. In some cases the chief executive officer can be brought into the interview to add weight to it. In most instances, however, it is more desirable, as stated, especially on a large road, for some other person, either by name or impersonally as a "prominent official," to make the statement as coming from "the company." Then, if through any unfortunate slip which sometimes occur, it is found that a mistake has been made, the president can explain that the official quoted had been misinformed, but that the correct facts are as given by him.

To be successful, such a plan would have to be conducted in a way that would insure the absolute confidence of the papers. The official designated as the medium for presenting the company's side of any story should be accessible at all hours of the day or night, either in person or by telephone. He should be conversant with newspaper methods as well as railway practice, and should be able to explain intelligently to the untechnical readers of the papers and to their representatives, the newspaper men, any of the simple points in railway operation which may make one line of policy or another advisable. He should be fully conversant with the policy of the company and promptly informed as to all events of public interest which occur on the road and should know definitely just how much of this information should be given out. Above all he should be perfectly impartial and frank in his dealings with the papers, and should be absolutely accurate in any facts which he may give out.

Such an official could also be of great service in other ways than in defending the company against the publication of erroneous statements. He could often bring to the attention of the papers facts creditable to the company in its relations with the public or its employees, but which otherwise might escape notice, and thus create a sentiment that the corporation has the interests of the community as well as its own at heart.

The plan outlined above, of appointing a special official for this service, may seem to many companies unnecessary, and where the managing officer of a corporation has the time to devote to the subject this is undoubtedly so. But the method laid down of the proper relations between the press and the company is absolutely correct, and on large roads a multitude of other affairs demand the attention of the president or manager, and often prevent him from caring properly for the outside press, and it is here that the intelligence bureau can accomplish the most good.

THE PACIFIC ELECTRIC RAILWAY COMPANY'S SYSTEM—I

The electric railway systems in and about Los Angeles are considered by outsiders as somewhat complicated, confusion having been caused, possibly, by the rapidity which has marked the traction development of the city. A few years ago the Los

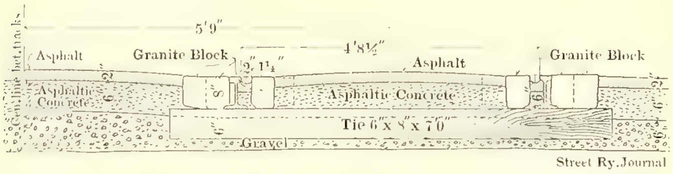


FIG. 2.—STANDARD TRACK CONSTRUCTION ON PAVED STREETS

Angeles railways were practically unknown outside of the vicinity of operation. To-day they have placed Los Angeles first among cities of its size in respect to the excellence of local transportation facilities.

Prominent names in the short but comprehensive history of the Los Angeles railway systems are those of Messrs. Clark, Sherman and Hook, but much of the recent development has been due to the Huntington-Hellman syndicate, which entered the city field in 1898 and the interurban field in November, 1901.

At the present time three of the five operating companies having headquarters in Los Angeles are controlled by this syndicate. They are the Los Angeles Railway Company, the Pacific

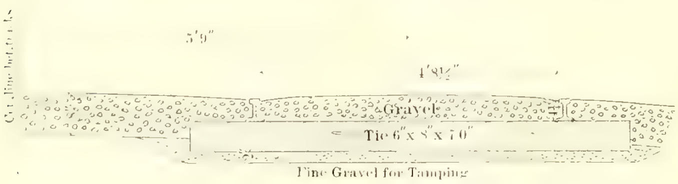


FIG. 3.—STANDARD TRACK CONSTRUCTION ON GRAVELED STREETS

Electric Railway Company, and the Los Angeles Interurban Railway Company. The first mentioned company operates entirely within the city and has fifteen lines, with 115 miles of track, and 8 miles under construction. To the Pacific Electric Railway Company has been given the work of developing interurban railways, and on Jan. 1, 1904, it was operating seven lines, extending north, east and south to Pasadena, Mt. Lowe, Monrovia, San Gabriel, Whittier and Long Beach, in addition to five city lines, its trackage at that time amounting to 190 miles. Since then the Los Angeles Interurban Railway Company, which was incorporated by Huntington interests last June to carry on the interurban development when the capital of the Pacific Electric Railway Company was exhausted, has come

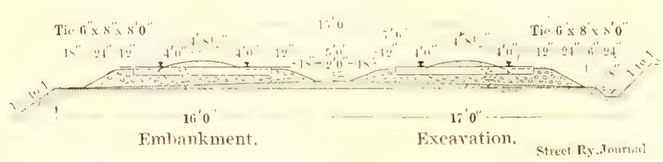


FIG. 4.—STANDARD INTERURBAN "TRACK CONSTRUCTION" OF PACIFIC ELECTRIC RAILWAY

into operating existence. It has taken over 27 miles of city lines of the Los Angeles Traction Company, the 24-mile single-track road to San Pedro of the California Pacific Railway Company, the Whittier line of the Pacific Electric Railway Company, and of lines under construction an 11-mile double-track road to Glendale on the north, a 10.27-mile branch to San Pedro from Dominguez on the Long Beach line, a 20.40-mile branch from the Long Beach line to Newport Beach, and several shorter branches. To the interurban company will fall practically all of the many extensions that are proposed. The Los Angeles Railway Company and the Pacific Electric Railway Company are distinct operating companies, and for that reason will be treated separately, as far as possible, in this and succeeding descriptive articles of the Los Angeles traction systems. The Los Angeles Interurban Railway Company is a separate corporation from the other two, but as it is closely allied with the Pacific Electric and is virtually carrying on the construction

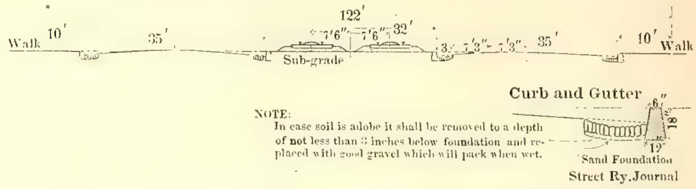


FIG. 6.—CROSS SECTION OF TRACK ON BOULEVARD, SAN MARENO AND LAMANDA PARK EXTENSIONS

work begun by that company with the same engineering staff, it will be treated together with it.

Besides the three Huntington corporations mentioned, there are two independent companies. The Los Angeles-Pacific Railroad Company operates upon 140 miles of track a network of interurban lines from Los Angeles west to the ocean resorts of Santa Monica, Ocean Park, Playa del Rey, Manhattan, Hermosa and Redondo; and the Los Angeles & Redondo Railway Company has recently converted a steam line, between Los

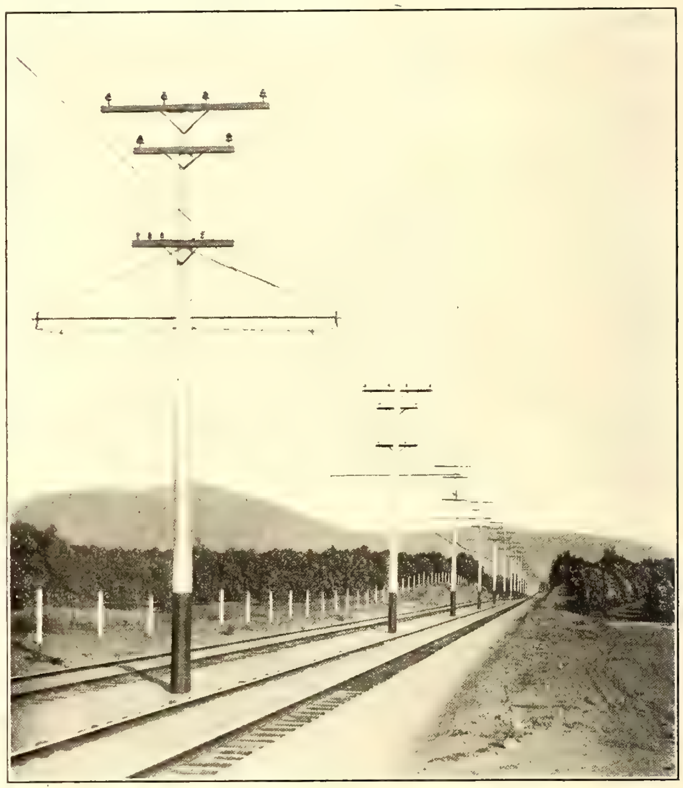


FIG. 5.—BALLASTED TRACKS AND OVERHEAD CONSTRUCTION ON MONROVIA LINE

Angeles and Redondo, into an electric system with 42 miles of track.

The routes of all of these roads, excepting the Los Angeles Railway, are indicated on the accompanying map, Fig. 1. This map covers the valley of Southern California from the ocean to the San Bernardino Mountains, and from the San Gabriel Mountains south to the ocean, and includes most of Los Angeles County and parts of San Bernardino, Riverside and Orange Counties. The Pacific Electric Railway Company's completed and proposed lines are indicated, as are also the roads of the Los Angeles Interurban Railway Company, the Los Angeles-Pacific Railway Company, and the Los Angeles & Redondo Railway Company. The tracks of the interurban company, which are indicated by short dashes, are really only tentative, since, although they are covered by the company's charter, their construction may be considered at present as only a possibility,

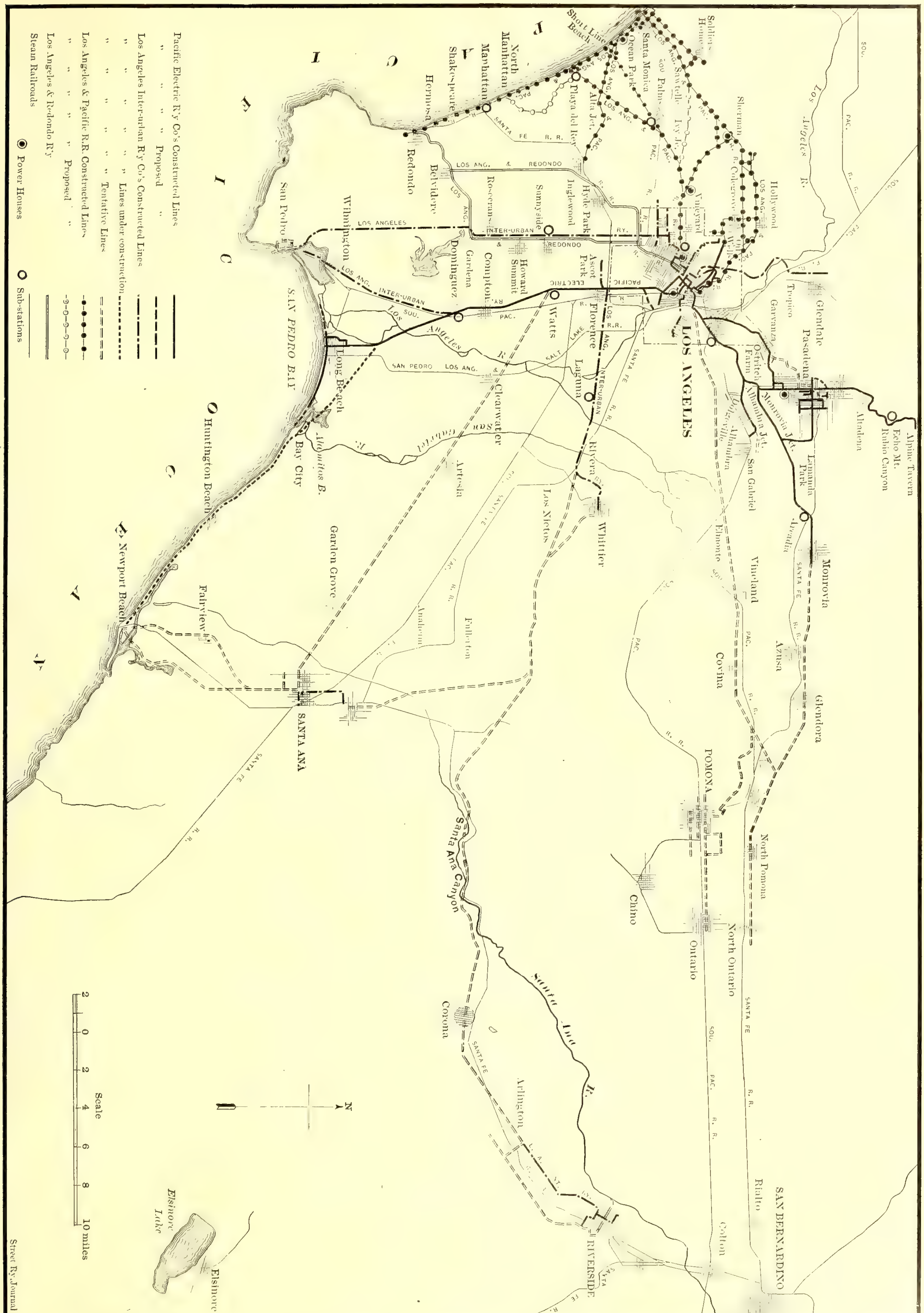


FIG. 1.—MAP OF INTERURBAN ELECTRIC LINES IN THE NEIGHBORHOOD OF LOS ANGELES

no definite plans for their building having been made. By reference to the map it is seen that these lines extend to Pomona and Ontario by two routes, to Santa Ana by two routes, with extensions to connect at Newport Beach with the coast line now building from near Long Beach, and an extension to Riverside, where connection would be made with the lines of the Riverside & Arlington Railway Company, already controlled by Mr. Huntington. Between Orange and Santa Ana there is at present a 4-mile steam-motor road, owned by the Pacific Electric Railway Company. Steam power stations and sub-stations that are already built are also indicated on the map.

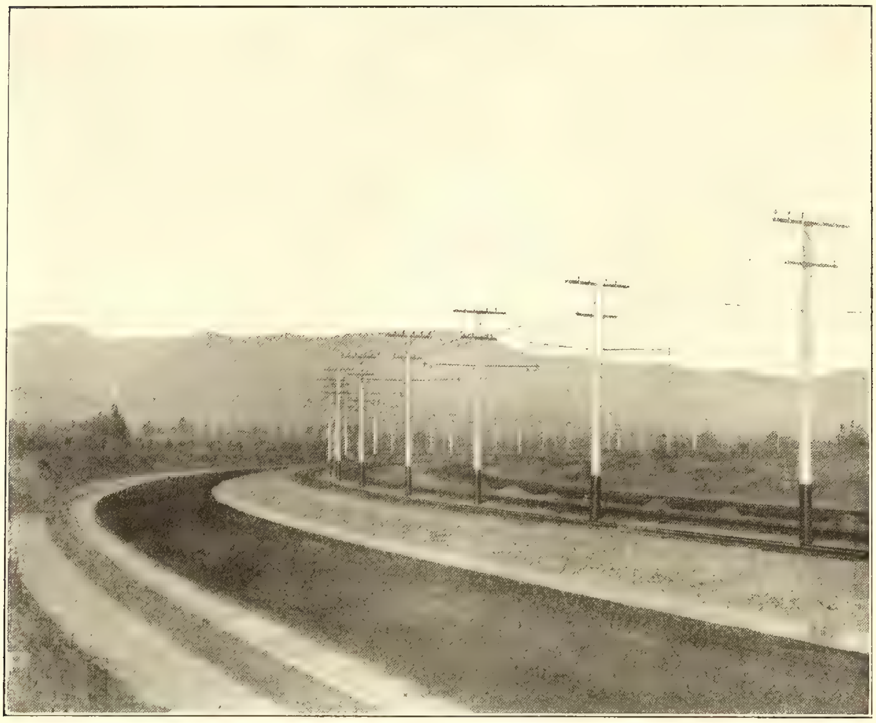


FIG. 7.—VIEW OF BOULEVARD—HUNTINGTON DRIVE

Of the three railway companies controlled by the Huntington interests, the Pacific Electric Railway Company, as already mentioned, is the principal one which at present operates interurban lines. H. E. Huntington's personal supervision has been given to the construction of this company's new lines, and the operation and maintenance of those already built, and it is of some of the distinctive points of the physical features and operation of this road, as they have been worked out under his management, that the present article will treat.

STANDARD TRACK CONSTRUCTION

One of the most noteworthy features of the Pacific Electric Railway system, considering that its official age is less than two years, is the standardization of its track and overhead construction. But in these standards and the methods of construction and maintenance may be seen the results of the years of practical experience in steam railroad operation which the chief officials of the company have had.

The standard tie construction in use on paved streets is shown diagrammatically in Fig. 2. The rails are of the 6-in. shanghai T-section, weighing 60 lbs. to the yard, and coming in 60-ft. lengths. They are laid on 6-in. x 8-in. x 7-ft. redwood ties. The pavement construction consists of 6 ins. of gravel and 6 ins. of asphaltic concrete topped with 2 ins. of asphalt. The gravel bed extends 2 ins. below the ties, and is thoroughly tamped. On both sides of the rails are laid 6-in. granite blocks, the outer ones close to the head of the rail and the inner ones 2 ins. from the rail, leaving a groove 1½ ins. deep for the wheel flange. The space between rail and block is filled in with asphaltic concrete and asphalt. There are about 9 miles of broad-gage double track of this standard in the streets of Los Angeles and Pasadena. The tracks are laid on 11-ft. 6-in. centers, and the company is required to keep the pavement in repair to a distance of 2 ft. outside of the rails.

On gravelled streets the standard tie construction is that illustrated in Fig. 3. The rails are of the 60-lb. 4¼-in. A. S. C. E. section, and they are laid on 6-in. x 8-in. x 7-ft. ties. Between ties is placed 8 ins. of ballasting gravel, while 2 ins. of fine gravel is used for tamping under the ties.

The construction adopted for the standard roadbed of the interurban lines of the Pacific Electric Railway Company, where the company has its own private right of way, has the good points of the best steam practice adapted to suit the conditions of electric service. Fig. 4 shows a section of this standard roadbed with tracks laid on 15-ft. centers. Very recently the standard has been changed to 15 ft. 6 ins. between centers, but in other respects the drawing illustrates the construction used. The rails are of the 4¼-in. T-section, of such proportions and composition necessary to meet the A. S. C. E. inspection standard. They are laid in 60-ft. lengths, on 6-in. x 8-in. x 8-ft. hewn redwood ties, spaced 2 ft. centers on roadbed and 16 ins. on bridges.

I. & C. tie plates are used. The gravel ballast is rounded to 4¼ ins. above the ties in the center, and from the rail is carried 1 in. below the ties to a point 12 ins. beyond their ends, where an 18-in. slope is given to the toe of the ballast. The tops of the ties are placed 15 ins. above sub-grade, which, in case of embankment, is 32 ft. wide, and in case of excavation is 34 ft. wide, including 24-in. gutters. A 4-in. elevation in the center of the roadbed, with even slope to the sides, provides for drainage. All embankments are given grades of 1½ to 1, and excavations 1 to 1. All grading is done by contract, but the company does its own track work and construction. The ties

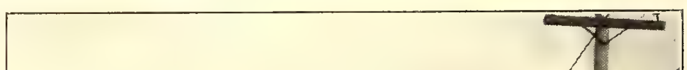


FIG. 8.—VIEW OF BOULEVARD, WITH CURVE, SHOWING BALLASTED TRACK

are all bar tamped, and every precaution is taken to settle the roadbed and insure a permanent good-wearing track. For the construction of each line the engineers were given the speeds and operating conditions of the prospective service, and the roadbed was laid out to meet these conditions, the actual construction following the theoretical design very closely.

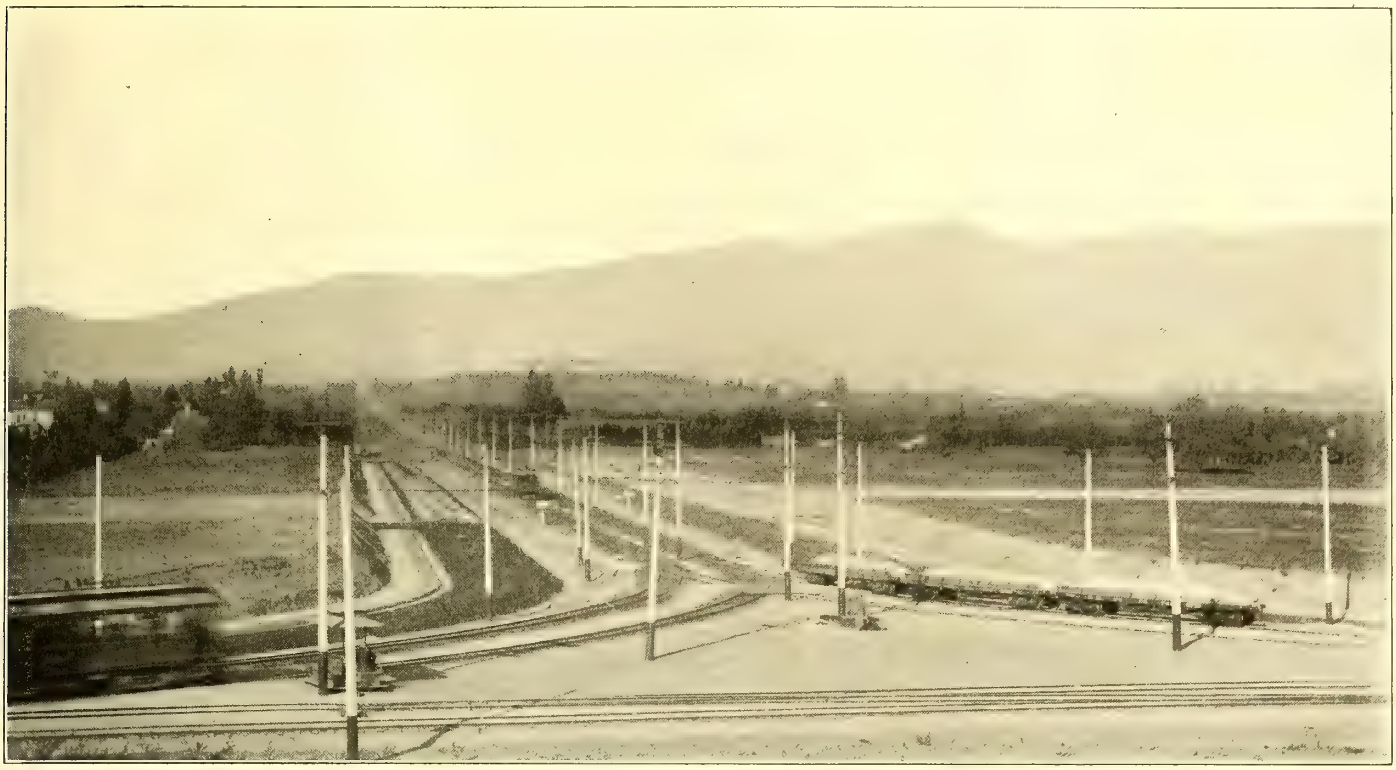


FIG. 9.—VIEW OF MONROVIA JUNCTION, WITH THREE-PART "Y"

The company has over 30 miles of this standard double-track ballasted section, including the Pasadena Short Line and the Monrovia and San Gabriel lines. Fig. 5 is a view on the Monrovia line, showing the ballasted section together with a short cut. On each side are seen orange groves, while some of the private right-of-way wire fencing is also shown. This road, known as the Orange Grove Route, was literally cut through large orange groves, and, near the Monrovia end, it passes through the famous 54,000-acre ranch of "Lucky" Baldwin.

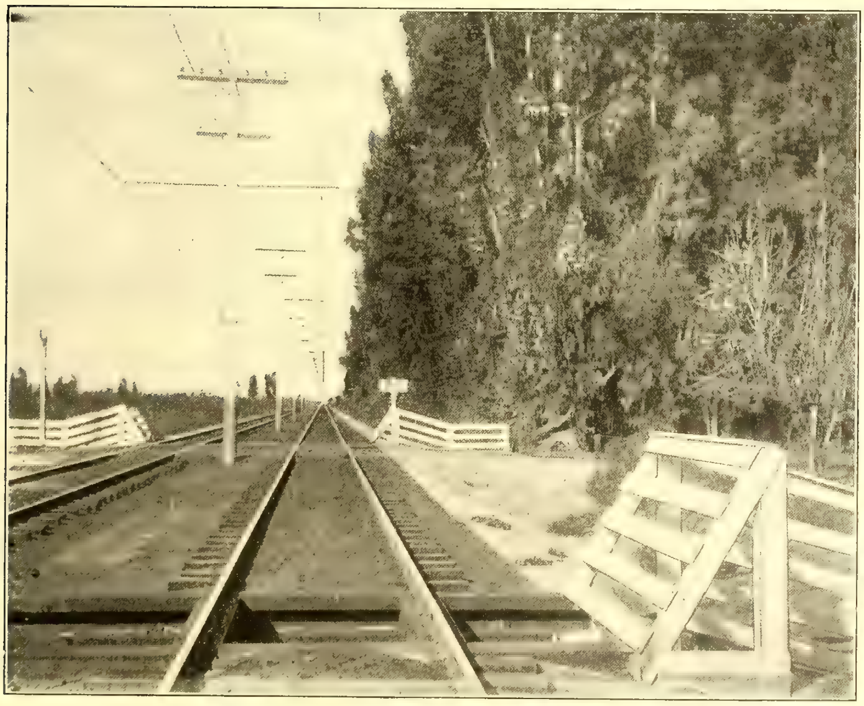


FIG. 10.—VIEW ON LONG BEACH LINE, SHOWING ROAD CROSSING

BOULEVARD SECTION

In the vicinity of Monrovia Junction, where the Monrovia line branches off from the Pasadena Short Line, the land department of the company has platted and put on the market a large residence tract, known as Oneonta Park. A similar tract, San Mareno Park, has been laid out a little further east. One of the substantial improvements made upon these tracts is a system of excellent boulevards. On portions of the Pasadena Short Line, the Monrovia line and the San Mareno and Lamanda Park extensions within the tracts, these boulevards have been laid out with a private right of way for the railway in the center. The total width of such a street is 122 ft., and this includes a 32-ft. railway roadbed in the center, with a 35-ft. road and 10-ft. walk on each side, the section being as shown in Fig. 6. The roadbed is ballasted in the standard manner, with tracks spaced 15-ft. centers, and the sub-grade raised to the level of the roadway on each side. Each roadway is held in place by concrete curbs, which flank garroted gutters. The curbs are 18 ins. high, 12 ins. wide at the bottom, and 6 ins. at the top, while the gutters are 3 ft. wide, and are laid with 6 ins stone and sand foundation. Where the soil is of an adobe nature it has been removed to a depth of not less than 3 ins. below the foundation and replaced with good gravel, which will pack when wet. Spaced at frequent intervals in the roadbed are cross drains which empty into the gutters. The roads are especially prepared by working crude oil and water into the natural soil and then rolling it. When completed there is an excellent surface, nearly equal to an asphalt pavement.

About 7 miles of this boulevard is being built along the railway right of way. One portion of it, known as Huntington Drive, has a total width of 140 ft., divided into a 60-ft. railway roadbed, two 30-ft. roads, and two 10-ft. walks. A portion of this is illustrated in Fig. 7, while Fig. 8 shows a view of the

122-ft. boulevard, with the railway ballasting completed. Both views show typical curves, and in the foreground of Fig. 8 may be noted a wooden box cross drain to the gutter. Fig. 9 is a view of Monrovia Junction, showing the three-part Y with the middle track leading toward Pasadena. In all three views the boulevards shown are not entirely completed.

FIG. 11.—VIEW ON LONG BEACH LINE AT SOUTHERN PACIFIC CROSSING

FOUR-TRACK ROADBED PROPOSED

Over that portion of the Pasadena Short Line, between East Lake Park, Los Angeles and Monrovia Junction, a distance of about 5 miles, the Pacific Electric Railway Company has planned to build a four-track roadbed, an undertaking decidedly novel for an interurban railway, and one not at all common with steam roads. On this portion of the Pacific Electric system, however, the four tracks have become a necessity. With a regular 10-minute service, increased sometimes to a 7-minute service, to Pasadena, and frequent cars going to and from Monrovia and San Gabriel, the cars are often required to run but 2 minutes or 3 minutes apart over this section. In order to provide safe and efficient transportation with operating speeds as high as 50 m. p. h., or even 60 m. p. h., it is thought the present service has about reached the limit. With the neighboring country rapidly being platted and settled, and the prospect of early extension of one or both of the eastern lines, the four tracks seem to be essential. Plans have all been drawn, and it is possible that the improvement will soon be made.

Two tracks will probably be reserved for the through Pasadena service and two for the other lines. The standard roadbed for four tracks will be 58 ft. wide on embankments and 60 ft. on excavations, the inside tracks being spaced 15-ft. 6-in. centers, and the outside ones 13 ft. from them. On that portion of Huntington Drive south of Monrovia Junction, such as that illustrated in Fig. 7, the 60-ft. roadbed has been reserved so as to provide for the four tracks. Elsewhere a 100-ft. right of way will adequately provide for the four tracks.

UNBALLASTED TRACK

An example of unballasted roadbed of the Pacific Electric system is the Long Beach line, which has come to be recognized for the high speeds at which the cars are operated. It is 21 miles in length, and is the longest single line of the system. It was built completely and put in operation inside of four months, and with the exception of two coatings of oil is in practically the same condition as when first opened, on July 4, 1902. Cars in regular service attain speeds of 60 m. p. h., while on tests, speeds of about 70 m. p. h. have been reached, these, too, with overhead trolley. The cars operate over a private right of way the entire distance between the limits of the terminal cities. Most of the road consists of tangent track, the maximum grade is 1 per cent, and as there is but one town of any considerable size on the route, the conditions are favorable for high speeds. Figs. 10 and 11 are views on the private right of way of the Long Beach line, and Fig. 12 is a view on American Avenue, in Long Beach, showing the construction on a boulevard. Fig. 13 shows an unballasted track on the Monrovia line, taken during construction. Fig. 14 is a view showing the construction of roadbed on this line without borrow pits, practically doubling the cost of the roadbed.

CURVES AND GRADES

In laying out track work the engineers of the company use a compensating clearance on curves by increasing the track center in proportion to the degree of curvature and by then giving the superelevation necessary. This is done by leaving the outside curve in the same relative position to the outer line, as on tangent track, then running a parallel offset curve for the pole line and throwing the inside track toward the radial point

FIG. 12.—VIEW ON AMERICAN AVENUE IN LONG BEACH

the same amount. The maximum curvature used on trunk line work is 3 degs., but on close interurban work through subdivided country, maximum curves of 7 degs. are allowed. On all the regular interurban lines the maximum grade allowed is 1 per cent. On the Rubio line, toward Mt. Lowe, an 8 per cent grade is necessary.

JOINTS, BONDS AND SPECIAL WORK

All rail-joints in the city track are cast-welded, the Falk process being employed. On interurban lines six-pole angle-joints are used, with holes drilled for ⅞-in. bolts. Even joints are laid in the city and broken joints in the country. The Brown-Edison 0000 copper bond is the standard adopted, and it is applied in the usual method, the Brown grinding machine being used to polish the rails. For cross bonding between tracks 000 copper is employed, and the rails are connected to the negative leads at the sub-stations with cables of calculated sizes.

All track is laid with tight joints, and none but extreme temperatures are taken into consideration for contraction and expansion, since variations in temperature in Southern California are not great at any time of the year. No trouble from electrolysis has been experienced, but it is guarded against in the conduit districts of the cities by laying brick or other non-conducting material around the base of the rail.

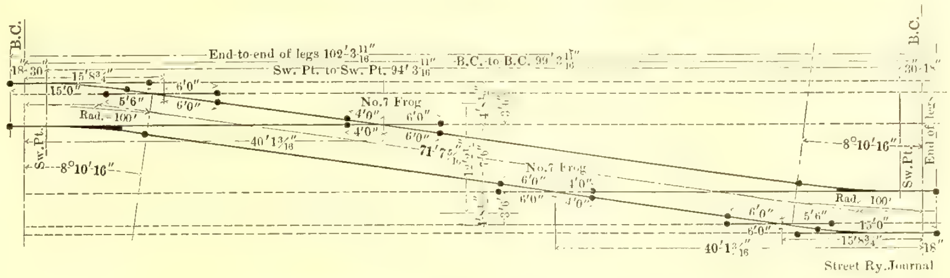


FIG. 15.—RIGHT-HAND CROSSOVER WITH TWO GAGES

Except those on bridges the ties used throughout the system are of California redwood, and their life is estimated at from ten to fifteen years. In the seashore cities, where the streets are sprinkled with salt-water from the ocean, both rails and ties have a life of only about six years.

FIG. 13.—UNBALLASTED TRACK ON MONROVIA LINE

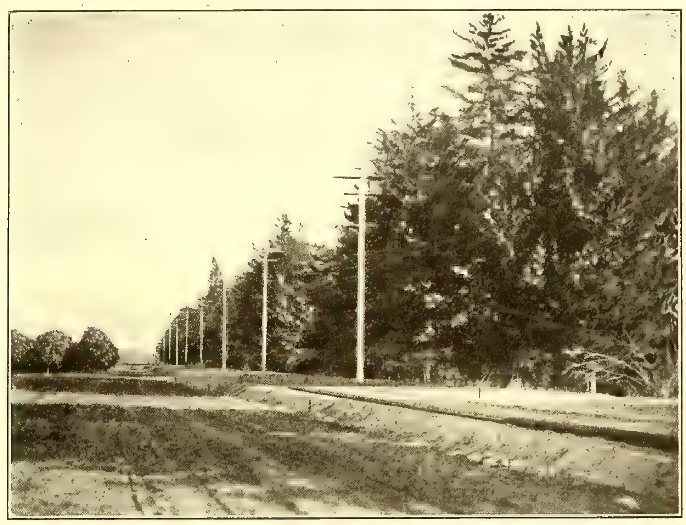


FIG. 14.—ROADBED WITHOUT BORROWPITS

The company builds all its own special work, except the cast joints, in its own shops, where ample facilities are provided for this class of work. Since the city systems have the narrow gage of 3 ft. 6 ins., and all the interurban lines have the stand-

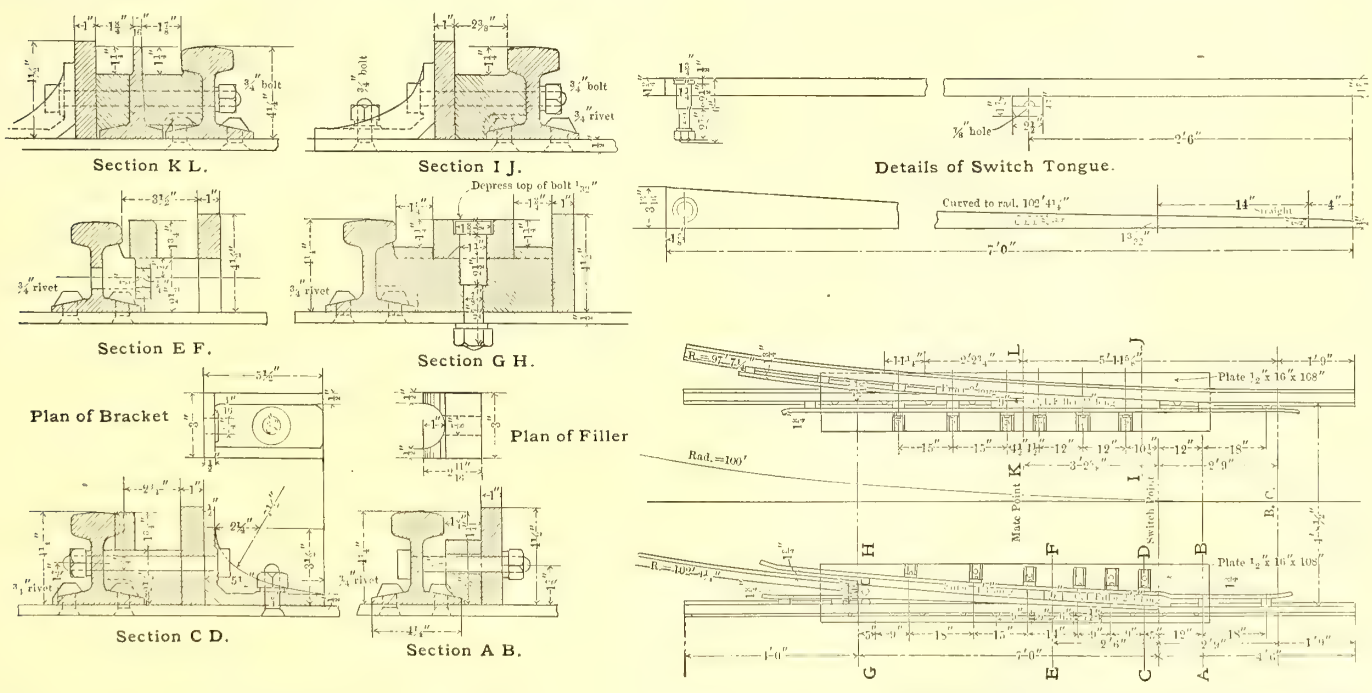


FIG. 16.—STANDARD SWITCH AND MATE USED BY THE PACIFIC RAILWAY COMPANY

ard gage, the special work necessary is quite extensive. Fig. 15 illustrates the special work used in a standard right-hand cross-over for combination gage, 6-in. 62-lb. T-rail being used.

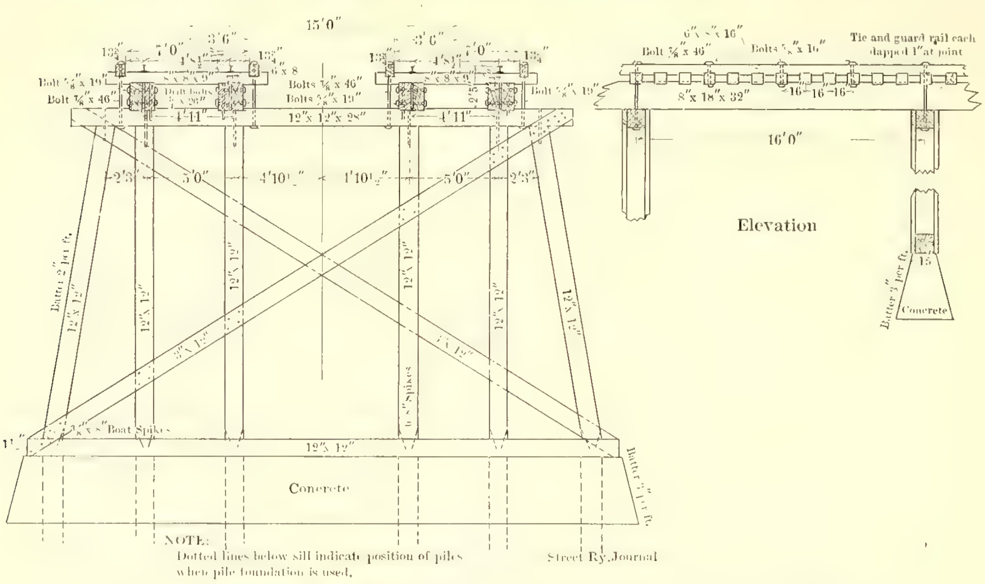


FIG. 17.—CONSTRUCTION AND DETAILS OF STANDARD TRESTLE

In Fig. 16 is shown a standard switch and mate, used with 60-lb. A. S. C. E. rail. All joints are planed to close fits, and great care is exercised in having all parts properly proportioned.

New Century switch stands, manufactured by the Pennsylvania Steel Company, are used for all interurban switches.

FIG. 18.—PILE BRIDGE 1000 FT. LONG ON LONG BEACH LINE

For street work a spring switch, operated by chain and handle that drops flush with pavement, is used.

TRESTLES, CULVERTS AND CATTLE GUARDS

For all trestles on the lines, standard framed vents, with 16-ft. spans, have been adopted. The rails are laid on 8-in. x 8-in. x 9-ft. ties, spaced on 16-in. centers, which are supported by double 8-in. x 18-in. x 32-ft. girders, bolted together. The caps are 12 ins. x 12 ins. x 28 ft., and are fastened by ⅞-in. x 24-in. drift bolts to the 12-in. x 12-in. posts. The construction is shown in Fig. 17, which illustrates the standard trestle with concrete foundations. The dotted lines below the 12-in. x 12-in. sill indicate the position of the piles where pile foundations are used.

Across the bed of the San Gabriel River, on the Whittier branch, a 1320-ft. pile bridge of this standard construction has been built. The bed of this stream is dry the greater portion of the year, but as it is apt to carry heavy floods in the springtime, the company has taken especial precautions to protect the bridge and the farming country in the vicinity, by clearing the channel of all brush and driftwood and building up the banks, so that the river will not be diverted from its course.

For most of the other bridges on the interurban lines similar pre-

FIG. 19.—BRIDGE ON MONROVIA LINE—FLOOR VIEW

cautions have been taken to keep the spring floods within the beds of the rivers. The usual method is to dig a trench along the bank and build in it a barb-wire fence, with wires about 4 ins. apart. Cactus plants, as they are chopped or dug out of the roadway, are then filled in around the fence, and packed and covered with sand to form a sort of dyke. The idea of using cactus was obtained from the custom of the Mexicans and Indians who inhabited the country about a century ago. Many of their old irrigating ditches are still to be found, and where cactus was used in the banks they are very well preserved. The cactus is ever present in that part of the country, and as it grows equally well in dry and wet weather it serves to hold the banks together better than willow or anything of a similar nature.

In Fig. 18 a pile bridge, 1000 ft. long, across the Los Angeles River, on the Long Beach line, is illustrated. A typical concrete

pier bridge is illustrated in Figs. 19 and 20. This structure is on the Monrovia line. Concrete abutments are employed, and it will be noted that they are stepped at the ends, so that in

FIG. 20.—BRIDGE ON MONROVIA LINE—SIDE VIEW

FIG. 22. STANDARD POST TRESTLE WITHOUT FLOOR

case the company desires to widen the bridge for four tracks, there will be a good foundation for the necessary additions to the abutments. Fig. 21 is a detail view taken during construction of a concrete abutment, showing the method of stepping the end. Fig. 22 shows a standard post trestle with-

When conditions are favorable, concrete steel culverts are built, a typical one on the Monrovia line taking the form illustrated in the drawing in Fig. 24. The railway crosses the

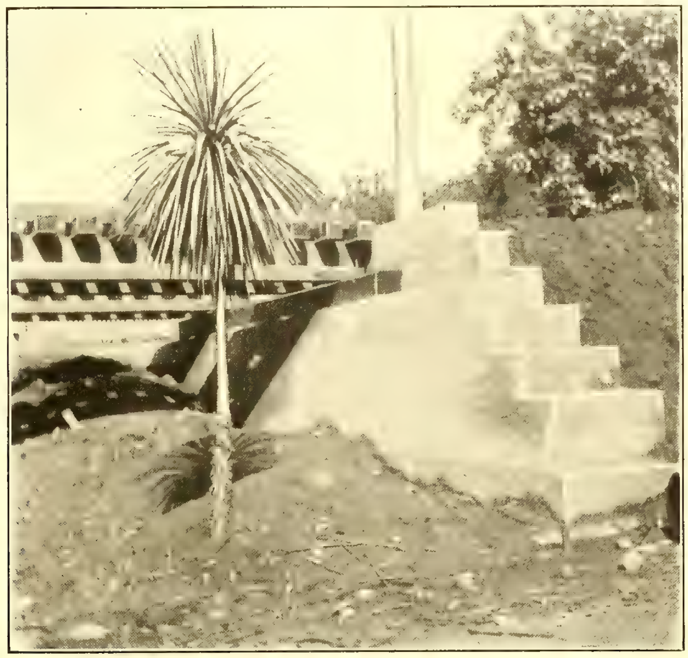


FIG. 21.—DETAIL, SHOWING STEPPED ABUTMENT OF CONCRETE PIER BRIDGE

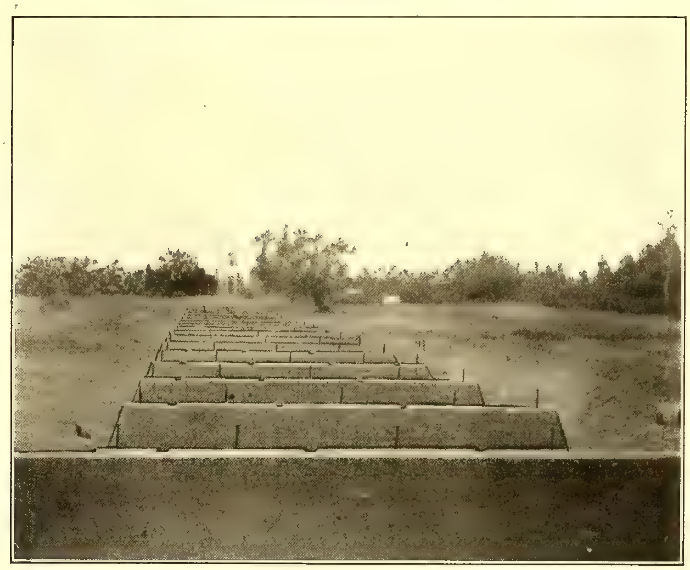


FIG. 23.—CONCRETE PIER CONSTRUCTION WITHOUT POSTS

culvert at an angle, with a roadbed 32 ft. wide. The culvert is 200 ft. long, and has an arched section 20 ft. wide, with 4-ft.

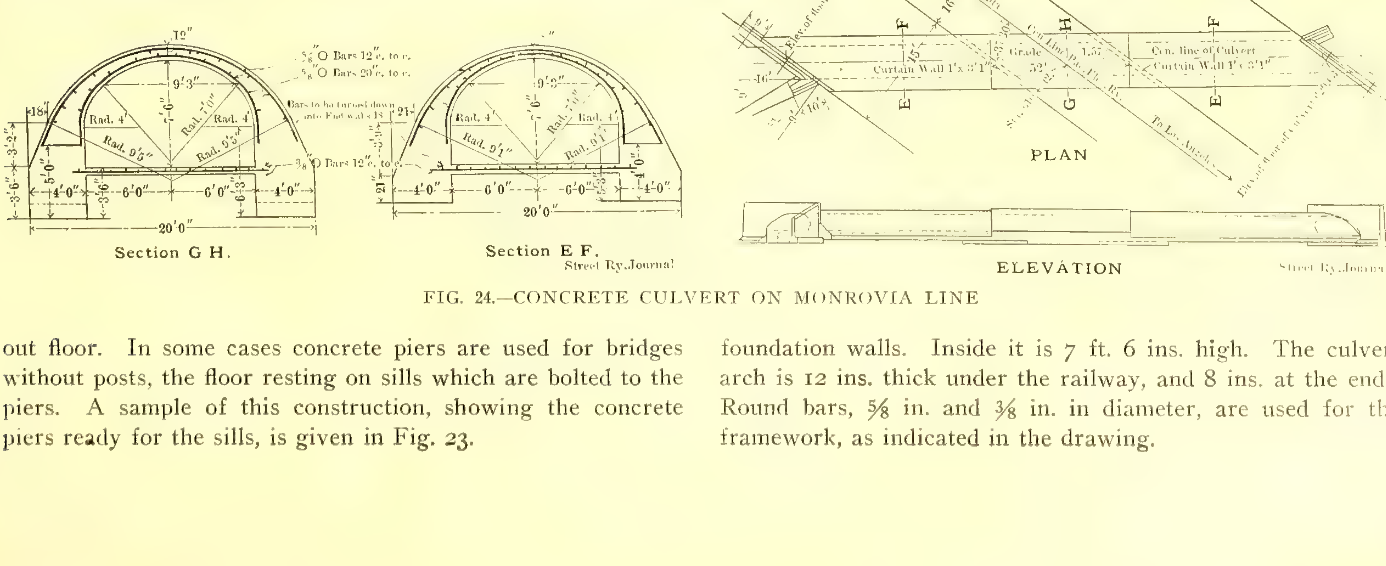


FIG. 24.—CONCRETE CULVERT ON MONROVIA LINE

out floor. In some cases concrete piers are used for bridges without posts, the floor resting on sills which are bolted to the piers. A sample of this construction, showing the concrete piers ready for the sills, is given in Fig. 23.

foundation walls. Inside it is 7 ft. 6 ins. high. The culvert arch is 12 ins. thick under the railway, and 8 ins. at the ends. Round bars, 5/8 in. and 3/8 in. in diameter, are used for the framework, as indicated in the drawing.

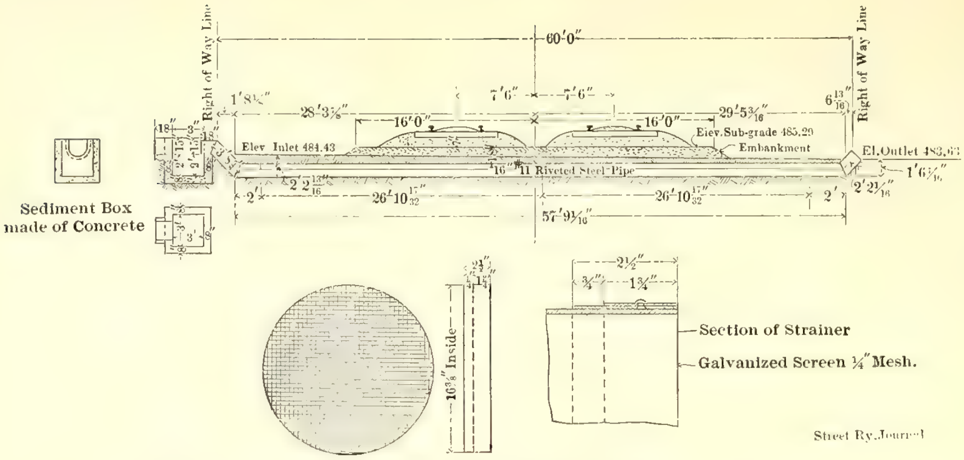


FIG. 25.—SPECIAL INVERTED SIPHON FOR IRRIGATING WATER

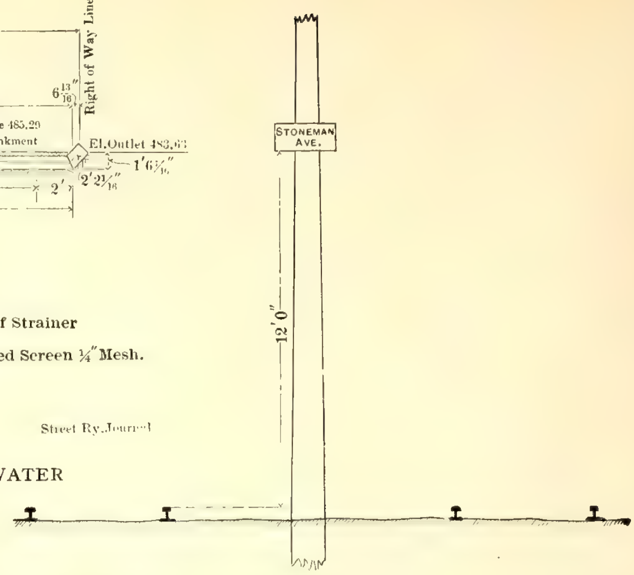


FIG. 29.—STANDARD STREET SIGN FOR CENTER POLE

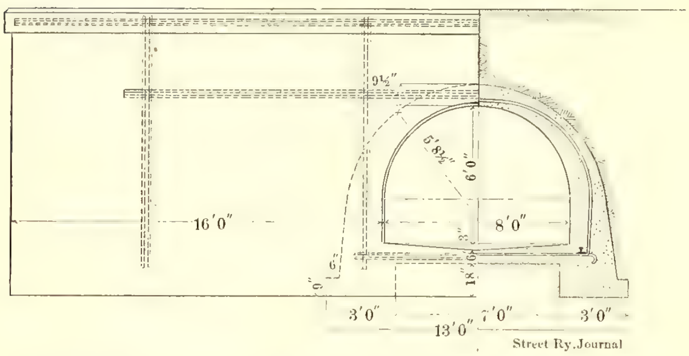


FIG. 26.—CONCRETE CULVERT FOR IRRIGATING WATER

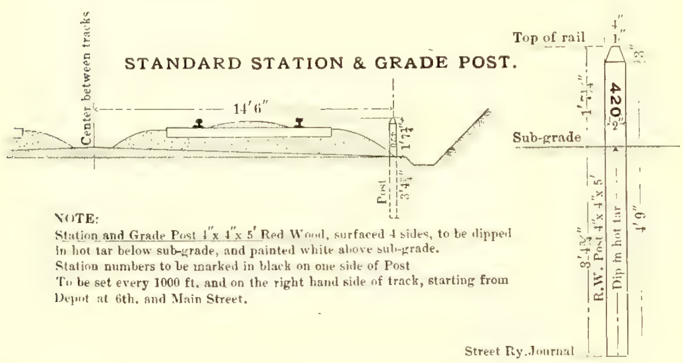


FIG. 30.—STANDARD STATION AND GRADE POST

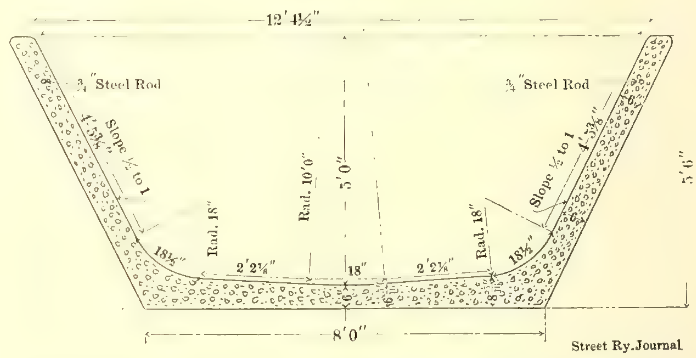


FIG. 27.—CONCRETE DITCH CONNECTING WITH CULVERT

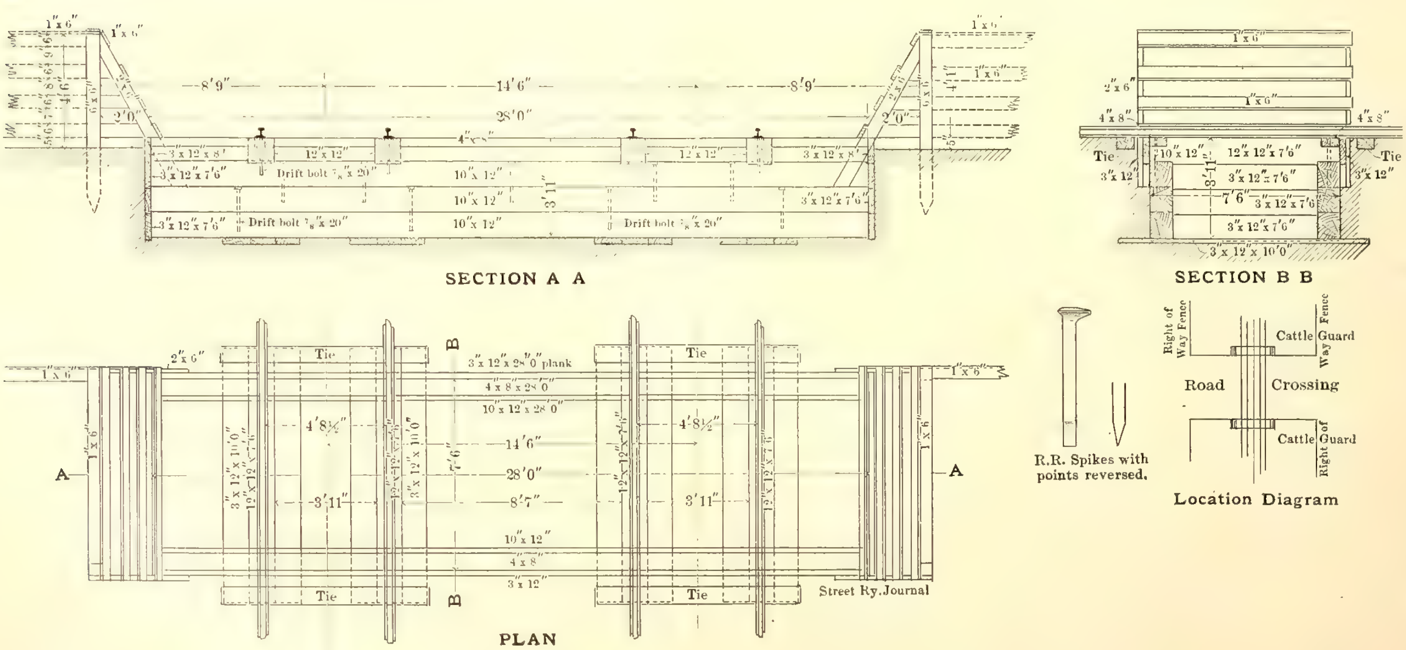


FIG. 28.—OPEN-PIT CATTLE-GUARD

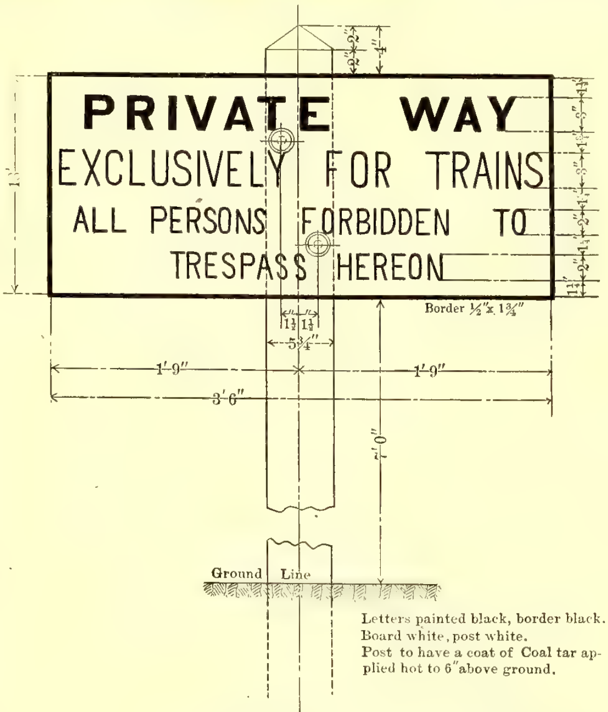
Another type of concrete culvert is illustrated in Fig. 26. This is used on the Monrovia branch to carry the waters of a large irrigating ditch under the tracks. It is 140 ft. long, and has a width at the foundation of 13 ft. The culvert has an arched section with interior dimensions of 8-ft. x 6-ft. 3-in. Wing walls, the height of the culvert, extend 16 ft. on each side of the opening at each end. For strengthening these wing walls old railroad rails are used.

Rails are also run longitudinally in the foundation of the culvert, and to them are joined hooks of ¾-in. steel rods. For 30 ft. in the center these rods are spaced on 18-in. centers, then for 18 ft. on each side they are spaced on 2-ft. centers, and for the remaining 37 ft. at each end they are spaced on 3-ft. centers. The section of the cement ditch which connects with this culvert is given in Fig. 27. Its construction, as well as that of the culvert, are of interest, as they indicate the attention which railways have to pay to irrigating projects in California. For carrying similar ditches across the tracks the Pacific Electric Railway Company frequently employs the special inverted siphon shown in Fig. 25. The water is discharged from the open ditch made of concrete, with 8-in. walls. This box is 3 ft. square and 3 ft. 3 ins. deep, 2 ft. of the depth being provided for sedimentation. After passing through a strainer, formed of galvanized screen with ¼-in. mesh, the water is carried under the track in an inverted siphon, formed of 16-in. No. 11 riveted steel pipe.

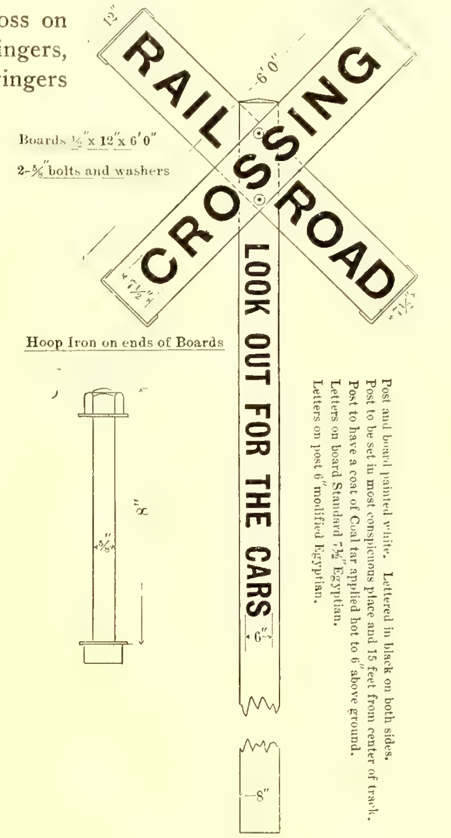
Small openings in the roadbed, such as for drains, are carried across under the track in terra-cotta tile. Where iron pipe lines for water, oil or gas are carried across the right of way they are enclosed in redwood boxes or log water pipe, so as to guard against electrolysis or loss of return current from the rails.

On the private right of way open-pit cattle guards, of the standard type illustrated in Fig. 28, have been placed. The open pit is preferred, as cattle are not so apt to venture across them and they are large enough for animals to fall into without being injured. The pits are 28 ft. long, 7 ft. 6 ins. wide, and 3 ft. 11 ins. below the top of the ties. The sides are formed of 10-in. x 12-in. sills, and the rails are carried across on 12-in. x 12-in. stringers, both sills and stringers being fastened by ⅞-in. x 20-in. drift bolts. The bottom of the pit is floored only beneath the rails. The drawing also shows the details of the guard fence. One of these cattle pits, as used on the Long Beach line, is also shown in the earlier illustration, Fig. 10.

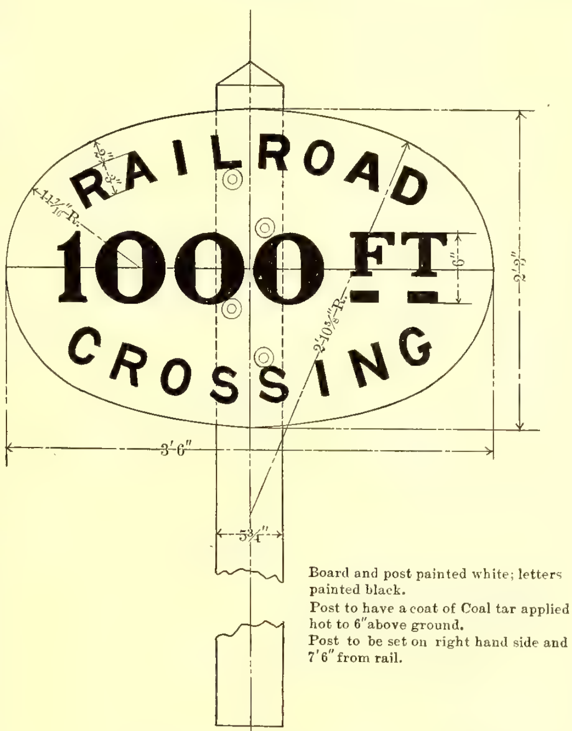
For fencing the right of way no great uniformity can be applied, as the fences are built to suit the owners of the adjoining property, or according to the terms agreed upon in the grant



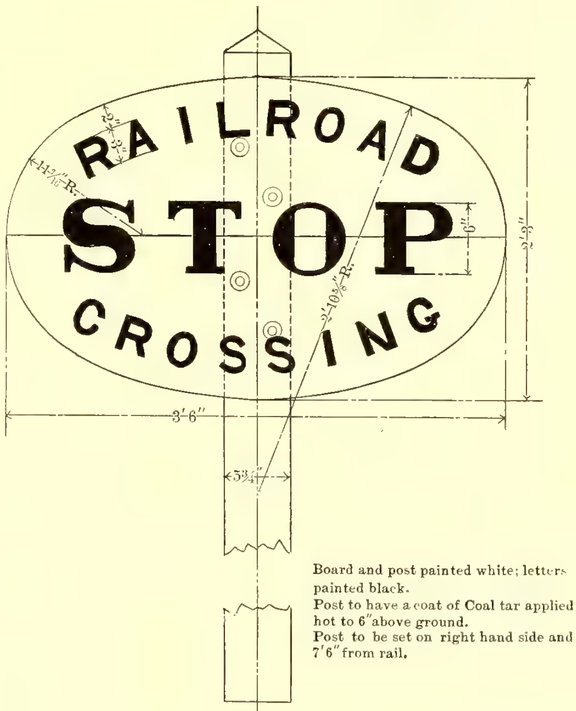
TRESPASS SIGN BOARD



CROSSING SIGN BOARD.



1000 Ft. SIGN BOARD



STOP SIGN BOARD

FIG. 31.—COLLECTION OF TRACK SIGNS

of the right of way. Wherever barb wire with top board is used the standard adopted is a fence 52 ins. high with four wires, and with posts spaced 12 ft. apart.

STANDARD SIGNS AND POST MARKINGS

The standardization of the track and roadway of the Pacific Electric Railway has also been made to include the public and trainsmen's signs, the stake markings, etc. In Fig. 29 is shown the standard street sign carried on the poles, and in Fig. 30 the standard station and grade posts. Fig. 31 gives a collection of these signs, the drawings being self explanatory. Those shown are the trespass signboard, stop signboard, 1000-ft. signboard and crossing signboard. Fig. 32 illustrates the standard bridge and culvert post and the standard letters and figures for stencils for stake marking. The posts for the signboards are of dressed 4 x 4's, are set 4 ft. in the ground and are dipped in hot coal tar to a point 6 ins. above the ground. The street sign, which is screwed to the center trolley pole, has white letters, on black board, but the other signs are of black letters on white boards, the posts also being white. Other interesting features of this line will be described in the next issue.

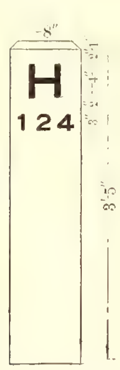


FIG. 32.—STANDARD BRIDGE AND CULVERT POST

THE ALTERNATING RAILWAY MOTOR SITUATION

BY LOUIS BELL, PH.D.

For some years past it has been obvious that an alternating-current motor, suitable for railway service, would be of enormous value in the progress of the art of electric traction. Look at the question as one may the uncompromising fact stands clearly out in the foreground that 500 volts is a pressure altogether unsuitable for the distribution of large amounts of power over considerable distances. It is a situation altogether comparable with that encountered in the early days of electric lighting, when a desperate stand was made by the low-tension contingent against the competition of alternating current. No one is disposed to deny the admirable simplicity of the direct-current distribution at short range, but even to-day, when there is scarcely a central station in the country that has not fallen back upon alternating-current auxiliaries, a plain, unvarnished statement of the losses incurred in the direct-current feeders and mains would pretty nearly raise a riot.

The development of the electric railway raises the same issues. Had it proved feasible to work railways upon the three-wire system, the situation would have been now less acute, but the exigencies of practical service have proved to be such that so far as three-wire service is concerned the game is not worth the candle.

The next step in the fight against the inevitable was the use of alternating currents for distribution, via rotary converters. This system has been developed with far more enthusiasm than wisdom, and there are to-day literally dozens of plants in which the frantic effort to develop all the energy in a single primary power house involves a daily waste of money. Even granting (which I do not) that the generation of the power in a single big plant is, under existing conditions, usually cheap enough, compared with generation in several independent stations, to offset the losses in transmission and conversion, and the up-keep and attendance on the plant required, still the rotary converter scheme fails in two essential points. First, it does not, in practice, reduce the amount of copper required in the working conductors, and, second, leaving the working voltage unchanged, it retains the serious difficulties connected with the collection of current from the working conductors.

Even the much advertised third rail, useful as it is on elevated roads and in tunnels, is not adequate for general service. When so sheltered and insulated as to be suitable for general service it must become to all intents and purposes a huge lateral trolley wire. The key to the gate that opens into the field of electric traction, *au large,* is increased voltage of the working conductors. Practically this means that the alternating current must be carried clear up to the car. It must not be understood that I am here advising the wholesale use of high-voltage alternating currents upon all trolley wires. Considerations of public safety will prohibit such a step, just as they would prohibit indiscriminate raising of the direct-current voltage, and should prohibit absolutely the use of an unshielded third rail.

Until very recently the only systems which gave promise of meeting the case were the polyphase systems with induction motors. So far as the motors are concerned they suffer from difficulties of speed regulation, being comparable in this respect to shunt direct-current motors, but are in other respects admirable. The necessity for at least two working conductors is, from the American standpoint, an almost insuperable objection, and, more than anything else, has turned American engineers toward the evolution of the single-phase motors, which have now, apparently, been brought to a very business-like condition. The somewhat tentative announcement of Mr. Lamme before the Institute set people to thinking, and the later work done abroad, fortunately, forced the hands of the American manufacturers, and served to put the commutating single-phase motor at once upon a commercial basis.

The motors already upon the stage have been already rather fully noticed in the press, so that detailed description need not be attempted here. They belong to two clearly indicated types, neither of recent invention in its main features, and both having properties akin to series-wound direct-current motors. The first type includes the Lamme and the Finzi motors, and has as its prototype the very interesting Eichemeyer motor of a decade ago. It is simply a series-wound commutator motor, with a laminated field and allied precautions against the inductive effects of alternating current. Any series-wound motor holds its direction of torque unchanged, whatever the polarity at its main terminals, and reverses only when the relative polarity of armature and field is changed. Hence, if the construction is such that the polarity reversals can rise to the frequency of a commercial alternating current without introducing collateral difficulties, one has a practical single-phase series motor with the general characteristics of the series type. To keep down reactances and parasitic currents it has been found desirable to design the motors with very powerful armatures and rather weak fields, to use high-resistance commutator leads, to keep down the currents in the coils short-circuited by the brushes, to channel the poles longitudinally, thus checking cross induction by the armature, and to make other minor structural changes. The result is a motor which is claimed to be practically sparkless in operation, and which has, to a remarkable extent, the working properties of an ordinary railway motor. The alternating machine in its present state of design is somewhat heavier than its direct current rival, and a few per cent less efficient, but it has a high power factor under conditions demanding large in-put of energy, and, thanks to the possibility of induction voltage, regulation does not make unreasonable demands upon the generators even in starting and accelerating. It requires in practice a transformer between it and the trolley wire, since it is unwise to put high voltage upon the commutator. The tests published from the Lamme motor here and the Finzi abroad, are surely most encouraging. One of the most important features of these motors is the fact that they can be made to work pretty well on a direct-current circuit, so that they can run on an ordinary trolley system by the addition of suitable regulating appliances.

This is not quite so simple as it sounds, because it has been found advisable to keep down the voltage of the alternating-current armature so that in running on a 500-volt direct-current circuit the two motors would be worked in series, or a four-motor equipment in series parallel. Still, the new motors can undoubtedly get through a direct-current route creditably well on the way to and from their regular field of action.

The second type, represented by the General Electric motor in this country, and the Eichberg-Winter motor abroad, is a derivative of Professor Elihu Thomson's repulsion motor of 1887. It is essentially a transformer motor, in which the phase relations of armature and field are definitely maintained by an artificial polar line, established by the commutator and brushes. The result is a motor which starts, as ordinary single-phase transformer motors do not, with a definite and powerful torque, and is not limited by a tendency toward a purely synchronous speed. It has, in fact, the speed-torque characteristics of a series-wound direct-current motor, so long as it is operated with its brushes, while it may be merged into a pure induction form by short-circuiting the commutator. In railway work this is not advisable, and is merely noted here as a matter of interest. The original Thomson motor and its present representative is an out and out transformer motor, but the same general scheme of operating in virtue of a polar line established by a commutator has been variously applied by Thomson himself, Wightman, Latour, Eichberg and Winter and others. Such motors all are properly derivatives of the induction motor idea, rather than foster children of the direct-current motor.

The repulsion railway motor, as described in the Institute papers by Slichter and Steinmetz, presents characteristics very similar to those of the pure series alternating type. Like them, it has rather greater weight and rather less efficiency than a standard railway motor of similar capacity, but starts and accelerates without an objectionable call for energy, and has, save at starting, a good power factor. It is radically different in the features of design from the series motors, having no salient poles, working its iron at fairly high density, and being wound, so far as its exterior connections are concerned, for relatively high voltage. As it can be readily wound for voltages up to 2000 volts or more it does not require an exterior transformer save when the trolley voltage is exceptionally high, and thus gains in weight of equipment. It can be arranged to run as a series-wound motor on direct-current lines, but probably with less ease than a pure series motor, on account of a less favorable form of magnetic circuit and radical differences in design. In spite of this it may answer sufficiently well in this function for practical purposes.

It is quite out of the question, on present data, to form a proper opinion as to the relative value of the series and the repulsion motors. The published results from the former are rather the better, but it is pretty clear that the announcements regarding the latter represent a somewhat earlier stage of development. In point of fact the characteristics of the two types differ from each other probably no more than two examples of the same type by different designers would be likely to differ. The same machine cannot be operated on both plans to obtain comparative results, for if it is a thoroughly good repulsion motor it will be a rather bad series-alternating motor, and *vice versa*.

As to general operating conditions I think we must now recognize the fact that an alternating-current railway motor, possessing thoroughly practical properties, has been produced, and must be taken into account in all future operations. Certainly within limits, and, perhaps, generally, these new machines will find an immediate place in the art. They are young yet and their design will, doubtless, be greatly improved, but even now it is probably within bounds to say that they are considerably better motors than those upon which the art of electrical traction was built up. For the present their effect will be most felt in the consideration of new roads, and it is to be hoped will prevent a repetition of some of the shockingly bad engineering not uncommonly to be found on interurban roads. One must await further experience before venturing to guess the inroads that the alternating motor can make on existing systems. Much will depend on the facility with which the alternating motors can run on direct-current networks. This feature of the case it is impossible at the present to judge. Our existing direct-current railway motors are wonderfully good machines, not to be put out of service without excellent reasons, but if they can gradually be replaced by motors able to pass out upon an interurban line with a high-voltage trolley wire, at least upon its own right of way, this replacement will assuredly take place in very many instances. At least, it may be regarded as certain that the extension of electric traction into general railroad service can take place only by the aid of high voltage-working conductors, preferably feeding alternating-current motors.

RESULTS OF THROUGH SERVICE BETWEEN CLEVELAND AND TOLEDO

Managers of all high-speed interurban railway properties are watching with great interest the possibilities of connecting up such lines and competing with the established steam roads for what may be considered as the intermediate class of the long-distance traffic. It has been demonstrated in hundreds of instances in this country that interurban lines cannot only take from the steam roads a considerable amount of traffic between points 30 miles to 50 miles apart, but actually create a large amount of new traffic under such conditions. But the possibilities of securing a similar percentage of business on lines from 75 miles to 100 miles in length are still in doubt. The whole proposition simmers down to the question of whether the frequent service and lower rates of the electric lines can be made to compensate for undeniably the higher speed of the steam lines over such distances.

In view of these existing conditions, it is with interest that this paper is enabled to present the experiences of the Lake Shore Electric Railway in its efforts to secure a portion of the through business between Cleveland and Toledo, a distance of 118 miles.

Before going into these figures, however, it is well to consider carefully a number of mitigating circumstances which have undoubtedly prevented this company from making as good a showing as it might have done, or will in the future, as well as conditions which will probably not be found with other companies similarly situated for long-distance traffic.

During eight months in the year there are daily steamers between Cleveland and Toledo which are well patronized, as it is a pleasant trip and the fare is low. For a steam competitor the company has the Lake Shore & Michigan Southern Railway, admittedly one of the greatest trunk lines in the country, giving high speed and frequent service over a route which is nearly 10 miles shorter than that of the electric road. The fastest trains make the distance in 2 hours and 35 minutes, while the ordinary trains require 3 hours and 30 minutes. The fare on the steam road is $3.25. It should also be stated that in both cities it is necessary for steam railroad passengers to take street cars to reach the business districts, which increases the time as well as the fare, as compared with the electric line, which touches the centers of both cities, and incidentally gives transfers good on the city lines. The schedule of the electric line is 6 hours for the regular cars and 4 hours and 30 minutes for the limited cars, which leave the terminals morning, noon and evening. The fare on the electric line is $1.75, and no extra charge is made on the limited.

As the result of the Everett-Moore embarrassment the Lake Shore Electric was placed in a receiver's hands just after the lines which make up the through system were physically connected. For months the power equipment and rolling stock were indifferently maintained, owing to necessary retrenchments, and the service could not be relied upon. Furthermore, it was necessary to change cars at two points. These conditions, however, have been greatly improved during the last few months, and the schedule was reduced from 7 hours to 6 hours, and was better maintained. It is only within the last three or four months that cars have been run through without change.

About the middle of October the company installed the limited cars mentioned, and a pronounced increase in through traffic was at once noticeable. In November an accident to the power station necessitated the withdrawal of the limited cars and the reduction of regular cars to 2-hourly headway. This condition extended over into December, so that in the figures presented herewith there are not a fair showing for either the limited cars or the regular through cars. It should also be borne in mind that the figures include only actual tickets sold at the Toledo and Cleveland stations. Cleveland has no electric railway station worthy of the name, and it is a safe guess that half the people who ride on the interurbans do not know of the existence of a ticket office. Many passengers board the cars at some point other than the Public Square, and pay cash fare to the conductor. Many other people, particularly traveling men, who wish to visit the intermediate towns, buy tickets from town to town and stop over a car to see customers. In this way it is possible to cover six good towns and only spend a day on the trip from Cleveland to Toledo. It is safe to figure that if an accurate record of these various classes could be obtained they would more than double the so-called through traffic:

	Tickets Sold, Toledo to Cleveland			Tickets Sold, Cleveland to Toledo		
1903	Single	Excursion	Total Single Trips	Single	Exc'sn	T'l Single Trips
January	439	51	541	364	67	498
March	465	88	641	432	75	582
April	487	83	653	360	69	498
May	493	69	631	368	82	532
June	532	55	642	421	67	555
July	586	58	702	492	85	662
August	779	101	981	570	117	804
September	752	117	984	578	115	808
October	870	124	1,113	752	161	1,074
November	674	124	822	641	112	865
December	730	198	1,126	781	200	1,181

The officials of the company figure that the new limited cars are a most profitable feature of the service. They cost no more to operate—possibly a trifle less than the regular cars in view of the less frequent stops—and they are earning a trifle over 40 cents per car mile as compared with an average for all cars, including the limits, of 22 cents per car mile.

MANGANESE STEEL RAILS IN THE BOSTON SUBWAY

The Boston Elevated Railway Company has been making some interesting experiments with solid manganese steel frogs and curve rails in its subway, where the conditions of wear are very severe. It has now three solid manganese steel frogs, and is installing a fourth. The manganese steel rails are laid in 20-ft. lengths, and the experience with them, so far as wear is concerned, has been very satisfactory. The company has laid four curves, one of 90 ft. radius, with this rail, and has a total of 685 ft. of this rail in service. The Boston Elevated Railway Company is also conducting some experiments with nickel steel rails for curves where the wear is very severe.

SHOP KINKS

A STATIONARY LAMP BANK

It is safe to say that all who have done motor repair work in a car house remember, with many misgivings, the portable lamp bank that was nearly always out of order. This bank, used for testing and detecting grounds, as frequently constructed, consisted of five 16-cp lamps attached to a board by means of wall sockets. When needed some of the lamps are usually found to be broken, or, if this is not the case, the leads have become tangled, or possibly a car has run over the leads, and has put them completely out of business.

Fig. 1 shows a diagram of a testing outfit that has many advantages over the portable lamp bank. Its chief drawback is that it can be used in a limited space only.

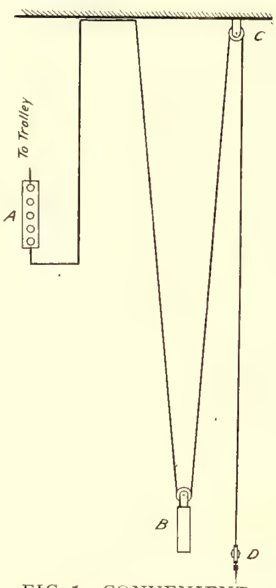


FIG. 1.—CONVENIENT LAMP BANK

The heavy line represents a No. 14 flexible insulated wire. After tapping off the trolley it passes through a bank of five lamps, placed on the wall at A, and then ascends to some high point of the building, where it is cleated firmly. From there it passes down under the movable pulley with weight attached at B, and then over the fixed pulley at C. It again descends, and, after passing through pulley D, which is screwed into the wall, it terminates in a suitable test point. Just behind the test point a knot should be tied in the wire to prevent it passing through pulley D. To use the apparatus it is simply necessary to pull the test point out to the place required, letting the weight, B, ascend. When released the test point is returned to the pulley, D, by the weight B. The apparatus is not costly, and very little time is required to rig it up. Should a greater range of usefulness be desired the wire can be made to pass through a second movable pulley after running through C, and then ascend to another fixed pulley above.

A PORTABLE LAMP BANK

A lamp bank which is quite an improvement over the five-lamp instrument, as usually constructed, is shown in Fig. 2. This consists of two 300-volt lamps, arranged in a framework as shown. These 300-volt lamps are readily obtainable, as they are used on many electric railways for switch lights. Where lamp breakages occur every few days with the old bank, it has been the experience of the writer that not an accident of this kind happened to the newly-constructed one in which the 300-volt lamps were used in a period of six months. If desired the bulbs could be further protected by tacking a wire screen over the opening on each side.

A CIRCUIT-BREAKER TESTER

Automatic circuit breakers, like all other electrical apparatus, are liable to get out of order. When they do so extensive damage may result to the motor before the condition is discovered, unless some systematic method of testing is practiced.

Fig. 3 shows a diagram of connections for apparatus by means of which the circuit breaker may be quickly tested.

After leaving the trolley the current is passed through a barrel rheostat. This consists of an ordinary 50-gal. or 60-gal. barrel filled with salt-water. One of the leads entering terminates in an iron plate resting on the bottom of the barrel, and

from the other is suspended a second plate, which may be raised or lowered to regulate the amount of current.

A circuit breaker to be used in case of emergency is put in the circuit at C, and millivoltmeter, A, is connected around the shunt B; D being a false trolley wire running parallel to the main trolley wire, and 2 ft. or 3 ft. away from it.

The car whose breaker is to be tested is run on the track under the false trolley wire, and the pole is shifted over this wire. The brakes of the car are set tightly and the motors thrown in multiple. The circuit breaker, C, is closed, and the current, which is read at the millivoltmeter A, is regulated by lowering the movable plate in the water rheostat. By repeated testing and adjusting, the circuit breaker in the car may be set at any value desired.

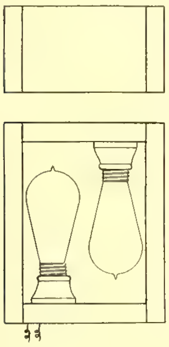


FIG. 2.—LAMP BANK

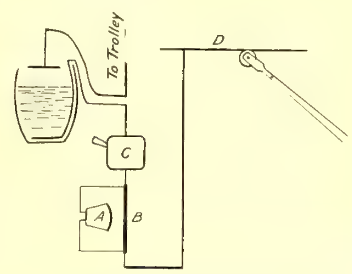


FIG. 3.—APPARATUS FOR TESTING CIRCUIT BREAKER

As the current used in testing is abnormal, the motors are thrown in multiple, so that each motor will get but one-half the total current flowing. If the brakes will not hold the car, or if putting current through the motors is deemed inadvisable, the motors may be shunted.

On a K-10 controller, or one of similar type, this may be readily done by soldering to the ends of a wire of suitable length two flat plates. One plate is slipped between the top finger and top segment of the controller cylinder, while the other is placed under the bottom finger. This gives a direct connection from trolley to ground, and very little current will pass through the motors.

As extreme accuracy in the measurement of the current provided is not required, the carefully calibrated shunt accompanying the millivoltmeter need not be used. One that can be left in the circuit permanently may be made of a piece of copper wire of suitable size, and calibrated by means of the standard shunt. The small leads from the shunt may be lead to suitable binding posts, so that to insert the millivoltmeter it is only necessary to connect its terminals to these binding posts. This obviates the extra trouble of inserting the shunt in the circuit every time the apparatus is used.

Many managers who have implicit faith in their automatic circuit breakers would certainly have to modify their ideas considerably were they to construct such a testing apparatus and use it. In the writer's experience some of the breakers tested absolutely refused to open. In several instances the power-house breaker was blown while the car breaker stood firm.

AN ELECTRIC GLUE HEATER

The shop in which the writer was employed was provided with a four-pot hot-water glue heater. When, in summer, the shop heaters were turned off, there was no means of supplying heat to the glue heater, and its use was discontinued. A kerosene stove was obtained; but, besides consuming about 15 cents worth of kerosene per day, this stove was an endless source of trouble to the cabinet-maker in charge. Caring for it consumed from one-half hour to 1 hour per day of his time.

The writer hit upon the idea of providing the old heater with electric heat. Two of the glue pots were removed, and through one of the openings a bank of three lamps was inserted, so that half the lamp bulb was immersed in the water. In the other opening was placed in the same manner the two other lamps of the five in series. At first 16-cp lamps were used, but these did not provide sufficient heat, and 32-cp lamps were substituted. These provided plenty of heat, and aside from an occasional burning out of a lamp no trouble at all was experienced thereafter. As a great deal of the water evaporated, it was necessary to add considerable water each morning, but the cabinet-maker, remembering his previous troubles with the oil stove, did this willingly.

This simple idea affected a saving of at least 30 cents per day, while the cost of constructing, considering cost of lamps, sockets and time, was about $2.50.

RAIL JOINTS AND THEIR RELATION TO PAVEMENTS*

BY C. R. VAN BUSKIRK

Ever since railroads were first introduced in the country there were, of necessity, rail-joints, but these joints were made with only two objects in view. One, of securing the rails in such manner as to prevent any longitudinal motion, except for the allowance of expansion and contraction, and the other to secure the ends in such a manner as to prevent any lateral or vertical motions.

It is the latter movements which we are to discuss principally, as their actions cause the main, and, I might say, the only troubles which harass the municipal engineer in his dealings with streets, and the rail-joints in their relation to pavements.

Rails are put together and kept from moving apart by two pieces of metal, called fish-plates, one on either side and bolted, and the result of this particular part of track laying is what causes in a great measure the disturbance so disastrous to pavements, and while it is more noticeable in some than in others, still the trouble can be discerned in all kinds of pavements, and more particularly in the asphalt pavement of the present day. Concerning the first object, we have very little to discuss or enter into, for in the putting together of the rails they are bolted together in order to prevent any motion longitudinally except that allowed for expansion and contraction, caused by changes in temperature, which in this vicinity amount to an average of 110 degs., according to the official reports of the weather bureau of New York City; to admit of this the holes in the plates are punched elliptical in shape, which allow the rails to expand or contract without cutting the bolts joining the fish-plates and rails together, this applies to exposed rails as on steam roads or on streets without any pavement, or with old cobble pavement; the change in the length of the rails, due to expansion and contraction for 110 degs. variation in temperature, are three-sixteenth of an inch for a 30-ft. rail and three-eighths of an inch for a 60-ft. rail, the latter being the only rail now laid in the Borough of Brooklyn. On account of the friction of pavement and rail it is conceeded by the best authorities that where the pavement is laid on a concrete foundation or even granite blocks on a sand foundation, provided the blocks are close together, there is no longitudinal movement of the rails, for although there is a tendency to do so, yet the strain is taken up by the rail itself.

The old Nassau Railroad Company, which became a part of the Brooklyn Rapid Transit Company's system in 1893, probably furnished the only case where the longitudinal movement of the rails caused any trouble in the pavement in this city. The case quoted was the result of the company's desire to give an easy riding road by making a track without any joints, theoretically, and the process of welding was instituted which made the various rails one long rail.

The processes of welding were of two kinds, electrically

*Read before the Brooklyn Engineers' Club, Feb. 11, 1904.

welded and cast welded, the latter being known as the Falk patent. The method of electrical welding consisted of joining the rails together and applying an electric current, which caused the two rails to fuse together. This was found by the Johnson Company, which built the Nassau system, to be very expensive, and, therefore, was temporarily abandoned, and the cast-welded joint was substituted in its place over the greater portion of the entire system.

In the cast-weld, a mould was placed around the ends of the abutting rails, the ends having been first cleaned by a sand blast, in order to remove all scale and rust, leaving the surface clean and bright and in perfect condition for amalgamation, and molten iron was taken from a portable cupola and run from this into ladles and poured into the mould by the workmen; in both of these no electric bonds were needed.

Whether the question of temperature never entered in their calculations or not is hard to tell, but this fact remains, that as the work was done in cool weather, as soon as the summer came the rails buckled in such a manner as to displace the pavement and bring the first point in our discussion into prominence. When the winter came and the rails once more came back in their place there were holes, caused by the buckling of these rails. This occurred only in the cobble-paved streets and on streets where there was no pavement. On the granite-paved streets it had no effect, proving the statement made previously.

In the movements now before us for discussion we have the joint exclusively to deal with, and it brings us to the second point in our discussion, and the main one in which we are interested; this joint and its relation to pavements, totally regardless of the length of the rail, its size, depth or any other dimension, it is the the joint only which we are interested in and which has given the city engineer all the trouble.

When the first rails were laid in our city little thought was given to the joint other than to its usefulness in holding the rails together and to prevent the motion previously cited. There was no pavement which was ruined by the joint, nor which would cause the engineer on municipal work any uneasiness, for in most cases, and I might say all, there was either cobblestone for the pavement or the earth itself, neither of which had any impression made upon it by a loose joint or one where one rail was lower than the other, causing a pounding which eventually loosened the joint. None of these different faults, however, caused any uneasiness to the city engineer, but only to the railroad companies themselves, until the new and improved pavements began to come more and more into use on streets where car tracks were laid, and with it came the question to the railroad companies as well as to the city engineer, what fish-plate is there which will reduce, if not prevent, the lateral and vertical motions of the rail and the pounding at the joint, and by so doing preventing the wear of the pavement.

We find the trouble making itself manifest principally in the asphalt pavements, although it occurs as well in other pavements but not so disastrously. The Brooklyn Rapid Transit Company has tried many methods to obviate this trouble, but have had failures with all, more or less, until the Weber joint came upon the market. The construction of the Weber joint admits of the even distribution of all shock and movement at the joint, and, being a base support joint, prevents low or dipped rail ends, and thus does away with the pounding at the joints, which ultimately destroy the pavement around the ends of the rails, more especially the asphalt pavements. This joint is designed with sufficient strength but does not produce excessive stiffness or rigidity, and is not only as strong as is the normal rail at the center and quarter but is also as elastic. Otherwise it would wear the rail and make a hollow at the joint, for this defective quality causes a joint to become a hard spot, or it might be likened to an anvil, where constant pounding will flatten the rail, and causes excessive wear of the rolling stock and a poor riding track.

In the Weber rail-joint there is an angle called a shoe-plate, on which the two rails rest to give the rail an even bearing, and in the comparison of the angle-bar with the Weber joint we do not find it strange that as angle-bars have but about one-third the strength of the rail 30 per cent to 50 per cent of the track labor is concentrated at the joint where the angle-bars are used in the endeavor to maintain surface and line and secure to the rail a uniform wear. Between the angle-iron and the joint-plate is placed a piece of yellow pine wood, full of resin, which serves as a filler. Naturally the moisture from the earth and atmosphere soon begin to get in the wood filler, and it commences to expand so that the plate and bolts are under a constant strain, and as the wood filler, which does not decay, being under constant compression and practically enclosed in steel, preserves a tension in the bolts which prevents any movement in the parts. It can be readily seen that this expansion of the wood prevents any looseness in or around the plate and forms a joint which is absolutely tight, which prevents any sag at the joint ends, prevents any lateral or vertical motions, and, above all, makes a joint against which asphalt pavement can be safely laid.

Since the Nassau Railroad Company introduced into this city the process of welding a great many improvements have been made by the Lorain Steel Company in electrical welding. The present method of electrically welding rail joints, as applied by the track welding department of the Lorain Steel Company, comprises three distinct operations. The first is that of sand blasting, by means of which all dirt, rust and foreign matter is removed from the rails at the points where the welds are to be made and from the bars used in making the joints. The apparatus for this work consists of a 10-hp motor driving an air compressor, a tank for the storage of air and a bin for holding a supply of sand. By means of a hose and nozzle the operator directs the blast of air carrying the sand to the rail until all foreign matter has been removed. The bars are similarly treated, and the joint is ready for the actual operation of welding.

The apparatus for welding is carried in two cars, coupled together by a special form of slip coupling, which permits of sufficient range of movement for the car carrying the welder proper to be moved from one weld to another of the three welds necessary in making a joint without the necessity of moving the second car. The welder itself is hung from a bail on a crane extending out beyond the end of the car. This crane permits of lowering and raising, so that the jaws of the welder itself are hung from a bail on a crane extending out beyond the end of the car. This crane permits of lowering and raising so that the jaws of the welder can engage the side of the rail, and also the shifting of the welder from one side to the other to engage both rails of the track. The crane is operated by friction clutches from a shaft in the car, which is kept running continuously by a 5-hp motor. This motor also drives a small rotary pump for circulating water through the welding transformer and the faces of the contacts to keep them cool. After the water has passed through the welder it goes to a cooling tank on top of the car, which has a false bottom, and air, from a blower in the car, is forced under the false bottom and upward through numerous holes into the water, thus forming a most efficient method of cooling. The welder itself is an alternating-current transformer, on each side of which and supporting it, but insulated therefrom, are two large levers, hinged together at about two-thirds the distance from the top, for transmitting the necessary pressure to the weld. These levers are connected at the top by an hydraulic jack. A hand pump for forcing water into the jack is bolted to one of the levers. A pressure of 4100 lbs. per square inch is obtained on a 3⅞-in. diameter ram of the jack, the leverage on the arm increasing this so that about 37 tons pressure is developed at the weld.

In making a joint, flat rolled steel bars are used, having at each end a boss or projection on one side, which form the contact points between the bars and the web of the rail and confine the weld area to these sections. A flat strip of steel, ⅛ in. thick by in. wide, is placed across the middle of the bars on the same side with the bosses. The bars are supported on small blocks and placed across the joints so that the middle strip engages the web of both rails. The middle weld is a vertical one, and made the full width of the bar, the end weld a horizontal one.

The welding train of two cars is moved up to a joint, and the welder is thrown into place and the jaws made to press against the bars at each side of the rail. The current is then turned on and flows from contact to contact through the bars and the rail web. By altering the pressure on the jaws the resistance of the junctures is increased and the whole is soon brought up to a welding heat. As soon as this point is reached the current is cut off, and simultaneously the pressure is brought up to the full amount. The pressure is then loosened, and the welder car moved back to bring the jaws opposite the extremity of the bars. The same process is again followed here, except that when the final pressure has been applied it is held there and the weld permitted to cool under pressure until the metal has cooled sufficiently not to show any glow. The welder is then moved forward to the other end of the bar and the process repeated, after which the welder is raised and moved to the other side of the car to engage the opposite joint.

By holding the pressure after the weld is made a remarkably tough weld is secured. It will be noted that only the end welds are thus treated, as the center weld is not subjected to any strain it is not essential to have toughness there. It has been found desirable to weld the ends of the bars while the bars are in an expanding state. By making the center weld first and not stopping to cool it under pressure the greatest elongation of the bars is secured. After the ends are welded and the bars cool off they shrink and exert a powerful pull to bring the abuting rail ends together, thus closing the slightest opening and leaving practically no joint at all. This is an important point in the manufacture of a continuous rail, for if the abutting rail ends are not brought firmly together the metal in the head of the rail will have a chance to flow into the opening between the rails, and this in time will cause a low spot in the head of the rail. As the bars are always in a state of tension it follows that the rail itself, enclosed between the bars, is in a state of compression. Any construction of the rail itself between the joints will be transmitted to the end welds, and it is, therefore, necessary to have these welds exceedingly tough to withstand the strain. The object of the center weld is simply for vertical stiffness and to prevent any movement of the rail ends.

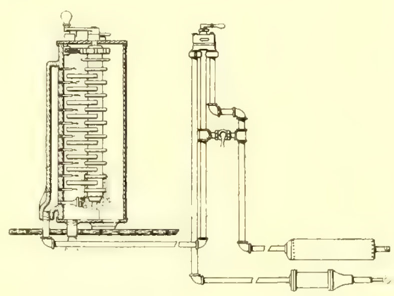
In the car coupled to the welder is carried a rotary converter for changing the direct current from the trolley to an alternating current. The third and last operation in the process consists in grinding the head of the rail to a true surface. In welding new rail there is little need for this tool, but in old track, where the rail ends have been battered, the receiving rail is purposely welded higher than the other. The grinder is then used to grind out the inequalities in the rail head and bring it back to a true surface. The grinder consists of an emery wheel mounted on a carriage having two rollers, which are about 4 ft. apart. This carriage is let down on the rail so that the rollers pass along the head of the rail, the emery wheel being over the uneven portion at the joint. The carriage is connected with a motor on a car by a swing frame, thus enabling the operator to move the emery wheel back and forth over the joint while the car remains stationary. By means of a hand wheel the emery wheel is gradually fed down, and as it is moved forward and back it grinds off the high places until the whole joint is brought to a true surface. The principle is very much the same as a carpenter's plane. With this final operation the joint is left complete.

Carried on as a continuous process, it takes from 12 minutes to 15 minutes to complete a joint. About eighty joints can be made on an average in 24 hours, or a mile of single track of 30-ft. rails could be welded in about 4½ days, at a cost ranging between $2,000 and $2,500, or in the welding of the 60-ft. rails now in use the work could be done in about 2¼ days, and at a cost of $1,000 to $1,250. The bars used are 1 in. x 3½ ins. and 1⅛ ins. x 3 ins., the length varying with the form of joint previously used. On new rail, where the ends are left without any drilled holes, especially for welding, the length of 18 ins., while on old rail the bars must be long enough to reach back of the old bolt holes, and in some cases requiring bars as long as 48 ins.

This method of joining the rails together is to be instituted during the coming season by the Brooklyn Rapid Transit Company, and as the rails are made one long rail there can be no sag at the joint, and hence no wear of the pavement, and the cause of trouble to the municipal engineer will be lessened, if not removed entirely, by the use of either the Weber joint or welding by the method just described.

AIR BLAST FOR CONTROLLERS

H. P. Wellman, superintendent of motive power of the Camden Interstate Railway Company, the electric railway connecting Huntington, W. Va., Cattlettsburg, Ky., and Ironton, Ohio, has devised an ingenious method of keeping the controller contacts clean from dirt and copper dust and thus preventing burn-outs by tapping the air brake exhaust into the controller casing, as shown in the illustration. No changes are required in the controller except the addition on the outside of the casing of a vertical duct or channel, which can either be made integral with the casing or bolted on. The air brake exhaust pipe is tapped into the lower part of this duct and the nozzles connected with it are directed against the controller cylinder, a large bell-mouth nozzle being located close to the regular blow-out magnetic coil at the bottom. These nozzles are made of an insulating material, such as mica, fibre or wood, and the diameters of their bores vary in size, the smaller openings being near the bottom, thus allowing an even play of air into the controller from all nozzles. The air exhaust from the controller is at the bottom of the casing and discharges through a pipe in the platform.



AIR BLAST FOR CONTROLLERS

Mr. Wellman has taken out a patent on his device, and claims that it not only keeps the controller clean but that it also muffles the noise of the exhaust and so prevents the annoyance heretofore experienced by passengers and pedestrians on account of noise and avoids the danger of frightening horses.

That the Shreveport Traction Company is wideawake is shown by a perusal of the pamphlet which it issues for public distribution. The company supplies current for many manufacturing purposes, and the publication contains letters from users evincing their satisfaction with its service. The booklet also includes some sensible suggestions to passengers, and, in general, serves as a medium between company and public.

METHOD OF MAKING COMPETITIVE TESTS OF CAPACITY, POWER CONSUMPTION AND EFFICIENCY OF MOTOR-DRIVEN COMPRESSORS FOR BRAKE SERVICE

BY EDWARD H. DEWSON

The proper basis for the determination of the size of compressor to be supplied for a given brake service is that when the equipment is new, the required amount of air can be supplied with the compressor operating one-fourth of the time. This gives a safe margin to cover the decrease in efficiency due to natural wear, also the temporary derangements of the system calling for an increased supply until repairs can be made, or excessive demands due also to temporary causes. Thus, during the life of a compressor, the time it was running would average somewhat less than one-third of the total time the car was on the road.

A test to determine the relative efficiency of the various makes of compressors designed for car braking should, therefore, be based not upon what the compressors might do when operated continuously, but rather under conditions which pertain in actual service, when the compressor is rarely in operation more than a minute at a time. That is, the basis of comparison should be the electrical energy required by the different compressors to deliver a given number of cubic feet of free air compressed to a given pressure every 3 minutes, the quantity and pressure to be such that the compressor will be in operation not to exceed one-third of the time, the tests to continue until the temperature of the various parts of the compressors has remained constant for at least 1 hour.

INSTALLATION

With the compressor on the car and in operating condition, that is to say, with the box in place, if one is used, etc., connect the discharge outlet by means of a proper hose to a reservoir of not less than 3 cu. ft. capacity, the air to enter, preferably, at the side of the reservoir. From one end of the reservoir make connection with a second reservoir, of a capacity, preferably, not more than one-fourth the rated capacity in cubic feet of free air per minute of the pump being tested. It is not essential that the capacity of the first reservoir be known, but that of the second reservoir should be determined by taking the weight of the reservoir, when empty, and that when filled with water, and divide the difference between the two weights by 62.3, which will give a very close approximation to the volume of the reservoir in cubic feet. In the pipe connecting the two reservoirs, and quite close to the second reservoir, should be placed a three-way cock, of which the branch should be open to the atmosphere. Between the three-way cock and first reservoir should be placed a needle valve for regulating the flow from the first reservoir, to which is attached a standard single pointer gage, reading to 180 lbs. The second reservoir should be provided with a single pointer gage, graduated in atmospheres up to 10. In addition to the above the first reservoir may be provided with a drain cock for the purpose of bleeding the air from the same without passing it through the needle valve. In the pump circuit there should be a wattmeter, also an ammeter, if convenient. A voltmeter should be so connected that it will measure the drop across the entire motor. A revolution counter should be provided, and means for driving same from the end of the pump shaft. The com-

Co.

File No.............Sheet No. 1.

Test of motor-driven compressor for brake service.

Place of test.. Date.................190...

Make of compressor..

Form....................Rated horse-power....................

No. of Motor...................No. of pump..................

Diameter of cylinder..............in. Stroke................in.

Piston displacement per revolution C =..................cu. ft.

No. of teeth in pinion................and gear..................

Temperature of atmosphere................................°C.

Constant pressure reservoir...........Diameter...........Long.

Measuring reservoir..................Diameter...........Long.

Actual volume of measuring reservoir V =................cu. ft.

Atmospheric pressure attained in measuring reservoir on each run. At =..

Volume of free air compressed per run V × At =..........cu. ft.

Time between starting each run..............................min.

Record certified by

....Co.

....Co.

Run No. 1	Counter Readings 2	Revolutions of Pump = R 3	Seconds Pump is in Operation = T 4	R. P. M. of Pump vs 90 Lbs. = $\frac{R \times 60}{T}$ 5	Volts Average = E 6	Amperes Average = A 7	Wattmeter Readings 8	Watt Hours = Wh 9	Temperature of Valve Cap °C. 10	Theoretical Capacity Cu. Ft. per Minute C × RPM 11	Cu. Ft. of Free Air Delivered per M $\frac{V \times At \times 60}{T}$ 12	% Cylinder Efficiency = $\frac{No. 12}{No. 11}$ or $\frac{V \times At}{C \times R}$ 13	Electrical Horse Power EHP = $\frac{E \times A}{746}$ 14	HP to Compress to 90 Lbs. 1 Cu. Ft. Free Air per Min. $\frac{EHP \times T}{V \times At \times 60}$ 15	16	17

FORM OF TEST RECORD RECOMMENDED

pressors should also be provided with a valve cap drilled for the reception of the bulb of a thermometer.

TEST READINGS

When the above has been accomplished the test proper should be made as follows:

One man should be stationed at the needle valve with the duty of maintaining a uniform pressure of 90 lbs. per square inch in the first reservoir; just previous to the starting of the test fill this reservoir, the needle valve being closed and three-way valve thrown to pass air into the measuring reservoir.

At a given signal the pump should be started, the needle valve opened sufficiently to hold the pressure in the first reservoir at 90 lbs., and a stop watch started, wattmeter and revolution counter readings having been taken just previous to starting.

When the predetermined amount of free air has been delivered into the measuring reservoir, as determined by its gage, stop the pump and watch, at the same time close the needle valve and take the wattmeter and revolution counter readings. During this time the readings of the ammeter and voltmeter should have been taken, the average reading of each, as well as the temperature of the valve cap and of the surrounding atmosphere being recorded.

Let the air in the measuring tank escape, and when 3 minutes from the time of starting the pump have elapsed, repeat the test as above outlined, continuing until the readings of the thermometer in the valve cap have remained constant for an hour. If desired the temperature of the motors may be obtained by inserting the bulb of a thermometer in a cavity drilled for the purpose in one of the screws by which the poles are secured to the frame. Note that the pressure of 90 lbs. is to be retained in the first reservoir throughout the entire test, the air in the measuring reservoir only being permitted to escape after each run.

The following sizes of measuring reservoirs and corresponding pressures at which pumps are to be stopped are recommended:

Horse-power	Reservoir	Pressure	Approximate Amount Free Air
2.5	12 ins. x 33 ins.	4.5 atmos.	8 cu. ft.
5.	16 ins. x 42 ins.	4.5 "	16 "
7.5	16 ins. x 48 ins.	5.5 "	26 "

Bear in mind, however, that the actual capacity of the measuring reservoir must be determined for each test in the manner above described.

In making competitive tests it is important that the voltage is the same for both, and is maintained at a constant pressure through the tests.

CALCULATIONS

The data called for in columns 2, 4, 6, 7, 8 and 10 will be recorded exactly as read from the various instruments. In column 3 will be entered the difference between the figures on the same line in column 2 and those of the succeeding line of the same column. That is to say, the entries in No. 2, and also No. 8, will be the readings of these instruments just previous to the run in question, consequently, there must be one more observation in each case than the number of runs made.

By multiplying the number of revolutions as figured in No. 3 by sixty, and dividing the product by the number of seconds the pump is in operation, the average speed in revolutions per minute is obtained, which is to be entered in column 5.

Unless a special wattmeter is obtained, readings from same will not be sufficiently close to warrant taking them every run, particularly with the smaller sized pumps. A record, therefore, made after every tenth run (recorded on lines of runs 1, 11, 21, etc., until the test is closed, when the final reading must be entered) will suffice in most cases. When taking the readings be sure to enter the cipher, if one appears printed on the dial just to the right of the moving figures in the little rectangles, as this indicates that the right-hand movable figure is in the ten's place instead of units, as might be supposed. To obtain the watt-hours the differences obtained from column 8 must be multiplied by the "constant," as indicated on the dial, these products to be entered in column 9.

The theoretical capacity in cubic feet of free air per minute, column 11, is obtained by multiplying the piston displacement per revolution, C, by revolutions per minute of column 5.

As the pressure obtained in the measuring reservoir is read in atmospheres, the volume of free air which has been compressed to 90 lbs. per run is readily obtained by multiplying the capacity, in cubic feet, of this reservoir by the number of atmospheres of pressure, i. e., $V \times At$, which will be the same for all the runs.

The rate per minute at which compressed air is actually delivered, in terms of cubic feet of free air, is obtained by multiplying the product, $V \times At$ by 60, and dividing the result by the duration of the run in seconds. See column 12.

The cylinder efficiency, column 13, is obtained by dividing the number of cubic feet of free air actually delivered per minute (column 12), by the theoretical capacity expressed in cubic feet per minute (column 11).

The rate of expenditure of electrical energy in doing this work, expressed in electric horse-powers, is obtained by multiplying the average volts by the average amperes and dividing the product by 746—column 14.

In a test to determine the relative efficiency of two types of compressors, the true basis of comparison is the amount of electrical energy consumed in performing a given amount of work.

A convenient basis is the horse-power required to compress to 90 lbs. per square inch 1 cu. ft. of free air per minute. From the data already obtained this may be calculated by multiplying the electrical horse-power (14) by the duration of the runs in seconds (4), and dividing this product by the volume of free air compressed per run ($V \times At$), multiplied by 60.

NEW THIRD-RAIL SLEET BRUSH ON THE BOSTON ELEVATED

The Boston Elevated Railway Company has been obtaining very satisfactory results from a sleet brush which has been used on all the cars this winter, in connection with the third-rail shoe described in the issue of Feb. 6. Each brush is made up of about 670 flat steel wires, ⅛ in. wide and 1-32 in. thick, carried on the shoe hanger attached to the journal box. Pressure is secured by a spiral spring. When not in use the brush is kept raised from the rail by a pawl, which can be automatically tripped by a lever as the cars pass a certain point. Tripping levers are located at three points on the line, viz., at each end of the subway and at Rose wharf, so that if instructions are sent out by the superintendent of the elevated division to drop the brushes all will be in operation in 10 minutes. A pressure of about 30 lbs. is used on the brushes. For emergency sleet cutting service a hanger, rigged with seven of these brushes can be attached to any motor car or to a work car and run over the line.

The wires in the sleet brush are set at an angle instead of being set to bear directly across the rail. It is considered that a flat brush will pile up sleet in front of itself, but that if the wires are set at an angle the sleet will be brushed to one side. The angle is such that the sleet is brushed from the third rail away from the track rail.

The Columbus, London & Springfield Railway and the Dayton, Springfield & Urbana Railway have instituted through night freight service between Columbus, Springfield and Dayton. This branch of the business is increasing rapidly.

THE INSPECTION OF EMPLOYEES

BY H. N. BROWN

In a recent article in this paper the writer discussed the inspection of conductors by secret service agents to detect the appropriation of cash fares. Although the receipts all pass through the conductors, motormen can exert a greater influence upon the rectitude of a conductor than many realize. For instance, when a new conductor commences work he relies on the motorman to a great extent for information in regard to rules, regulations, etc. Should the motorman be inclined to be dishonest he can readily lead this man astray. First he will usually feel his way by asking the new man whether he is scrupulous about turning over all fares that he collects to the company, and if he finds his man on the fence he suggests ways of defrauding the company, which, if acted upon, soon brings the conductor into his clutches. Should he find the conductor firm in trying to do right, he will use different tactics in order to get around him. For example, he can run his car on fast time, thereby causing the conductor much annoyance by being called into the superintendent's office for running ahead of time. Again, he will run slow and have his conductor 5 minutes or 6 minutes behind his schedule time, which also means a reprimand from the superintendent or despatcher. After receiving one or two of these reprimands the conductor will usually feel that the company is not treating him exactly right, and will confide in his motorman to this effect. The motorman sees his opportunity and replies that if the conductor will knock down a few fares during the day and divide with him, he will see that the car is run on schedule time and there will be no further trouble. The conductor readily accepts this proposition, as he is well aware of the strict rules of the company in regard to reprimands, and knows if his attention is called to this matter too many times it means a dismissal from the company's service. He falls, therefore, into the trap that has been laid for him, and every time he runs with this particular motorman he knows that the latter expects to receive his share of the money taken, and on his part will endeavor to carry as many passengers as possible, in order that the conductor can knock down as much as he can and still compare favorably in his receipts with other cars on the line. Very frequently a motorman of this class will lay back on another car's time through the crowded sections of the city, and pick up all the passengers he can get, and after leaving this section run his car very fast to catch up to his schedule time before reaching the car house or the despatcher.

The only way the management can obtain information in regard to dishonest motormen is by placing inspectors on the rear end of the cars as conductors. Being the last on the list they are extra men, and are compelled to take the place of regulars on the lines when they are off duty. In this manner an inspector acting as a conductor can run with a number of the motormen during the inspection, and give a great deal of information to a railway company.

IRREGULARITIES OF THE CASHIER'S DEPARTMENT

Another opportunity for irregularity is in the cashier's department. It frequently happens on all street railway companies that when the cashier counts the money turned in by the conductors for a previous day's work he finds that some of them have made a mistake in their count and are either short or over. If a conductor is short, naturally, the company notifies him to that effect, and the conductor is compelled to make good the shortage. While all conductors are liable to mistakes in counting their money and placing it in their envelopes to be turned over to the company, the fact should not be overlooked that the clerks in the cashier's department, should there be one among them dishonest, could cause quite a contention among the conductors. In other words, if this clerk was inclined to be dishonest he could readily report four or five conductors as being short on the previous day's receipts from 15 cents to 25 cents or more, and by submitting this report to the cashier of the company, could compel them to pay this money without any redress.

Naturally, the conductor, upon notice from the cashier that he was short so much money on the previous day's receipts, is compelled to send this money at once to the cashier, and believing that he placed the proper amount of money in his envelope the previous night, will feel quite blue over receiving such a report. If he makes up his mind that he does not propose to lose the amount of the shortage charged up against him, on his next day's run he will collect an amount of fares equal to the amount charged against him and fail to register them, and by so doing reimburse himself for the previous day's loss. Should he not hear anything from the company in regard to these fares collected and not registered, he gives way to his first temptation, and finding that it is so easy to fail to register fares, he continues to do so until discharged by the company, when, as a matter of fact, he may have been perfectly honest in every respect until this shortage was charged against him.

Should the manager of any road find considerable complaint among his men in regard to unwarranted claims of shortage, it would pay him to place an inspector on the rear end of the car to find out whether the conductor was at fault or whether irregularity existed in the cashier's department. This information can be obtained in a very short time by the inspector, who is acting as a conductor, by placing in his envelope every night a certain amount of money over his actual receipts, and seeing whether it is returned to him from the cashier's department, providing the rules of the company are to send all over money back to the conductors and compel them to pay all shortage. In all large railways the cashiers have a number of assistants, and each assistant is given a certain number of envelopes of conductors' receipts from the previous day on one division. Should the complaint of the conductors come from this particular division the manager could easily single out, through his cashier, which assistant counted this money and was dishonest.

PETITIONS FOR RAILWAY FRANCHISES IN NEW YORK

President Edward A. Maher, of the Union Railway, of New York, which is controlled by the New York City Railway Company, has forwarded to the Board of Aldermen a petition for franchises to effect thirteen new connections, including the rights to cross several bridges. Under the extensions sought to be effected by the company its lines would be taken over the Washington Bridge, the Willis Avenue Bridge, the 155th Street viaduct, over the 149th Street and new Fordham Heights Bridges, when completed, and also over two bridges crossing the New York & Putnam Railway and the New York & Harlem tracks.

The proposed system would effect connections with the New York City Railway Company's system at more than a dozen points, and the Union Company's tracks would completely interlace the Bronx territory.

The petition from the company has been referred to the committee on railroads, with instructions to hold a public hearing on the proposition on March 23. It was developed that the privileges asked by the Union Railway are largely the same as those granted by the Aldermen a year ago to the Interborough Company. The State Railroad Commission refused to approve the request of the Interborough Company for permission to construct the road, and an appeal to the courts from this decision now is pending.

CORRESPONDENCE

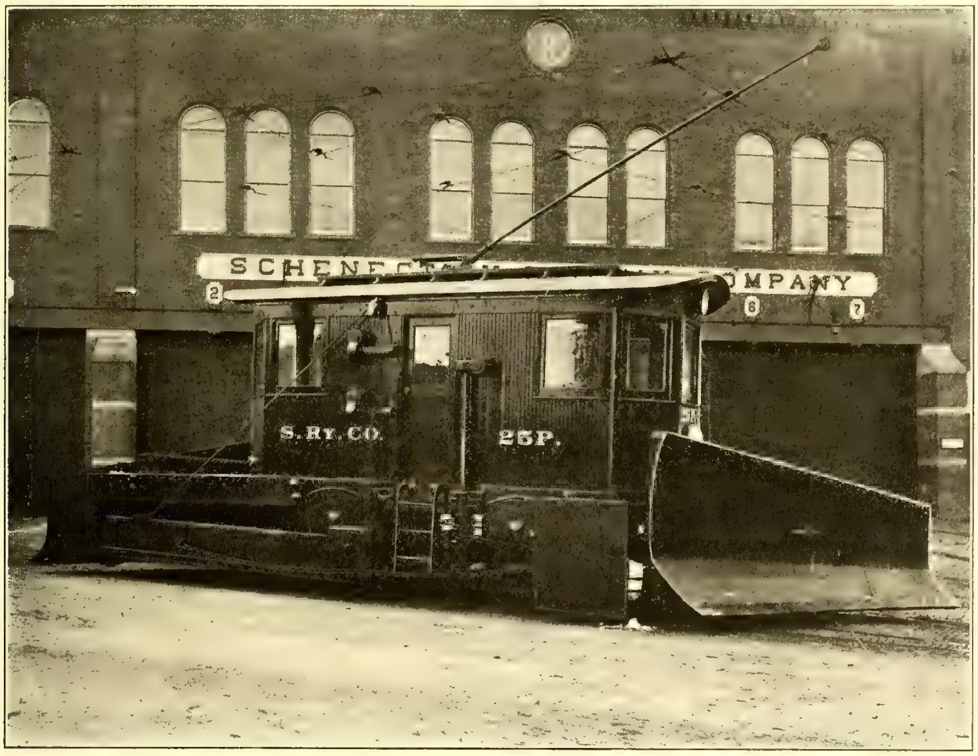
FIGHTING SNOW NEAR SCHENECTADY

SCHENECTADY RAILWAY COMPANY

Schenectady, N. Y., Feb. 10, 1904.

Editors Street Railway Journal:

I have read with much interest your recent editorial on the handling of the snow problem, and I am prompted to furnish you the accompanying description and illustrations of our work and methods, in the hope that our experience may assist others who may be confronted by similar problems.



SIDE VIEW OF SNOW PLOW

We have now in use in connection with our system for the removal of snow, both in the city of Schenectady and on our interurban roads, three rotary plows, one double-truck and three single-truck plows of the shear type and one sweeper. With this equipment we have been able to cope with all the severe storms of the winter, and have operated our road continuously without any interference whatever with our schedule time. The principal features of the three single and one double-truck shear plows, which we have recently added to our system, are shown in the accompanying illustrations, and there is also presented a street scene showing the condition of the track and roadway after having been cleaned by one of these plows. Following is a description of the shear plows which were built by our company during the last year:

TRACK AND STREET CLEARED OF SNOW IN SCHENECTADY

The single-truck plows are 34 ft. over the shear, and the double-truck plow 47 ft. The single-truck plows weigh approximately 17 tons, and the double-truck plow 30 tons. The single-truck plows are equipped with two G. E. 57 motors, with a gear ratio of four and one-half to one. The double-truck plow has four G. E. 57 motors, with the same gear ratio. In order to ensure ease of operation, worm gearing was adopted in the manipulation of the "shear" and the side wings. The worm gearing is operated by hand wheels inside the cab.

All the wires and cables are housed in a wooden box, asbestos lined, and fastened inside of the plow alongside of the wall, thus making them weather and water-proof. Only where the cable is carried to the controller is it taken underneath the floor, and at this point it is well housed in a water-proof box with asbestos lining. Thus far no trouble has been experienced from short circuits.

The rheostats are all fastened on the inside walls of the plow body, and protected with an iron casing of the squirrel-cage type. This eliminates much trouble that, as a rule, is experienced with rheostats, and, moreover, furnishes some heat to the men operating the plow. The wires leading from the inside of the plow to the headlight are carried in iron pipe, ¼ in. in diameter, thus making them water-proof.

The main frame of the plow is built of heavy yellow pine timber, well stiffened with angle-iron, giving it strength and weight. The shear, which stands at an angle of 45 degs. with the center lines of the plow, is mounted on a 12-in. channel-iron, backed up by 4-in. pine plank. The plank in turn is

END VIEW OF SNOW PLOW

fastened to two 5-in. T-rails. These T-rails slide in a cast-iron guide at top and bottom, which prevents cramping. The shear is raised by two ⅝-in. chains, fastened at either end of the 4-in. plank. The chains pass over pulleys and enter the cab, where they are wound on a 2-in. shaft, this shaft being operated by a worm and gear which enables the operator to easily raise the shear, and forming a self-locking device. The lowering of the shear is accomplished by simply loosening up the chain, the weight of the shear being sufficient to lower it. The shear is designed so that it can be raised 6 ins. above the rail. This has proved to be ample.

The side wings, one to each side of the plow, are 8 ft. long, and built of 2-in. oak planking. These wings are also manipulated by heavy chains wound on a drum, operated by worm and worm gear. The wing can be raised and lowered any desired height and angle, and made to project to a distance of 8 ft. from the side of the plow. In streets of fair width this permits of forming a driveway outside the track sufficiently wide to allow a vehicle to pass a car without getting in the way of it. If a ridge of snow be formed 2 ft. or 3 ft. from the rail, vehicles are quite sure to occupy the tracks. Underneath each end of the plow are two heavy wrought-iron diggers, which can be made to bear on the rails by the operation of a lever inside of the plow. A dog attached to the lever engages in a quadrant, permitting the diggers to be held at any desired angle and allowing any desired pressure of same upon the rails. It also permits of their being raised quickly when approaching a crossing or when backing up the plow.

There are four sand-boxes, two at each end of each plow. Each sand-box is operated independently, and the levers controlling them are within easy reach of the motorman.

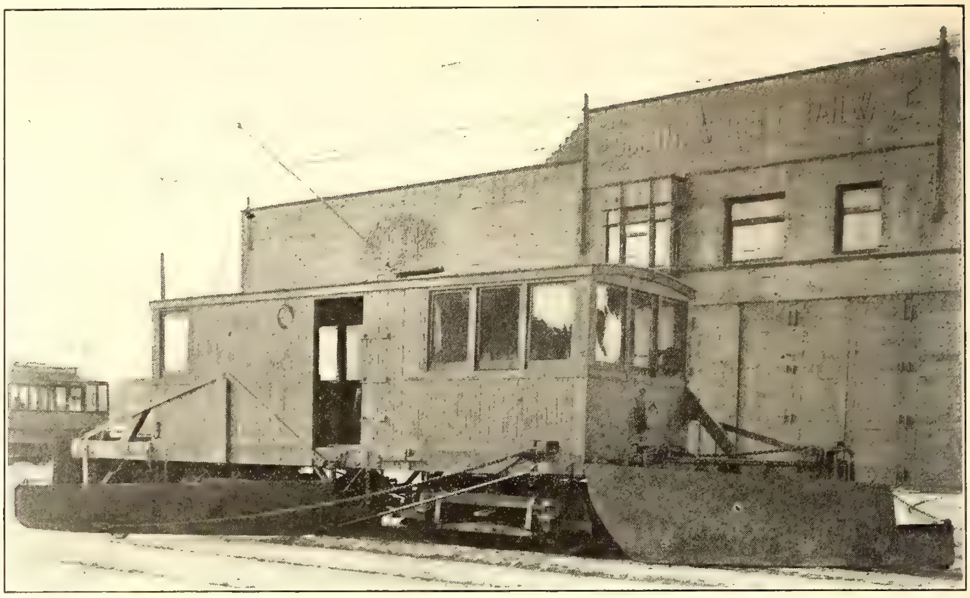
E. F. Peck, General Manager.

HANDLING SNOW IN THE NORTHWEST

Duluth, Minn., Feb. 10, 1904.

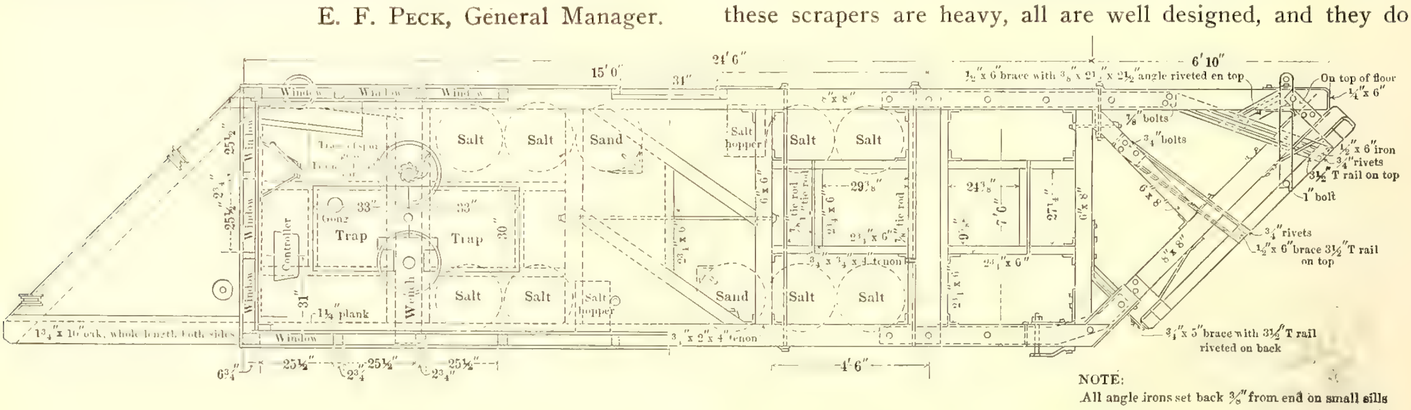
Editors Street Railway Journal:

In your editorial on the snow problem in the Street Railway Journal of Jan. 23, you ask for the experience of street railway companies in handling snow. The Duluth Street Rail-



SNOW PLOW BUILT IN DULUTH RAILWAY SHOPS

way Company has almost 75 miles of track in Duluth and Superior, 50 per cent of which runs through unsettled or thinly settled districts. Part of this track is from 300 ft. to 700 ft. above the lake level, and with the heavy snow-fall, low temperature (38 degs. below zero Jan. 25 this winter) and high winds, we would be expected to have trouble with snow, but in the last seven winters we have had very little trouble with it. We have on the different lines 8 miles of snow fences. All of our ninety-six cars are equipped with track scrapers. Part of these scrapers are heavy, all are well designed, and they do



PLAN OF SNOW PLOW BUILT AT DULUTH RAILWAY SHOPS

good work. On double-truck cars they are hung very low on the trucks.

In 1896 we designed and built a plow, which is shown in the illustration. This plow is provided with a front wing, track scrapers and a side wing on each side. It is a double-end plow, and carries salting and sanding apparatus. The front wing can be raised 1 ft., but when this wing is in use it scrapes the rail. The bottom edge of the wing at the rail is provided with cast-steel shoes, which will ride over the guard rail, switches or anything which the wing has ever struck. This wing is 4 ft. wide and 11 ft. 5 ins. long, and is at an angle of 45 degs. with the rails. The wing is hung and shaped in such a way that any snow which can't get out at the side on account of the

PETITION TO SUSPEND ST. LOUIS LINE.

The World's Fair management has asked the City that the St. Louis Transit Company be permitted to suspend the operation of its Clayton division through the World's Fair grounds until six months after the close of the exposition. The petition adds that the arrangement is to be conditional upon the operation of the line from its western terminus to the entrance at Pennsylvania Avenue, where passengers are to be transferred to the St. Louis & Suburban Railway Company without the payment of additional fare. The exposition management is said to have perfected an agreement between the Transit and Suburban Companies which will permit this.

deep banks is thrown on roof of the cab and is blown off. Side wings are each 2 ft. 4 ins. wide and 14 ft. 6 ins. long, and the end extends under the plow inside of rail line so that any snow that falls back from the front wing is taken up by the side wing. Wings are built of 3/8-in. tank steel, reinforced with heavier steel where needed. The front wing can be raised and lowered, and the side wing can be let back or brought out into position by means of double-geared winches, so that when obstructions or teams are met the side wing can be instantly let back, and brought out into position again without delay or stopping of plow. The cab, or enclosed part of the plow, is 7 ft. 6 ins. wide, and 24 ft. 6 ins. long, and is constructed about the same as an ordinary freight car. It has a sliding door on one side and seven windows at each end. In this cab are the controllers, cables, etc., the four winches that control the wings, eight oil barrels full of salt, two salt hoppers, two barrels of sand connected to valves, and the sand pipes.

It requires four men to operate the plow, a motorman, a side-wing man, and two men to operate salt. The front wing requires no attention. The man who operates the side wing stands to the right of and just back of the motorman, and has a good view of everything on the street. The plow can be operated in any storm with windows closed so that the men are warm and dry. The outer end of the side wing is connected with winches by a 5/8-in. high grade twist link chain. The 2 tons of salt we start out with will last 5 hours if the rails are salted heavily, and in that time we generally cover 50 miles of track. We have no center poles, and when the plow has passed over both tracks it leaves a clean path 35 ft. wide and four wet rails, at a labor cost of $5 for every 50 miles of track, or about 1 cent for every 1000 surface yards of snow removed. The plow is mounted on two Brill No. 27 trucks, and it rides smoothly. The trucks never leave the rails. The plow is equipped with four G. E.-67 motors and two K-6 controllers. Trucks and motors are the same as we use under our regular cars, so that seven months in the year we have no trucks or motors tied up under the plow. Neither can the plow be disabled longer than the time required to run out the truck and run another one in.

We find that the long, heavy side wing is a great help, as it piles the snow back 10 ft. from the rail and makes a place where track scrapers can throw the snow. In a heavy, wet snow-storm and a lowering temperature we run the front wing only, and use salt, keeping the plow moving as rapidly as possible. When a storm is over we clean up with the side wing.

In 1902 we built a second plow, exactly the same as the first one, and with these two plows we have no trouble and very little expense in keeping the tracks clear of snow.

We believe that plows should be kept in perfect repair, and should be equipped with the best of trucks and motors. Motors should have sufficient power so that plows can run on schedule time, otherwise it sometimes happens that the snow-plow as well as the snow-storm causes delay. It is not a good plan to take trucks that will not stay on the track, and motors that you know will burn out, and put them under a plow just because you cannot use them anywhere else.

William J. Smith, Master Mechanic.

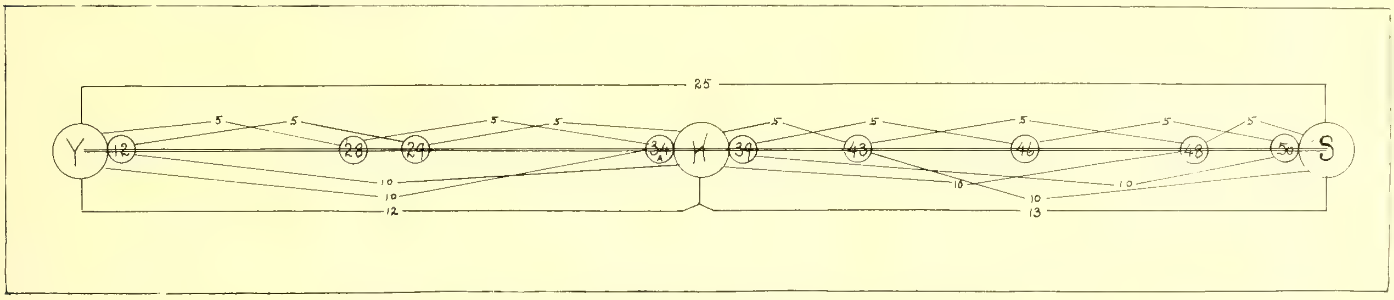
THE COLLECTION OF FARES ON THE YOUNGSTOWN & SHARON

THE YOUNGSTOWN & SHARON STREET RAILWAY COMPANY
Youngstown, Ohio, Feb. 1, 1904.

Editors Street Railway Journal:

The collection of fares on interurban roads has been a problem for some time, as on the majority of roads fare limits are established absolutely at different points, but there are many instances where this is not practicable and would be unfair for those desiring short hauls. For instance a passenger desiring to ride perhaps a quarter of a mile, would by this system be required to pay 10 cents, whereas by adopting fare limits overlapping each other, this is avoided. The latter plan has been adopted on the Youngstown & Sharon Street Railway, but, unfortunately, much confusion resulted among the conductors as to the fare limits.

The attached schedule showing the limits diagrammatically solved the problem and may be of interest to your readers who are operating under similar conditions.



FARE LIMITS ON YOUNGSTOWN & SHARON STREET RAILWAY

The letters Y, H and S, indicate Youngstown, Hubbard and Sharon, respectively, and stop numbers are placed within the circles, the small figures indicate the fares between the points outlined.

Godfrey Morgan, General Superintendent.

STATION MASTERS ON THE BOSTON ELEVATED STATION

Station masters are employed at all the stations of the elevated railway system in Boston, to oversee the loading of cars, direct passengers into the end doors, which are the doors used for loading during the rush hours, and instruct those leaving the trains as to the location of the exits. The station master also opens the side doors of the first car of all trains. The other side doors are opened only during the rush hours, that is, between 6:30 a. m. and 10 a. m., and between 3 p. m. and 8 p. m. This work is performed by assistant station men. As four-car trains are run between 6:30 a. m. and 9:30 a. m., and between 4 p. m. and 6:30 p. m., three extra station men are required during these hours. At all other times three-car trains are run as a rule.

The station masters are divided into two shifts. The day masters' hours are from 5:30 a. m. to 10:30 a. m., and from 1 p. m. to 5:30 p. m. The night masters work from 10:30 a. m. to 1 p. m., and from 5:30 p. m. to 12:30 a. m. As the side door attendants are on duty a maximum of only 8½ hours they work on one shift.

A new schedule has gone into effect on the Lackawanna & Wyoming Valley Electric Railway, between Scranton and Wilkesbarre. An express service of eight trains has been added, three trains running in the morning, three in the afternoon and two at night. These trains are run every 30 minutes or less.

THE WESTINGHOUSE SINGLE-PHASE SYSTEM ADOPTED BY TWO INDIANA ROADS

Two of the most important contracts for electric railway equipment that have been let in recent years have just been awarded to the Westinghouse Electric & Manufacturing Company. These contracts, while not comparatively large as regards the money involved, although of no mean proportion, are of immense importance to the future of the electric railway industry, as they involve the equipment of two long interurban railways with the Westinghouse single-phase alternating-current motor. These are the first two contracts to be let for single-phase electric motor equipment in the United States, if the ill-fated Washington, Baltimore & Annapolis plans are excepted. The first contract let was for the equipment of the Fort Wayne, Decatur & Springfield road, extending from Fort Wayne, Ind., to Springfield, Ohio. On this road the Westinghouse single-phase motor equipment with induction control was adopted, as it was not necessary to use existing direct-current trolley lines in any of the cities which are entered.

The Indianapolis & Cincinnati Traction Company, which is constructing a high-speed line between Indianapolis and Connersville, Ind., last week let a contract for the equipment of this 53 miles of road with the Westinghouse single-phase alternating-current railway system. As has been mentioned before in these columns this is to be a high-speed line, largely on private right of way, with excellent alignment, which will permit of high speed. It is the intention of the management to complete this line through to Hamilton, Ohio, and thus make it possible to give high-speed electric service between Indianapolis and Cincinnati. It is a line which has been mentioned before as being built primarily for high-speed through service rather than for local business.

The third-rail system had been practically decided upon before the advent of the Westinghouse system. The opportunites for saving in first cost and operation by the Westinghouse single-phase system have induced President C. L. Henry and Sargent & Lundy, consulting engineers for the work, to reconsider their plans for a direct-current third-rail road with rotary converter sub-stations and to adopt the Westinghouse single-phase system. Two 500-kw, three-phase, 25-cycle, 2300-volt generators were contracted for some time ago, to be used in connection with the third rail direct-current system, with polyphase distribution. The power station equipment, as regards generating machinery, will remain unchanged. The step-up transformers, which will raise the voltage to 16,500 for transmission, will be connected on the Scott system, so as to give two-phase current on the high-tension line. There will be six static transformer sub-stations, one-half of which will be connected on one phase, and the other half on the other phase. The transformers in these sub-stations will give 3300 volts on their secondary terminals, which will be the trolley line voltage. This voltage will be reduced by a transformer on each car.

As all cars must operate over the 500-volt direct-current city lines in Indianapolis, in order to gain entrance into the city, rheostatic control will be used instead of the induction control, which would be used were it not necessary to operate over direct-current trolley lines. Both methods of control might be used on a car, but the weight and complication of having two methods on a car is thought to counterbalance the small economy gained by the induction control on the alternating-current portions of the line. One of the chief advantages of the induction control is its economy in starting a car. On the interurban portion of the line, however, the stops will be few, and hence, if induction control were used it would have to be put on simply to gain economy in a comparatively small number of stops.

The first contract calls for ten cars, each equipped with four 75-hp motors, with gearing which will give a maximum speed on a level of 42 m. p. h. These cars are intended for local service.

The sub-stations will be approximately 10 miles apart. The trolley wire will be No. 000 copper. There will be no feeders supplementary to the trolley wire. The sub-station transformers will supply 3300 volts direct to the trolley line.

The consulting engineers estimate that in the equipment of the entire road as proposed, 93 miles from Indianapolis to Hamilton, Ohio, a saving over the former direct-current plans of $500,000 will be effected in first cost. It is also interesting to note that the adoption of this new system involves so little apparatus which would have to be discarded in case the single-phase alternating-current system did not prove to be a success. The generators at the power station, the transmission lines and the motor equipments would all serve equally as well on a 500-volt direct-current system, with high-tension transmission, and to change to such a system with rotary converter sub-stations would necessitate only additional direct-current feeder copper and the installation of rotary converters and step-down transformers of the proper voltage at the sub-stations. Although at first sight it might seem that the three-phase generators at the power station would not be the best thing for the use of a single-phase road, it is a question whether after all they do not serve the purpose better than single-phase generators, because of the greater capacity per dollar invested, which can be obtained from a three-phase generator as compared to a single-phase, and because of the greater ease with which multiphase generators can be operated in parallel.

This road offers all the problems met on any interurban line which might adopt the single-phase system, and the ease with which it meets them shows its great flexibility.

LARGE CARS FOR ROCHESTER, NEW YORK

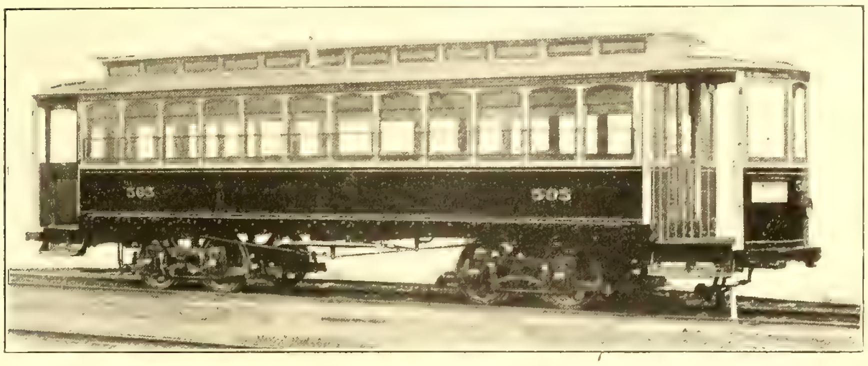
The car shown in the accompanying cut is one of ten lately furnished to the Rochester Railway Company, of Rochester, N. Y., by the J. G. Brill Company, for use on interurban branches of the extensive system which spreads like a network over Rochester and the surrounding country for many miles. The illustration shows the car before the motors were installed: the trucks will be equipped with four 25-hp motors per car.

INTERIOR OF ROCHESTER CAR

An interesting feature of these cars is the seating arrangement, which is shown in the illustration of the car interior. Longitudinal seats extending half the length of the car are placed at diagonally opposite sides, with transversely placed double seats opposite. This arrangement provides a wide aisle, and at the same time balances the load. The interiors are

handsomely finished in cherry, and the ceilings are three-ply curly maple veneer. The upper window sashes are stationary, and the lower have pockets in the side sashes with the openings covered with hinged lids.

The construction is extra powerful throughout. The side sashes, of long-leaf yellow pine, are 5½ ins. x 8½ ins., plated on the outside with 8-in. x ⅝-in. steel; end sills, 4¾ ins. x 9 ins.; sub-sills, 4¾ ins. x 7¼ ins.; diagonal braces, 4 ins. x 6 ins. The inside trusses are shouldered high upon the posts, and are 2½ ins. x ⅜ in.; under truss rods are anchored at the body bolsters. The platforms are dropped 8½ ins. below the car floor, and have 2¾-in. x 8-in. center and outside knees, reinforced with angle-iron. Seven steel rafters sandwiched between wooden carlings strengthen the roof. The length of the cars over all is 41 ft. ½ in.; length over platforms, 40 ft.; inside length, 29 ft. 3¾ ins. Width over posts, 7 ft. 9 ins., and over all, 8 ft. ½ in. The roofs at the center are 7 ft. 10 ins. Track scrapers, alarm and conductor gongs and angle-iron bumpers of the builder's patented make are also furnished.



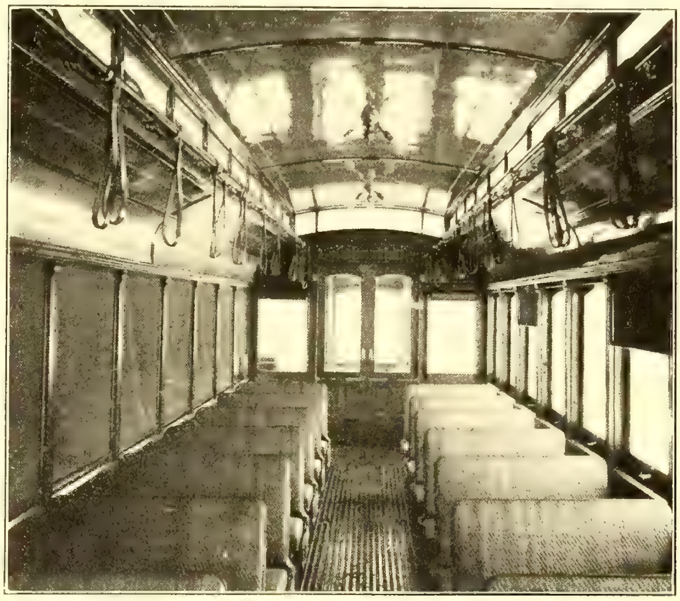
EXTERIOR OF CAR FOR ROCHESTER RAILWAY COMPANY

EAST BOSTON TUNNEL

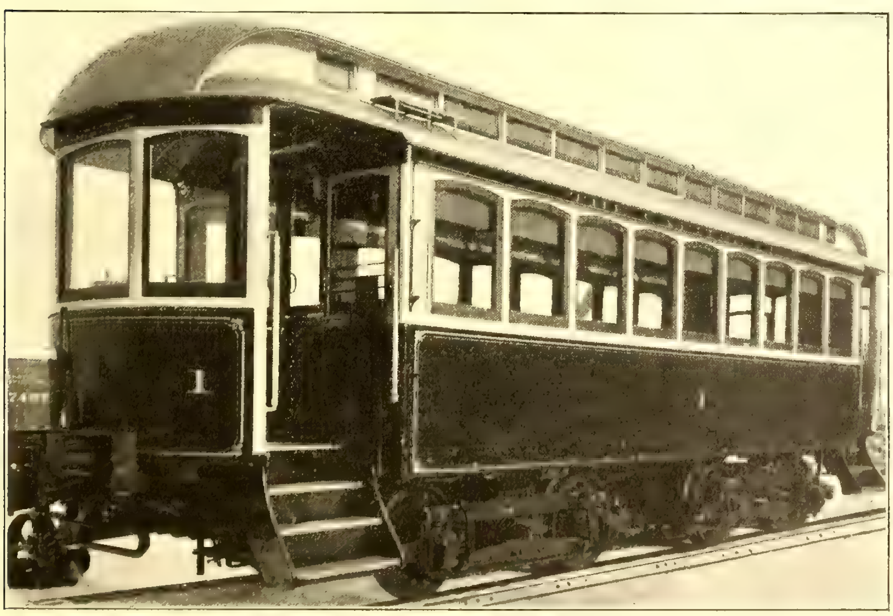
The tunnel connecting East Boston with Boston is now practically completed, as far as the structure of the tunnel is concerned, and the contractors are now installing the ventilating ducts and conduits for the feed wires. The track will be laid as soon as this work is completed. It is the plan of the Boston Elevated Railway Company, which will operate this tunnel, to run through cars from East Boston through the tunnel to connect with its Boston surface and elevated system, with probably a change of cars at the Boston end.

CAR FOR BISMARCK, N. D.

The American Car Company, of St. Louis, has delivered to the Board of Capital Commissioners of Bismarck, N. D., the handsome car shown in the accompanying illustration. This car is particularly interesting on account of its being one of the shortest ever mounted on high-speed trucks. It will be used on the State line referred to in the STREET RAILWAY JOURNAL of Feb. 13. The car is seated for thirty-six passengers, the seats being of the walk-over type, 34 ins. in length, leaving an aisle 22¾ ins. wide. Pockets in the side walls receive the window sashes. The interior is finished in natural cherry with decorated birch ceilings. The platforms are flush with the car floor, and are fitted with draw-bars and standard steam car couplers. The latter are placed between heavy buffers, solidly backed with oak. From the rail heads to the lowest platform step is 17¾ ins., and from step to step 9 ins. The length of the car over end panels is 25 ft., and over corner pieces, 34 ft. 5 ins.; width over sills, 8 ft. 4 ins. The side sills and end sills are 4½ ins. x 7 ins.; sill plates and outside of side sills, 7 ins. x ½ in.; thickness of corner posts, 3¾ ins., and side posts, 2¾ ins. Besides the radial draw-bars already mentioned it is equipped with sand-boxes, "Dedenda" gongs and Brill folding gates. The wheel base of the trucks is 6 ft. 6 ins., the diameter of the wheels 33 ins. The four-motor equipment aggregates 100 hp.



INTERIOR OF BISMARCK CAR



EXTERIOR OF CAR FOR BISMARCK, N. D.

Electric railway interests of Western Ohio are taking an active interest in the formation of a trolley baseball league. It is proposed to form clubs in Hamilton, Piqua, Wapakoneta, Findlay, Lima and Springfield. All of these towns are connected by electric railways and regular scheduled games during the season would furnish considerable additional traffic.

FINANCIAL INTELLIGENCE

WALL STREET, Feb. 24, 1904.

The Money Market

After last Saturday's unexpectedly large addition to bank reserves, the immediate money position would appear to be highly favorable. The surplus of the banks stands now at $27,000,000, as compared with $9,000,000 a year ago, and $12,000,000 two years ago. This comparison, however, must be viewed with several important qualifications. In the first place the movement which brought $7,500,000 cash into the local vaults last week was due to extraordinary causes, and is, therefore, only temporary. The government call for the public money to meet the Panama Canal payments involved the transfer to New York of a large sum held by depository institutions outside of this city. At the same time, large remittances were made from the South of currency released by the drop in cotton prices. Together, these have been the entire source of gain to the local institutions during the last ten days, and it is quite improbable that any further increases in local cash supplies will occur from these quarters. The real tendency at this season is for money to flow away from this city to meet the demands of spring trade in the interior; for the next two months we must prepare to see these customary requirements pressing upon the market. Meanwhile, the situation in the foreign exchanges is turning rapidly against this country. Our commercial exports, checked by the excessive prices to which speculators have forced the leading staples, are beginning to fall off heavily. The foreign discount markets, reflecting the strain of the war, are tightening steadily. Sterling rates have advanced a full cent in the pound during the last ten days. All this raises the question somewhat acutely, whether the Panama Canal financing will not be followed by an outflow of specie to Europe. It is certainly true that our money market is the cheapest in the world, and that if credit becomes any more strained abroad foreigners will apply for assistance to our bankers. In a general outlook of the money situation, therefore, the possibility of gold exports on a considerable scale this spring is what is being considered, perhaps more seriously than anything else in high financial circles. Borrowing by corporations has, for the time-being, at least, run its course, and the tendency shown in the last few bank statements toward a loan contraction is decidedly encouraging. Nevertheless it must not be forgotten that the great preponderance of recent credits have been created on unsalable collateral. This will naturally work against any very great improvement in the loan account during the immediate future. It seems virtually assured that for the next six weeks at least surplus bank reserves will decline more or less rapidly under the prospective drain upon cash holdings. This will force up money rates, although it is not expected that the rise will equal that of a year ago. Time money still commands 4½ per cent for the district options, and 3¾ to 4 per cent for the near-by periods. Call money is quoted at 1½ to 1¾ per cent.

The Stock Market

If the average Wall Street observer were asked what the main cause was for this week's decline in securities, he would say that it was the financial disturbances growing out of the conflict in the Far East. This, however, is the superficial, and by no means a complete explanation for what has happened. The foreign markets have been through a serious crisis, owing primarily to the enormous losses incurred by French and German investors in the decline in Russian bonds. Nearly all the important government issues in the semi-panic of last Friday and Saturday reached the lowest prices in a generation. In the general collapse of foreign values, it was to be expected, of course, that our market should be indirectly involved. There has been a great deal of liquidation undoubtedly of American security holdings, especially at Paris and Berlin. But this, while a powerful factor, has by no means been the sole influence on the local Stock Exchange. As a practical demonstration, when all the other markets of the world were recovering sharply yesterday, our market reached by far the lowest prices on the present downward movement. The greater part of the list sank within a few points of the very lowest level of last summer's depression, and in not a few instances stocks went below their previous low records. It is evident, from this, if from no other indications, that other depressing influences relating purely to domestic conditions have been at work. These may be summed up as follows: The unwillingness of investors, large and small, to enter the market until the Northern Securities decision is announced, the uncertainty always felt on the eve of a presidential election, the heavy decreases now being reported almost universally in railway earnings, the falling off in general trade, resulting from the unusually severe winter, and finally, what is in our judgment the most critical of all, the accumulation of an enormous quantity of unsalable securities in the hands of the banking interests. These articles have insisted all along that the argument of "undigested securities" applies with hardly less force to the present situation than it did a year ago. There is this reservation, that money is easier now than it was, then consequently that the pressure upon the larger representatives of capital is less severe than it was twelve months ago. But it is none the less true that the heavy load which the big men of Wall Street are carrying prevents them just as effectively from extending the support which they would ordinarily to the market. This, in our estimation, is the most serious fact in Wall Street conditions to-day.

Of the local traction stocks, Brooklyn Rapid Transit has been the weakest, because it is more widely distributed than the rest in purely speculative hands. The attempt to rally this stock a week ago did not succeed, and the indications are that the pool which started to put up the price has been forced to throw over a good part of their holdings at considerable loss. Metropolitan has had a special reason for its decline, in the shape of the deficit reported by the Interurban Company for the December quarter. On the other hand, Manhattan has held remarkably well, owing to the well-known fact that the stock has been so far absorbed by investors that its market supply is very small.

Philadelphia

The Philadelphia market has been depressed this week by the same general causes which have borne down the markets elsewhere. In only two of the local traction stocks can there be said to have been any heavy liquidation. Philadelphia Electric, in which a pool has been lately operating, with no success, sold down to 5¾, or nearly 1 per cent below its recent high point. Philadelphia Company common, on selling from Pittsburg sources, dropped from 39¼ to 38. Apart from these two issues, trading has been generally light. Only a few transactions are reported in Union Traction, at 47½ and 47⅜. Philadelphia Traction lost a fraction from 97½ to 97. Rapid Transit fell from 14½ to 14, but there was little trading. Other business on the week included American Railways at 44⅞ to 44½, Consolidated Traction of New Jersey at 63½, fifty shares of Fairmount Park Transportation at 21, and an odd lot of Pittsburg Traction preferred at 49½.

Chicago

New low records have been the order of the day in this week's Chicago market. North Chicago broke to 69¾, subsequently rallied to 70, sales altogether amounting to only about 100 shares, and then broke to 67½ on the sale of 10 shares. West Chicago, on sales of only 75 shares, dropped a sheer 5 points to 40. Metropolitan Elevated preferred also touched a new low level at 47½, later rallying to 48¼. About 100 shares of the stock sold from 49 down. Northwestern Elevated common changed hands at 17¼, Lake Street receipts at 2, Union Traction common at 5 and 4¾, the preferred at 29⅝, and South Side Elevated at 93. Directors of the last-named company will meet next week to act upon the quarterly dividend, which is expected to be maintained at the usual 1 per cent. The Metropolitan has applied to the City Council for the right to bring cars of the Aurora, Elgin & Chicago line over the elevated structure. This is the first step taken in connection with the plans for handling passengers in the new downtown terminal. If given the right to use the elevated tracks, the Elgin line ought to make a splendid showing during the next year, as the arrangement will afford it the best facilities of any outside road which enters the city. Some radical change in the operation of the Union Traction system is expected under the new receivers—John C. Fetzer and H. A. Blair—who have just been appointed.

Other Traction Securities

The principal weakness among the traction group in Boston has appeared in the Massachusetts Electric issues, in which some unloading by recent speculative purchasers has occurred. The common stock sold down from 20½ to 18¼, and the preferred from 77 to 74, trading being fairly active in both cases. Boston Elevated has held remarkably steady at 138, which is a gain of a point, as

compared with a week ago. West End common has sold between 90⅛ and 91, and the preferred at 108 and 108⅛. The Baltimore Exchange reopens for business to-day. There have been no dealings in that market since the great fire. On the New York curb, Interborough Rapid Transit sold down on transactions of 1000 shares from 103¼ to 100¾, but recovered to 102½ yesterday on purchases of 200 shares. One hundred shares of New Orleans preferred sold from 30⅛ to 30½. Brooklyn Rapid Transit 4s weakened still further to 74. This was all that was done in the traction list. On the New York Stock Exchange North American and Twin City fell sharply with the rest of the market, but selling was light in both cases. The transactions on the Cleveland exchange have been very light during the past week, owing to the holidays and the death of Senator Hanna.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid	
	Feb. 16	Feb. 23
American Railways	44	44
Aurora, Elgin & Chicago (preferred)	a55	a55
Boston Elevated	137½	137¾
Brooklyn Rapid Transit	43⅝	38⅞
Chicago City	162	160
Chicago Union Traction (common)	4½	4¼
Chicago Union Traction (preferred)	28	29½
Cleveland Electric	71	71½
Consolidated Traction of New Jersey	63	62
Consolidated Traction of New Jersey 5s	105½	105½
Detroit United	62½	60¼
Elgin, Aurora & Southern	—	—
Interborough Rapid Transit	103	101
Lake Shore Electric (preferred)	a45	—
Lake Street Elevated	2	2
Manhattan Railway	142⅞	141
Massachusetts Electric Cos. (common)	20½	18⅝
Massachusetts Electric Cos. (preferred)	77	74½
Metropolitan Elevated, Chicago (common)	17	17
Metropolitan Elevated, Chicago (preferred)	48	47
Metropolitan Street	118	114⅝
Metropolitan Securities	88½	86½
New Orleans Railways (common)	8	8
New Orleans Railways (preferred)	30	29½
New Orleans Railways 4½s	79	79½
North American	85¼	82½
Northern Ohio Traction & Light	14¾	14¾
Philadelphia Company (common)	39½	38
Philadelphia Rapid Transit	14¼	14
Philadelphia Traction	97⅜	97
St. Louis Transit (common)	8	7
South Side Elevated (Chicago)	92	92
Third Avenue	120	119
Twin City, Minneapolis (common)	90	87½
Union Traction (Philadelphia)	47	47¼
United Railways, St. Louis (preferred)	52	52
West End (common)	90	90½
West End (preferred)	108	108

a Asked.

Iron and Steel

Weakness in pig iron, on the one hand, and a more active business in the finished products at unchanged prices on the other hand, present a somewhat confusing situation in the present iron market. The best authorities assert that there is no real tendency in the trade either way, meaning by this that it is not yet clear whether prices are low enough all around to attract buyers freely. The most encouraging development recently is the large orders which the railroads have put in for steel rails. Some observers think this means that the deadlock in this quarter has been finally broken. As an offset to this, pig iron prices have again been reduced in the South and West, and further declines are expected. Quotations are as follows: Bessemer pig iron $13.50, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 12⅜ and 12½ cents, tin 28½ cents, lead 4 7-16 cents, and spelter 5 cents.

The Dayton & Troy Electric Railway has added to its service a new car known as the "Piqua Flyer," which leaves Dayton at 5.25 each evening, and arrives at Piqua at 6.25, covering the 32 miles between the stations in one hour.

NEW RECEIVERS FOR THE CHICAGO UNION TRACTION COMPANY

Judge Grosscup, on Feb. 17, appointed John C. Fetzer and Henry A. Blair receivers for the Chicago Union Traction Company to fill the vacancies caused by the withdrawal of James H. Eckels and R. R. Govin. This change, it is understood, was made to silence the dissentions between the Chicago Union Traction Company and the underlying companies. Henry A. Blair is a large stockholder in both of the underlying companies, while John C. Fetzer, a well-known Chicago man, who is a stockholder in neither company, was chosen by the court as a disinterested party of sufficient ability to handle the large interests involved. It is understood that Mr. Fetzer will give a large part of his time to the receivership. The Chicago Passenger Railway Company, which is one of the underlying companies, filed a petition for a renewal of its west side franchises with the Council immediately after the new receivers were appointed. This was referred to the Local Transportation Committee.

LIGHT ON THE SITUATION IN CHICAGO

The Chicago "Record-Herald" recently published an interview with John C. Fetzer, the newly appointed receiver of the Chicago Union Traction Company. Mr. Fetzer is manager of the real estate interests of the estate of Cyrus H. McCormick, the great harvester manufacturer, and occupies an important official position in various other large corporations in Chicago. Mr. Fetzer's interview is given to answering the question: "What does Chicago need most?" and appears in the real estate column of the paper above mentioned. As the interview throws a great deal of light on the real reason for the wearisome delay in franchise negotiations and the blocking of all matters of importance looking toward the betterment of Chicago transportation facilities, much of it is here reprinted.

Mr. Fetzer's first answer to the question: "What does Chicago need most" was: "We need a set of officials who will act," and then he continued:

"I met a man on the street not long ago, and he said to me, 'How do you get along over at the City Hall?' I told him that I got along all right, and wanted to know his object in asking. 'Well,' he replied, 'in the old days, when we had a set of boodlers in the City Hall, by paying their price one could get something done, even if by accident it did benefit the city. Now we have an honest Council, but they won't do anything at all.'

"That is the whole trouble with Chicago. We can't get anything done. It seems as though every public official is afraid to do anything for fear somebody will point the finger of scorn at him and suggest that there was something in it for him. They are so honest that they are afraid to do anything. Now, there is my good friend Mayor Harrison. No one can seriously doubt his honesty, and yet he is afraid to do things in a straight, business-like way, although he knows that they ought to be done, and done right off.

"Public utilities are constantly held up and defeated on the ground of some technicality, while many flagrant abuses of public property are allowed to continue without hindrance by the public officials. * * * * * * Let us see wherein the city is keeping back public utilities. There are the bridges, or rather the proposed bridges connecting the Union Loop with the big stores and office buildings. They cannot be built, because the city demands the payment of exorbitant rentals for them. I cannot see why at the Monadnock Building, for instance, the thousands of people who work there every day should be compelled to come down to the street level from the elevated, and then go up again, instead of entering the building at the second story, saving time and energy.

"Then, see the attitude of the city toward the Union Loop when it wanted to extend the platforms for the accommodation of the public, and so that they could handle more trains and the people would not have to wait so long. But the city officials said: 'No, you cannot build any extensions on your platforms and the public will have to be satisfied to wait for trains and to put up with being crowded.'

"Last year there was a coal famine, and our honest Council made a terrible stir over that. And yet I know that a certain railroad had hundreds of cars of coal in its yards, and could have brought still more here, but it had only the teaming facilities to unload forty cars a day. Because it was a railroad, however, the City Council would not give it the right to increase its team tracks without demanding all manner of exorbitant compensation and ridiculous conditions.

"I do not contend that public property should be used for strictly private purposes, but it should be encouraged when it benefits the public, just as much as it should be restricted when

it would be harmful. But because a private corporation makes money out of a public enterprise, it should not be condemned as long as the public is properly benefited. The trouble now is that, no matter if the members of our honest Council are convinced that certain concessions to private corporations would be of the greatest benefit to the city, when it is suggested they hold up their hands in holy horror and declare against it, when deep down in their hearts they know that the real reason is that they are afraid some one will insinuate that they have been bribed. What we need is a set of officials who can do business on business principles and still be honest."

CHICAGO CITY RAILWAY COMPANY'S ANNUAL REPORT

The stockholders of the Chicago City Railway Company held their regular annual meeting February 16, at which time President D. G. Hamilton submitted the following report:

To the Stockholders of Chicago City Railway Company:

The year 1903 has been an eventful one in the affairs of the company.

The conditions prevailing, differing materially from those of last year, as well as previous years, adversely affected the results of operation. The strike decreased the gross earnings. The abnormal increase in expenses decreased the net earnings.

EARNINGS

The gross earnings do not show the expected and normal increase, owing to the fourteen days' strike of employees in November, 1903, and also owing to the unfavorable weather conditions prevailing during the months of January and December.

The increase over 1902 was $22,383.26, of which $13,887.72 were passenger receipts.

While the passenger receipts increased less than one-fifth of 1 per cent, the transfer passengers carried increased 20 per cent, due to the enforced inauguration of the present transfer system, with its greatly extended transfer privileges.

Over fifty per cent of the fare passengers were carried on transfers.

EXPENSES

The total expenses over and above charges to reserves and depreciation in 1902, increased $311,837.41, as compared with 1902.

The increases in wages, cost of fuel, material and supplies, cleaning streets, removal of snow, insurance, taxes, and the strike expenses, caused this increase.

NET INCOME

The net income shows a decrease as compared with that of 1902 of $209,454.15, and the surplus for the year a like amount.

IMPROVEMENTS IN 1904

In addition to increased operating expenses for maintenance, replacements, and renewals in the year 1903, a large amount has been expended for additions to, and the betterment of the property. These expenditures were for underground feeder conduits, completion of the new repair shops, an addition to the new electric power plant at Twenty-First and Dearborn Streets, eighty new double-truck electric cars with electric equipments, work cars and other miscellaneous equipment.

NEEDED IMPROVEMNTS IN 1904

In order to pursue the policy of the management of this company, to best subserve the wants of the public, there should be expended, in the year 1904, further sums for additional cars and power plant apparatus, so that the present facilities for handling the traffic may be maintained to the proper degree of efficiency. In addition, a large amount of construction and reconstruction work will be required for underground feeder conduits, cement sidewalks, paving, tracks and buildings.

During the past year, negotiations were entered into, on the part of the company with the city authorities, with reference to the "franchise question," and a tentative ordinance is under consideration, by which it is hoped a fair and business-like settlement of the questions involved may be made.

Pending the settlement, the company proposes to efficiently maintain its plant and equipment, and make such improvements as will enable it to furnish the best service possible, under existing conditions.

The income account and operating statistics for the year ended December 31, 1903, are herewith presented. Respectfully submitted, by order of the board,

D. G. Hamilton, President.

Chicago, Feb. 16, 1904.

GROSS EARNINGS

Passenger receipts	(Increase $13,887.72)	$6,381,245.85
Recepts from other sources	(Increase 8,495.54)	54,319.40
Total	(Increase $22,383.26)	$6,435,565.25

TOTAL EXPENSES

Operating expenses and taxes—(Operating expenses, taxes, and reserves for replacements, renewals and damages in 1902)	(Increase $311,837.41)	$4,648,341.61
Depreciation	(Decrease 80,000.00)	100,000.00
Total	(Increase $231,837.41)	$4,748,341.61
Net income	(Decrease 209,454.15)	1,687,223.64
Dividends	(Same amount in 1902)	1,620,000.00
Surplus for the year	(Decrease 209,454.15)	67,223.64

PERCENTAGE OF NET INCOME TO CAPITAL STOCK

On $18,000,000	(Decrease 1.17 per cent.)	9.37

TABLE OF PERCENTAGES—EXPENSES TO RECEIPTS

Percentage of operating expenses and taxes to gross earnings—(Operating expenses, taxes and reserves to gross earnings in 1902)	(Increase 4.61 per cent)	72.23
Percentage of operating expenses and taxes to passenger receipts—(Operating expenses, taxes and reserves to passenger receipts in 1902)	(Increase 4.73 per cent)	72.84
Passenger receipts per day	(Increase $38.05)	$17.482.87

We have examined the above income account and the books and accounts of the company, and certify them to be correct,

Jones, Caesar & Company, Chartered Accountants.

MILES OF SINGLE TRACK

Electric	(84.11 per cent of total)	183.96
Cable	(15.89 per cent of total)	34.75
All		218.71

CAR MILES RUN

Electric	(57.15 per cent of total)	18,595,440	Increase	261,578
Cable	(42.62 per cent of total)	13,865,473	Decrease	378,717
Horse	(.23 per cent of total)	74,210	Decrease	19,672
All		32,535,123	Decrease	136,811

PASSENGERS CARRIED

Fare passengers	128,304,445	Increase	206,646
Transfer passengers	66,883,346	Increase	11,089,784
Fare and transfer passengers	195,187,791	Increase	11,296,430
Percentage of transfer passengers to fare passengers			52.13
Percentage of transfer passengers to fare and transfer passengers			34.27

BALL OF THE BROOKLYN EMPLOYEES

The first annual reception and ball of the Employees' Mutual Benefit Association, composed of employees of the Brooklyn Rapid Transit Company, was held at the East New York clubhouse of the association on Monday evening, Feb. 22. The affair was very successful, there being at least 1000 people present. A number of the officials of the company who take an active interest in the association were there. Among them were Dow S. Smith, general superintendent of the company; W. B. Graham, superintendent of the surface lines; W. O. Wood, superintendent of the elevated lines. One of the most pleasing features of the reception was the presentation of the prizes to the winners of the bowling tournament, which ended a few days ago. The committee in charge was composed of George Wolfram, H. Phister, W. O. Wood and E. Gilchrist.

TO REGULATE THE NUMBER OF PASSENGERS IN CLEVELAND CARS

The board of health of Cleveland is considering legislation for regulating the number of passengers that may be carried in a street car. The city solicitor has given his opinion that the board of health has as much right to take action on this matter as it has the right to regulate the manner in which live stock may be loaded in a freight car. It is the general opinion that the load of a car should be limited to the seating capacity plus one-half. In other words, a car which seats fifty pasengers should not be permitted to carry more than seventy-five passengers. It also is proposed to compel the company to place an extra man on all cars during the rush hours, whose duty it would be to assist passengers on and off, give the signals to the motorman and make it compulsory on this man to limit the number of passengers. It is not recorded that the board of health favors Mayor Johnson's 3-cent fare, universal transfer scheme.

CARS ON BOB-SLEDS IN NEW YORK STATE

As a result of the unprecedented fall of snow in Central New York, the Utica & Mohawk Valley Railway Company recently furnished a novelty in railroading. The huge drifts which buried the tracks beyond resurrection, necessitated the cessation of regular service on the North Genesee Street line, which runs from Bogg's Square to Deerfield Corners, but the company was equal to the emergency. Cars were lifted off their trucks, denuded of trolley appendages and placed on bob-sleighs. The service rendered by them was tolerably good, and a source of much comment by persons who found it necessary to take a Deerfield trip. The drivers employed on the line considered the novel vehicles as more of a joke than a reality, and often drove into side streets to deliver passengers at their door.

THE INTERURBAN'S EARNINGS

Comparative statements of the earnings of the Interurban Street Railway Company, of New York, for the quarter and six months ended Dec. 31, 1903, have just been made public. The statements show:

QUARTER

	1903	1902
Gross earnings from operation	$5,565,368	$5,500,061
Operating	3,016,018	3,090,151
Net earnings from operation	$2,549,349	$2,409,910
Income from other sources	359,032	297,942
Gross income from all sources	$2,908,382	$2,707,852
Deductions from income	3,012,673	2,924,882
Deficit	$104,291	$217,029

SIX MONTHS

	1903	1902
Gross earnings from operation	$11,135,580	$10,871,752
Operating expenses	5,777,619	5,826,173
Net earnings from operation	$5,357,960	$5,045,578
Income from other sources	729,257	723,868
Gross income from all sources	$6,087,218	$5,769,447
Deductions from income	6,028,133	5,840,106
Surplus	$59,085	$70,659

These statements include all leased and controlled companies, as well as the Third Avenue system. The decrease in operating expenses supposed to be due to the change of additional lines from horses to electricity.

ONE LINE IN NEW HAMPSHIRE EARNS DIVIDEND

The annual report of the State Railroad Commissioners of New Hampshire shows that but one street railway company, the Manchester Street Railway, earned a dividend last year, although there are eighteen operating companies. The companies have 228 miles of track, $3,552,119 stock, $2,066,000 in bonds, and $1,009,003 liabilities. The gross income was $834,894; operating expenses, $796,795; taxes and interest, $103,250, and a deficit of $65,161. The Manchester road had a divisible income of $31,807.

ALLIS-CHALMERS COMPANY ENTERS NEW FIELDS

Over the signature of W. J. Chalmers, vice-president of the Allis-Chalmers Company, there has just been issued the following official statement regarding the plans of the company for entering the electrical field, etc.

We beg to notify you that our company has widened its scope of manufacture, and engaged in most important industries. We could not give you the information at an earlier date, as we have only just concluded final arrangements for all the new industries we are to engage in, which we are pleased to enumerate as below: Steam turbines, hydraulic machinery, gas engines and electrical machinery.

As regards steam turbines, we have become associated with and form part of the Steam Turbine Advisory Syndicate of England, which is composed of Yarrow Shipbuilding Company, of England; Tweedie (Vulcan) Shipbuilding Company, of England; Willans & Robinson, engineers and well-known engine builders, of England; Mr. Fullager, formerly chief engineer Parsons Steam Turbine Company, of England, now consulting engineer for Steam Turbine Advisory Syndicate, and Allis-Chalmers Company.

Our turbine is of the horizontal type, which is the type Parsons, of England, and Brown Boveri, of Switzerland, manufacture. We are convinced, after an investigation by our engineering staff in Europe and elsewhere, extending over a period of two years, that we have a steam turbine that is at least in efficiency and economy equal to the best made of Parsons or Curtis, which are the types best known. We are now prepared to enter into the building of steam turbines of the following sizes: 500, 750, 1000, 1500 and 5000 kw, and can, if required, build up to units of 10,000 kw. The largest size that has ever been built of any type of turbine is 5000 kw. Our license from the Advisory Turbine Syndicate concedes to us all of the United States, Canada and Mexico, with equal rights and privileges in South America, and rights to do business elsewhere in the Western Hemisphere.

We have concluded arrangements with Escher-Wyss & Company, of Zurich, Switzerland, whereby we become the sole licensees for the Western Hemisphere of their famous hydraulic machinery, several types of which have been installed at the Niagara Falls plant of the Cataract Construction Company, aggregating 85,000 hp. Escher, Wyss & Company have long enjoyed, and still enjoy, the reputation of being the best-known manufacturers of turbines in the world. We only mention Niagara Falls as one of the plants employing thousands of horse power installed by Escher-Wyss & Company.

We have bought the American patents, and have become sole licensees for the Western Hemisphere of the Nurnberg Machine Company, Nurnberg, Germany, for their gas engines, and are now prepared to make gas engines up to any required horse power. At the present time we are prepared to build gas engines from 250 to 1500 hp. These engines are suitable for consumer gas or taking the waste gas from blast furnaces and utilizing same with economy and efficiency. It is in the blast furnace trade that we expect the largest business to result. The engine is not an experiment, but engines of 1500 hp are now in operation in Germany, and it was after two years' investigation by our engineering staff of the various gas engines, that we selected the Nurnberg, and have engaged in its manufacture. It is a prime mover, either for blowing engines in blast furnaces, or for direct-connected dynamos in generating electricity, or for any other purpose where power is required.

We have engaged in the manufacture of generators, motors and electrical apparatus in all its branches both for stationary and railroad work, power-house installation for transportation purposes and electric lighting. We have engaged to take charge of this department of our business John F. Kelley, formerly of the Stanley Electric Company; William Stanley, of the same company, as consulting engineer, and John H. Kelman, formerly superintendent of the Stanley Company, as superintendent of this department. In addition we have engaged others of the late Stanley Company's staff whose services we can use, and have drawn a further supply from the best electrical establishments in this country and in Europe; so that we are fitted out with a complete engineering staff in every branch of the electrical business, and we believe that Messrs. Kelly and Stanley are recognized in the profession as standing equal to the best.

From the above you will observe that we have entered the field not only in the line of prime movers, embracing reciprocating engines, in which field we have always led, but also with steam turbines, gas engines and hydraulics; and with electrical apparatus combined with any one of these prime movers we are now prepared to estimate upon and accept contracts for complete plants of all description and furnish the best of their respective kinds.

CLUB ROOMS AT TACOMA

The new car house being built by the Tacoma Railway & Power Company, of Tacoma, Wash., will provide bath rooms, plunge and gymnasium for the employees, all to be equipped with all the latest appliances. They are to be located on the basement floor of the new building, and will face A Street near the corner of Thirteenth Street. At the entrance will be the rooms for the motormen and conductors. Here will be chairs and benches where the men will be able to rest while waiting for their cars. Next will come the gymnasium with its punching bags, Indian clubs and other athletic appliances. The men will have lockers so that they may keep bathing and gymnasium suits if they so desire. Then will come the bath rooms. All this was provided for the men at the expense of the company.

THE BRIDGE COMMISSIONER'S PLAN FOR RELIEVING CONGESTION AT BROOKLYN BRIDGE

Bridge Commissioner Best, of New York, has sent to the Mayor and other members of the Board of Estimate and Apportionment a tentative plan for an enlarged bridge terminal, to cost, for land and building, about $9,000,000. The new terminal will cover all the irregular shaped blocks between the present terminal northward to Worth Street. Nothing is said in the plans about a connection between the present bridge terminal and the Williamsburg Bridge, but it is understood that Chief Engineer Nichols soon will submit a plan for connecting the bridges with an elevated structure.

For the purpose of putting the new scheme through there will be required the acquisition of all the real estate not now belonging to the city in the four blocks bounded by Centre Street on the west, Tryon Row on the south, Park Row on the east, and Duane Street on the north and east; and the small block bounded by Centre Street on the west, Park Street on the south and east, and Pearl Street on the north, and the small block bounded by Park Row on the west, the property of the New York and Brooklyn Bridge on the south, and North William Street on the east, and also certain parcels of land on the south side of Duane Street between City Hall Place and Park Street, and in Centre Street between Pearl and Worth Streets.

The construction will consist of an extension of the New York and Brooklyn Bridge tracks over Tyron Row and over private property to the southerly side of Worth Street, the construction of a large terminal building covering a portion of the westerly end of the present bridge station and extending along the easterly side of Centre Street to a point at or near the northerly side of Duane Street, the building to be about 140 ft. wide.

The ground floor of the station building in Centre Street will, excepting the space devoted to public streets and places, be used for entrance to the station, and will be provided with stairways reaching to the second, or mezzanine floor, which will correspond in level with the mezzanine floor of the present station, and will provide on an extensive scale for the distribution of passengers to and from the several railway platforms.

The third, or main, station floor, will contain tracks and platforms, four in number, which will be longer and wider than those now in use on the New York and Brooklyn Bridge. The head room on this floor will be 20 ft. to 25 ft. above the platforms, and provision will also be made for the construction of fourth and fifth floors, which may be used for office purposes. This building is to be of steel skeleton construction, with stone exterior and slate roof.

From the City Hall Park an incline will lead from the surface to the mezzanine floor, and stairways will be built to the ground near the westerly curb line on Park Row.

The present bridge station will be connected with the Centre Street station building and form a southerly wing thereto. The elevated railroad platforms in the present station will be extended and brought out nearly to Park Row, and two additional side platforms will be built and roofed in over the present carriageways of the bridge, and all of these four platforms will be fitted with capacious stairways to the mezzanine floor.

THE OTTAWA & NEW YORK COMPANY TO ADOPT ELECTRICITY

The report that the Ottawa & New York Railway, operating between Ottawa, Ont., and Tupper Lake, N. Y., is to adopt electricity as motive power is confirmed by General Manager Gays, of the company. Estimates are being prepared of the probable cost of the change, and are said to favor electricity. It is proposed to get power at Ottawa, at Cornwall and at Massena Springs, N. Y. At the same time there is a water-power along the line, which can readily be developed. The company hopes to be in a position to effect the change this year.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

STREET RAILWAY PATENTS ISSUED FEB. 16, 1904

752,037. Electric Train Service; Melvin D. Compton, New York, N. Y. App. filed Dec. 2, 1901. The speed of a generator driven from the locomotive axle is varied by throwing discs of different diameters into and out of engagement by means of pneumatic pistons which are controlled automatically by the condition of the current in the various circuits of the system.

752,081. Car Signal; Geo. M. Lane, Brooklyn, N. Y. App. filed may 14, 1903. Details.

752,084. Railroad Signal; John K. Leedy, Roanoke, Va. App. filed Nov. 10, 1902. Details.

752,121. Trolley Finder; Elisha S. Stitt, Newton, Mass. App. filed Oct. 17, 1902. A guiding fork for the wheel, arranged to be held in operative position by tension on the cord.

752,127. Railway Switching and Signaling Apparatus; John D. Taylor, Buffalo, N. Y. App. filed Jan. 12, 1901. Details of a locking mechanism for the signals.

752,139. Trolley Catcher; William C. Young and Johnson McMahon, Buffalo, N. Y. App. filed June 1, 1903. A spring normally under tension is released when the trolley-wheel leaves the wire, to contract and draw the pole downward.

752,374. Automatic Check Device for Trolley Cords; Seth F. Buckland, Springfield, Mass. App. filed April 22, 1903. A spring-drum and ratchet arrangement for retracting the trolley cord.

752,437. Overhead Trolley Guide; Charles W. Burkehead, Madisonville, Ohio. App. filed Aug. 16, 1902. A guiding fork constructed to perform its function whether the wheel is running forward or backward on the wire.

752,501. Trolley Hanger; Montraville M. Wood, Schenectady, N. Y. App. filed Aug. 8, 1903. A cup-schaped nut that holds the clip in place is provided with a locking device to prevent it from turning.

PERSONAL MENTION

MR. HENRY D. THOMAS, president and promoter of the Marion, Kokomo & Western Interurban Railroad, of Marion, Ind., died very suddenly Feb. 17, from heart disease. He was taken ill while out on the lines with a surveying party.

HON. W. W. GUEST has been elected president of the Lancaster County Railway & Light Company, of Lancaster, Pa., and all subsidiary companies. He is a resident of Lancaster, and a former secretary of the Commonwealth.

MR. JOHN F. DUSMAN, chief electrician of the York County Traction Company, and the York Street Railway Company, of York, Pa., has resigned from these companies to accept a position with the United Railways & Electric Company, of Baltimore. Mr. Dusman formerly was manager of the York County Traction Company.

MR. E. C. FOLSOM has been appointed to succeed Mr. J. T. McNary as superintendent of the Logansport & Wabash Interurban Railway, and the local lines in Logansport, Ind. In addition Mr. Folsom is to have charge of the reconstruction of the local lines. Mr. McNary will retire, but still retains his interest in the Logansport-Rochester line, projected.

MR. CHARLES LANG has resigned his position with the Wheeler Condenser & Engineering Company after ten years' service with that company. During that period Mr. Lang advanced from office boy to purchasing agent, and later entered the company's engineering department. He is at present enjoying a much-needed rest before taking up new work.

MR. E. D. ARNOLD, consulting engineer for the Council Bluffs, Tabor & Southern Electric Railway, who has been in California during the winter, looking over railway construction as carried on in the West, and securing data for his road, will return to Creston, Ia., about March 1. All correspondence as to the electrical and mechanical equipment of this line should be addressed to him at Creston.

MR. JOHN B. O'HARA, associate editor of the STREET RAILWAY JOURNAL, met with a sad bereavement on Feb. 14 in the death of his wife. Mrs. O'Hara was of most attractive personality and respected and beloved by all who had the pleasure of acquaintanceship with her. She was formerly Miss Margaret Hickey, of Rochester, and, besides her husband, leaves one son. The burial occurred in Rochester on Feb. 18.

MR. ABE COOK, who was secretary and treasurer of the Laclede Car Company for fifteen years, and more recently the purchasing agent of the St. Louis Car Company, is now connected with the Central Union Brass Company, of St. Louis. Mr. Cook has a host of friends and is thoroughly familiar with all branches of street railway work, and will be a valuable addition to the force of the Central Union Brass Company.

MR. H. E. BURCHFIELD, who was in charge of the construction work of the Evansville-Princeton Traction Company's line between Evansville and Princeton, Ind., and who has been superintendent of the line since its completion, has resigned from the company to accept a position with the Walker Construction Company, of Philadelphia, which has taken the contract to build an electric railway from Parkersburgh to Lafayette, W. Va., a distance of 21 miles.

INDEXED

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, MARCH 5, 1904 No. 10

Published Every Saturday by the
McGRAW PUBLISHING COMPANY
Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues).............................. $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Traffic Congestion in London

Some very interesting testimony has been elicited as to the causes for congestion in streets and the best methods of obviating it through the investigation now being conducted in London by the Royal Commission on London Traffic. This Commission, it will be remembered, is the one which visited this country last fall and took the testimony of a number of traffic experts in this country, and the one with which William Barclay Parsons, of New York, has just accepted an offer to act as consulting engineer for a short time. The traffic situation in London differs radically from that in other cities, owing to a number of circumstances, among them the one that there are practically no tramways now of any kind in the strictly business section of the city, their places being taken up by omnibus lines and a few lines of underground railways. Other factors which render a proper solution of the situation difficult are the narrowness and crookedness of the leading thoroughfares and the unwillingness, up to the present time, on the part of Parliament to permit the construction of a tramway line on the Thames Embankment, which, if improved in this way, would greatly relieve the now crowded Strand and Fleet Street.

Some of the testimony already taken by the Commission in London indicates that, somewhat contrary to general belief, the introduction of an electric railway line, either single or double track, depending upon the width of the street, tends to relieve the traffic congestion. This is explained partly on the ground that electric cars are the most compact method of conveying persons through a street, and also partly because a line of moving cars gives direction to the vehicle traffic and assists in keeping the movement to the proper sides of the thoroughfare. The improvement is particularly noticeable when cars are substituted for omnibuses. It may be thought because omnibuses can run over any portion of the road they are less liable to cause blockades, but in the opinion of the highest experts this facility of movement is by no means entirely advantageous. On the contrary, the practical consequence of this condition is that an omnibus is more difficult to pass by a faster traveling vehicle than a car, by reason of the fact that it is liable at any moment to turn to one side, rendering it extremely dangerous to pass between it and another vehicle at anything like close quarters. In addition, omnibuses in attempting to pass one another cause much obstruction, while railway cars are compelled to follow each other without the possibility of blocking the traffic by interference with each other. Moreover, the cars can be operated at a higher speed, and, if equipped with efficient brakes, at equal or greater safety, as compared with the omnibus, and for this reason also are less likely to block the ordinary vehicular traffic.

In discussing this question before the Royal Traffic Commission recently J. Edward Waller, of the well-known firm of London engineers, mentioned 30 ft. as the minimum width of street on which, in his opinion, a double-track line of street railways could advantageously be laid, and 22 ft. as the corresponding minimum width for a single-track line. This width is based on the space required for a car to pass one line of vehicles alongside of the curb without encroaching on the space required for the passage of the cars. Mr. Waller also believes that underground tube railways cannot serve the traveling population in the same way that street railways can, as the underground stations are necessarily at some distances apart, and are inconvenient of access by reason of the depth at which such railways must generally be built, and that while subways can be used in place of tramways in certain cases, especially where the route crosses any of the main arteries of traffic, they should be resorted to only in case of absolute necessity, owing to the large expense involved in their construction.

The Finances of Interurban Roads

In spite of the generally good returns secured in electric railroading we are at present hearing a good many wails from the interurban and country roads in various parts of the country, and the official reports of various States show a condition of affairs that is not altogether encouraging. We have vast faith in the future of electric railroads, but if we read the signs of the times aright it is time to run up a cautionary signal and to nail it to the mast. We have had a period of magnificent building, and to judge from the plans now maturing it has not yet begun

to wane to any notable extent. Thirty years ago the railroad industry at large underwent just such an experience, and the results, while very gratifying from the standpoint of mileage, were not in the long run altogether good. In the fullness of time the hopes of the builders will, doubtless, be fulfilled, but the original investors in some cases have small hope of sharing in the ultimate benefits. In view of this experience caution is a good thing to cultivate, for, after all, electric railroading is subject to the general laws of economics that govern all enterprises dealing with public transportation, and it should learn from the experience of its predecessor as well as its own.

We have over and over advised electric railway men to study the operating methods of general railroading, and in addition we would commend the study of their financial conditions. Of the paying quality of a good urban electric road there is little doubt; some suburban lines and some interurban lines are similarly happy in their prospects; but a good many systems have just now an outlook that is by no means cheerful. Of course, we must realize the fact that in most electric, as in most other railroads, the real investment is represented by the bonded indebtedness, and that the stock represents merely the contingent possibilities of future business, but understanding all this there still remains the unpleasant fact that a good many lines are hard pressed to meet their fixed charges and the necessary appropriations for the up-keep of the system.

The financial problem is at bottom a brutally simple one. An interurban road is built, let us say, at a cost, all ready to run, of $30,000 per mile, reckoned in its bonds. It must then earn net profits of, say, $3,000 per mile to pay the fixed charges and to allow even the most modest sum for depreciation of the physical assets. To obtain this return it must do a gross business enough larger to take full account of all the operating and miscellaneous charges. From past experience with such roads one certainly would not be safe in assuming these charges to be less than about 60 per cent of the gross earnings. Hence, it follows at once that the gross earnings should be about $7,500 per mile, in order to enable the road to pay interest on its bonds and maintain its assets. If the road costs $20,000 or $40,000 per mile, and operates on 50 per cent or on 70 per cent of its gross earnings, the principle remains the same. This is a rough and ready way of getting at the situation, but it is one long since applied to railroads in general. If one considers the number of interurban lines of his acquaintance that are earning $20 per day per mile of track, or more, he gets a pretty good view of the general situation. Twenty dollars means at least 400 fares taken in for each mile of track per day—if the terminal receipts are large, of course, the regions of scanty traffic are helped out, but the longer the road the more such help is required. There is, naturally, the constant hope of increased traffic, and when in a tight place the hope that by the time depreciation has begun to get in its work and elaborate rehabilitation is necessary, circumstances may justify an increase in the securities, but this is purely speculative, however legitimate such speculation may be regarded.

Granting the danger of the situation, the next question that arises is that of ways and means to escape it. The first thing in most cases is to see whether all reasonable means have been taken to keep up traffic. The whole income of an electric road is made up of those wretched little nickels. Every time a passenger gets tired of waiting for an overdue car and takes a steam road, every time a conductor fails to see a signal and diverts a passenger, one of those nickels takes wings. If the manager gets scared at small earnings and thinks that he can save money by changing 15 minutes' headway into half-hour headway, more nickels vanish, and while operating charges diminish receipts diminish more rapidly by far. We earnestly wish that some one could figure out the effect of better service on traffic. There is little doubt that in any region, with even rather ineffective competition, cutting down the number of cars or running them without sharp adherence to schedule, is a losing game, and in many instances doubling the service will, at least, double the receipts. A road can ill afford to make enemies of the owners of those nickels.

Then there needs to be a careful overhauling of the expense account. On interurban roads the cost of power is often, not to say generally, excessive, owing sometimes to badly planned distribution systems, and sometimes to shiftless methods of operation. Every unnecessary dollar spent for coal means that somebody has got to gather up twenty of those nickels to square accounts. If the power stations are badly planned, or the distribution system is inefficient, as it often is, owing to the methods chosen, more nickels still have to be collected. It is within bounds to say that a considerable proportion of interurban and cross-country roads are in a condition which will require the most shrewd and careful attention to the details of operation to pull out the balance sheet unscathed. And it is the little things that count here, for just as the whole income is made up of small change so is the whole possible saving made up of apparently trivial items, save when unskilful planning has entailed needless sources of expense.

The Vermillion Peril

We have several times discussed, half in fun and half in earnest, the bearing of the automobile upon the rights and prospects of existing rapid transit systems. The subject is growing in interest, particularly in view of the determined attempts to influence legislation so as to allow automobilists the practical monopoly of the highways. It must, at the start, be recognized that the devil-wagon has come to stay. It contains the elements of great practical usefulness, and while thus far developed in a scatter-brained sort of way by a heterogeneous mob of manufacturers, only a few of whom turn out a first-class product, is certain, sooner or later, to enter upon a stage of sound growth. At present thoroughly skilful engineering is a great rarity in the automobile business, and while almost every machine has some excellent points, few have many. We call to mind, for example, a very simply and thoroughly made gasolene car, in which the whole sparking device on which the action of the motive power depends, is placed unprotected below the body, where it can catch all the mud and dust of the road. Another has a capital engine coupled with a delicate needle-valve carburetter which goes wrong upon the slightest provocation. And so a long list might be written, as any automobilist knows only too well, of conspicuous and unnecessary failings. We have not yet approached the time when one can go out and buy at a reasonable price any one of a dozen makes of automobile with the certainty of getting a good, reliable machine which will do sterling service. In other words, the business has not yet passed out of the exploitation stage and gotten upon a standard manufacturing footing. But it almost goes without saying that such is the history of most innovations, and that in a few years the automobile will come upon a sound basis. What will be then its relation to other means of progression?

We are not inclined to share the roseate view of those who hold that the world will enter upon an automobile era, in which a swarm of flying devil-wagons will fill the highways and furnish the general means of transportation for everybody. In

the very nature of things the automobile must continue to be a costly machine, particularly if designed for anything above the most moderate speed. In the first place, it must have well-designed and very strong running gear, of the very best material, planned so as to avoid all unnecessary weight. Second, it must have light, powerful and reliable engines, of some kind capable of continuous heavy work, and in capacity ranging from 5 hp to 25 hp and upwards. Third, it must have a boiler and furnace, or carburetter and sparking devices, or a storage battery, coupled with strong and reliable auxiliary working and governing devices. Fourth, it must have a strong, well made and well-finished carriage body to ensure reasonable comfort, and this alone is no small item of expense, as every user of ordinary carriages must realize. Finally, it must be carried upon rubber or other highly resilient tires, which are never likely to be cheap either in first cost or maintenance. The net result is that an automobile of good quality, even of the more modest sort, is not likely to be cheap in first cost, and the cost of motive power, care and maintenance is likely to stay rather high. In other words, even with the cheapening that comes from manufacture on a large scale the number of private turnouts will be limited by the question of cost, just as the number of private vehicles is now limited. More than this, it takes more care and skill to run an automobile than to drive a horse, which imposes a further limitation. The mere question of money is likely to prevent automobiles from being a serious factor in the general rapid transit problem, so far as private ownership is concerned.

As regards possible competition with street railways the automobile omnibus is the one thing to be considered. Such vehicles have made no shining success thus far, but with further development in manufacture it will, doubtless, be possible to obtain a fairly reliable public vehicle, and then the trouble will begin. As regards competition with street cars on any fair basis we have little to fear. The vehicle working on good track with motive power supplied from a central plant, at good economy, must always retain an advantage over the vehicle running on the street by its own small engines. More than this, for a given carrying capacity the street car requires far less labor for its operation than a 'bus line. Of course, it is conceivable that one might build an automobile omnibus as big as a street car, but unless confined to a definite track it would be far too unwieldly to be permitted in a public street. The bicycle, with its low cost, easy storage and general convenience, was a far more serious menace to the receipts of tramway companies than the automobile is likely to be, and the bicycle has already ceased to be a menace in spite of its one-time popularity. No machine which requires even a low degree of skill for its successful use can ever find universal adoption in the sense in which the need for rapid transit is universal.

Even if automobile omnibus lines could be successfully worked commercially on the basis of a 5-cent fare, which is highly improbable, we think they would prove an intolerable nuisance on the streets. The car of Juggernaut would be a harmless plaything compared to them, when once they began to blockade the streets. As already outlined in the editorial on the London situation, in another column, a tramcar confined to a definite track, where everyone can steer clear of it at will, can be safely worked at much greater speed than if it were unconfined and free to dodge about over the street at the will of the motorman. Pedestrians have still some rights that must be respected, and one of these is some degree of assurance as to the location of fast running vehicles.

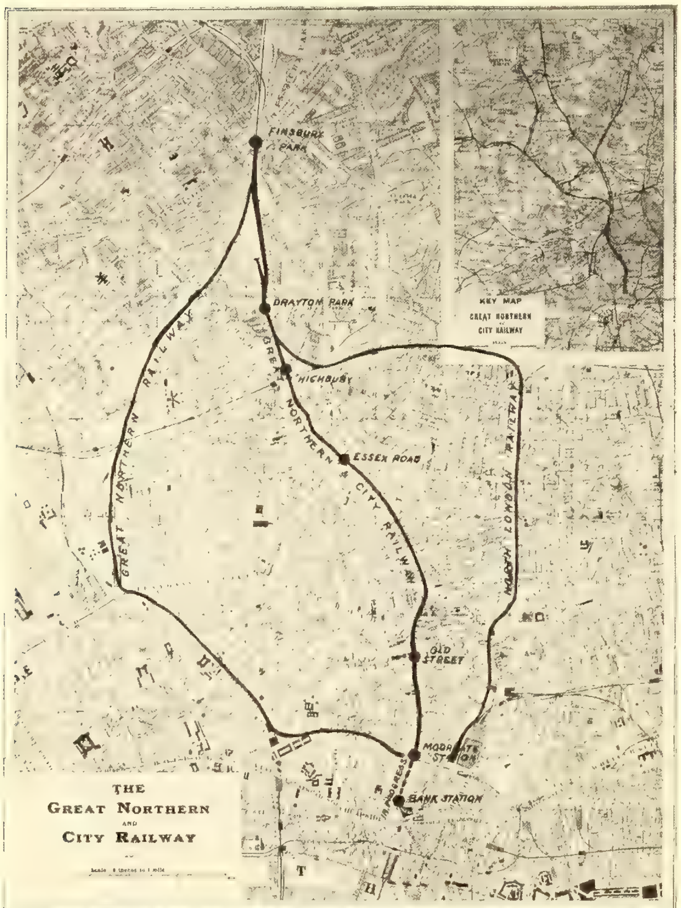
The particular danger to rapid transit interests in the automobile craze lies not in legitimate competition but in unfair discrimination. The whole headstrong crew of automobile scorchers, caring absolutely nothing for the rights of others upon the public roads, are using every effort to have all restrictions upon speed removed. To be sure, they are but a minority of the main body of automobilists, but they carry the influence that always attaches under a popular government to those who screech loudly that they are being oppressed. If private vehicles run unmolested at 25 m. p. h. or 30 m. p. h., then what is to hinder an automobile 'bus line from doing the same thing, and if such speed is legalized, which is the constant effort of the scorchers, then a new weapon will be put in the hands of the swine who desire the "common people," who use street cars, to take to the back alleys, while they, the self-chosen elect, pre-empt the streets. Even now, when an interurban or suburban trolley company tries to secure rights over streets that may better enable it to serve the public, there is a good chance that it will be met by a bid from some representatives of the Pharisaical "better element" to establish a "nice, gentlemanly" automobile line over the same route. Let once the speed limit be raised and the Pharisees could offer not only more "select" vehicles but higher speed. Bluffs of this sort have already been worked to a certain extent, and unless the street railways get down to work they will find extensions blocked in many directions. Let us have fair play in this matter, and hold all vehicles using the public roads to the same speed limits rigorously enforced. If the trolley car, confined to a track that keeps it in a definite line, is limited to 10 m. p. h., hold all other power vehicles to the same limit. If the automobilist is permitted to run 20 m. p. h. in the suburbs, give the street cars, which serve a thousand times more people, the same privilege.

The Turbine Situation

Just at present the steam turbine is at a very interesting stage of its industrial development. Recent tests give a more encouraging view of its economy that were justified by the earlier work, the best of them showing a result quite comparable with that reached by triple expansion engines. If this promise is borne out in commercial use the turbine will have taken a very long step toward replacing the reciprocating steam engine. Its inroads are already severely felt in the engine business, and from the present outlook will be felt more rather than less. Aside from all technical questions the turbo-generator is, or ought to be, very much cheaper than any form of reciprocating engine of similar efficiency. There are now, or soon will be, no less than four manufacturers of the first importance turning out steam turbines, which are, or should be, on the same high plane of quality and efficiency. With this introduction of active and genuine competition it is safe to say that the price of turbo-generators will fall from a level based on a tentative reduction below the prices of ordinary engine sets, to figures representing good ordinary returns upon manufacturing investments. A thoroughly well-made steam turbine will never be as cheap as the layman might figure from its size and weight, but it will, nevertheless, become very much cheaper per unit of power than the present open quotations. If the alternating-current railway motor takes the place in the art that its friends claim for it there will be an additional reason for a brilliant commercial outlook for the steam turbine. Its weakest point has been the practical necessity of using with it an alternating-current generator, but with the new field open for alternating-current working this property ceases to be a serious limitation. Indeed, the steam turbine may become an additional argument in favor of alternating currents.

THE GREAT NORTHERN & CITY RAILWAY

The Great Northern & City Railway, for which ground was broken in October, 1898, has now been opened for public service, and will, no doubt, prove an excellent addition to London's famous "tubes." The organization and engineering features of this project were dwelt upon at length in the Street Railway Journal of March 1, 1902, but before entering upon a general description of the railway it may be well to recapitulate the salient facts regarding its origin.



MAP OF GREAT NORTHERN & CITY RAILWAY (TUBE) AND GREAT NORTHERN & GREAT LONDON (STEAM) TERMINALS FINSBURY PARK TO MOORGATE VIA THE GREAT NORTHERN & CITY RAILWAY

ORGANIZATION

The act authorizing the Great Northern & City Railway was passed in 1892, Sir Douglas Fox & Partners, together with the late J. H. Greathead, being the engineers. The company for the construction of the line was formed in 1896, with a capital of £2,080,000. The contract for the entire work was taken over by S. Pearson & Son, Ltd., of Westminster, under the supervision of the consulting engineers, Sir Douglas Fox & Partners. The contractors also undertook to operate the line for three years after its opening for traffic.

LINE

The line joins the important Great Northern (steam) Railway station at Finsbury Park, just at the 4-mile radius, with the heart of the city in an almost straight line. It is 3½ miles long, and, as will be seen from the accompanying map, is the shortest and most direct underground route from this station to London's business section. The line in the center is the Great Northern & City Railway route, those to the right and left being respectively the North London Railway and Great Northern Railway routes.

The traffic prospects of the new line are excellent, as it runs through a very densely populated district of workers, who, up to the present time, depended for entrance to the city on omnibuses and tramways, both of which take considerably more than double the time to reach the city that is required by the tube trains. This economy in time is expected to attract a great deal of traffic. It is estimated that at least 5,000,000 passengers per mile, or a total of 17,000,000 passengers per annum, may be looked for from local business alone. These figures are considered very conservative, as the Central London Railway, for instance, is carrying about 7,000,000 passengers per mile per annum. About 30,000,000 passengers per annum are brought to Finsbury Park, via the suburban trains of the Great Northern Railway. It is figured that at least one-third of these passengers will use the new direct line in preference to the roundabout older ones, thus adding 10,000,000 passengers per annum, making an annual total of 27,000,000 passengers.

TUNNELS

The underground portion of the line consists of two 16-ft. diameter tunnels, opening out to nearly 23 ft. diameter at the stations. As the diameter of the Central London Railway tubes is 11 ft. 8 ins., and the City & South London Railway only 10 ft. 6 ins., the new line is able to carry much larger rolling stock and enjoy much better ventilation than the others. The track and tunnels are also arranged to permit the standard cars of the Great Northern Railway to run through the Great Northern & City Railway's tubes should it be found desirable to make the necessary connections.

STATIONS

The portion of the railway opened first has for its present city terminus (until the authorized extension to the Lothbury corner of the Bank of England is completed) a station at that part of Moorgate Street which adjoins the stations of the Metropolitan and City & South London Railways. At this place there is a common station for the City & South London and the new line which allows passengers to transfer from one to the other without coming to the surface. This facility will

MOORGATE STREET STATION, THE PRESENT TERMINUS OF THE GREAT NORTHERN & CITY RAILWAY

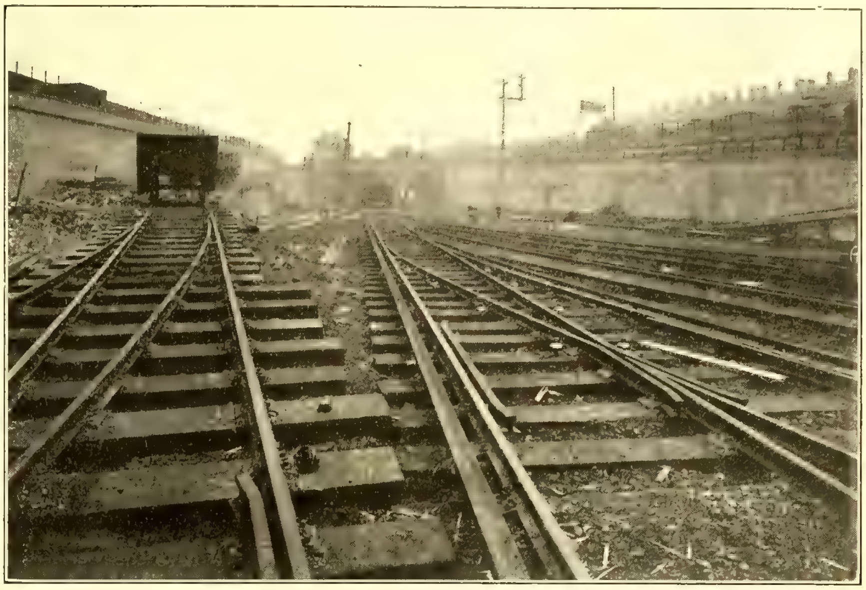
prove a great convenience to people passing between the north and south of London.

Going northward, the next station is Old Street, where the City & South London and Great Northern & City have common surface accommodation. The junction of Old Street and City Road is a very busy center, and the new line will cater jointly with Farrington Street for the large traffic coming from the Great Northern system, which at present has available only the latter station for use.

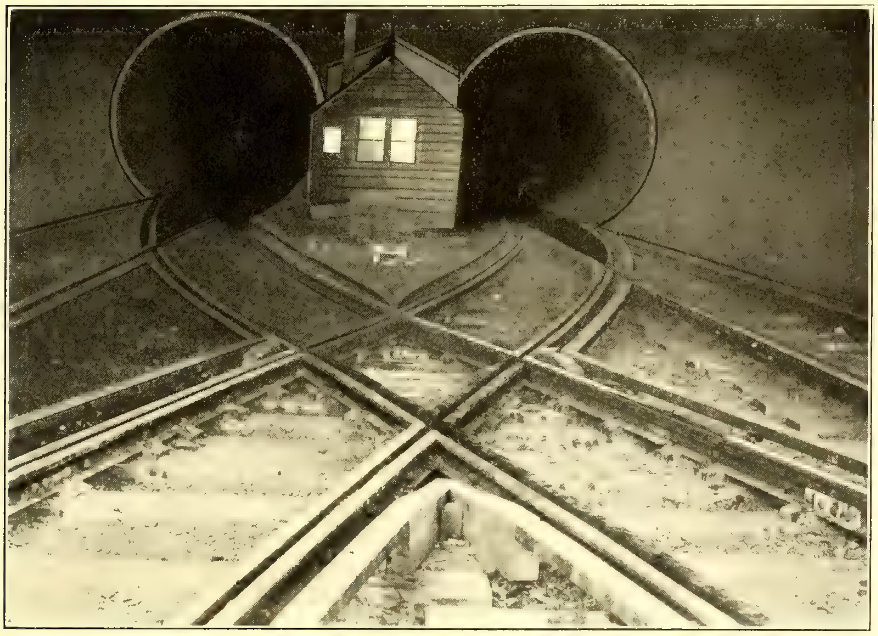
The following station, Essex Road, is in close touch with extensive tramway systems running at right angles, and is close to the Agricultural Hall.

The next station, Highbury, will tap an important and populous district as soon as completed. This station was not a part of the original scheme, but work has advanced so far as to enable its completion within a few months without interfering with the general running of the part now open.

At the next stopping place, Drayton Park, the line comes to the surface. Extensive repair and car shops have been provided at this point for the accommodation of the rolling stock. Originally it was intended to effect physical connection here with the Great Northern Railway. The act of 1892 gave powers for such connection, but after extended negotiations with the Great Northern Railway Company it was decided that Finsbury Park station would be incapable of handling the large number of Great Northern and other trains coming from the north and south, as well as the trains from the new line without seriously interfering with the Great Northern main line traffic. To meet this difficulty the Great Northern Railway Company offered to find the money for the connection to Finsbury Park station, which is now the northern terminus of the combined scheme. Here an extensive ticket office and other facilities have been constructed, in about twelve months, without interfering in the slightest degree with the traffic of the Great Northern Railway, notwithstanding that the main line expresses run right over the top of the workings within a few inches of the miners' heads. The placing of this structure so close to the level of the permanent way will enable the interchange of traffic at Finsbury Park to be carried on with the least exertion and inconvenience to the traveling public.

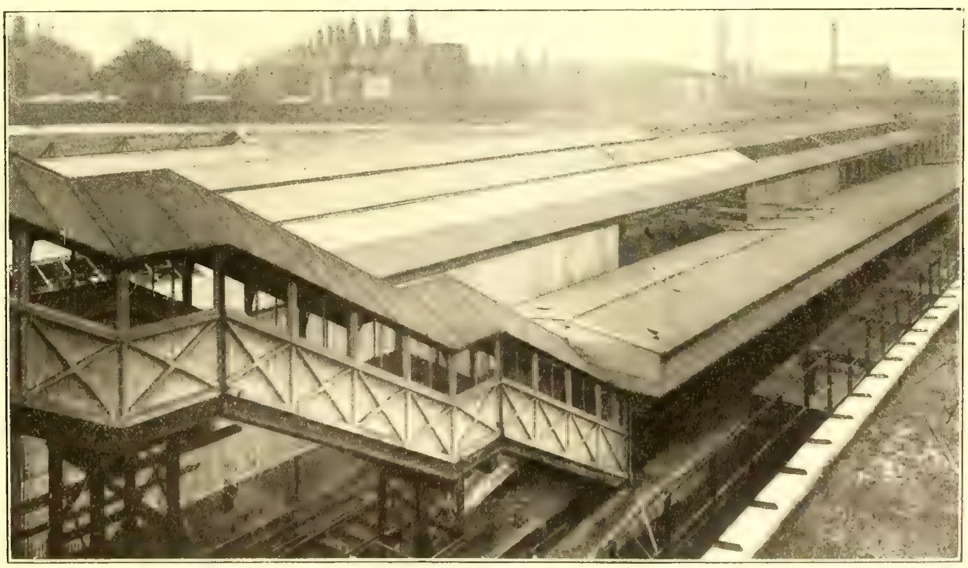


DRAYTON PARK, WHERE THE TUBES COME TO THE SURFACE



CROSS-OVER AT ENTRANCE TO TUBES AT DRAYTON PARK STATION

Ample elevator accommodation has been provided for dealing with the masses of people unloaded from the trains every few minutes. Easy inclines and stairways will enable the passengers to reach the subway platforms (about 40 ft. below the rails of the Great Northern Railway) in almost less time than the elevators can be filled, lowered and emptied. The electric elevators at Moorgate Street and Essex Road were supplied by Easton & Company, of Erith. Those at Finsbury Park had to be modified, in view of the small head room, and are electro-hydraulic. They were sup-



DRAYTON PARK STATION ON THE SURFACE

plied by the Chester Engineering Hydraulic Company.

STAIRWAYS AND PLATFORMS

All of the station stairways and passages are unusually wide, to prevent congestion. The terminal station platform is 450 ft. long, and the other stations 420 ft., allowing ample margin for the trains and their possible lengthening should the traffic demand it.

MEANS FOR LESSENING NOISE

A novelty in connection with the construction of the tunnels of the Great Northern & City Railway is the introduction, for a very great proportion of their length, of a vitrified blue brick invert. It has been demonstrated by trial runs that this material combined with a cast-iron roof will minimize noise and vibration. It is less resonant than complete iron rings, and the fact that the tubes are constructed of such different materials makes the transmission of sound waves more difficult with a consequent noise reduction.

MOTOR CAR USED ON THE GREAT NORTHERN & CITY RAILWAY

SAFETY PRECAUTIONS

In view of the recent disastrous fire in the subway of the Paris Metropolitan Railway, it is interesting to know that all possible fireproofing and other precautions have been taken in the construction of the Great Northern & City Railway's lines.

VIEW SHOWING THE CONSTRUCTION OF A STATION

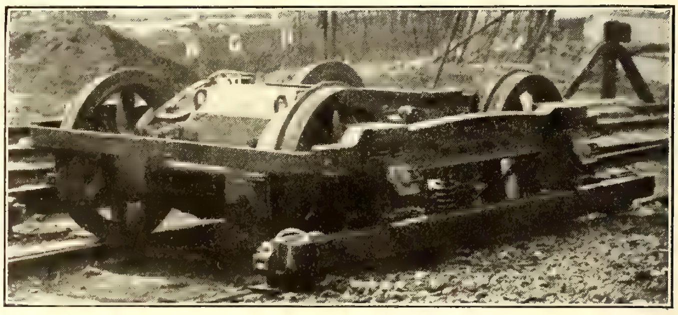
Even the signalmen's cabins are fireproof structures, and the station platforms are built of solid concrete and iron. An independent lighting system is used throughout the tunnels, so that in the case of a breakdown of the generators furnishing traction current, or other accident, the tunnel will not be in darkness. If the passengers are obliged to alight and walk along the tunnel, they will be amply provided with means of getting to the nearest station by the aid of this illumination and a continuous fireproof concrete gangway.

ROLLING STOCK

The standard trains are made up of seven cars, three motor and four trailers, having a total approximate seating capacity of 430. The first motor car is at the front of the train, the second in the center, and the third at the end. The approximate weight of the loaded train is 200 tons.

The cars were built by the Electric Railway & Tramway Carriage Works, Ltd., of Preston, and the Brush Electrical Engineering Company, Ltd., of Loughborough. They are supplied with Westinghouse quick-acting brakes. Each motor car carries a British Thomson-Houston motor-driven air compressor, reservoir, etc. There are also conductors' emergency cocks at the end of each car for applying the brakes in case of need.

The cars are 50 ft. 6 ins. long, 12 ft. 2 ins. high, and 9 ft. 4 ins. wide, this width being equal to that of the widest cars used over any other British railway. They are handsome teak structures with steel underframes, are of the corridor type, have center doors and are provided with roomy seats. Each motor car is carried on two McGuire trucks, having 36-in. diameter driving wheels. The trailer cars are mounted on Brush trucks. On each truck of



TRUCK FOR MOTOR CAR

VIEW SHOWING VITRIFIED BRICK CONSTRUCTION

the motor cars is mounted one 550-volt, series wound, direct-current motor. Current is collected by four collector shoes per truck.

The capacity of each motor is 125 hp, rated on the basis of 75 degs. C. rise in temperature above the surrounding air after

1 hour's run on full rated load. The gear is of steel, machine cut, and enclosed in a waterproof case.

The motors are controlled by the type "M" multiple-unit control system. An interesting fact in connection with this installation is that the Great Northern & City Railway was the first British electric railway to adopt the multiple-unit control system, the type adopted being chosen after elaborate tests.

SERVICE

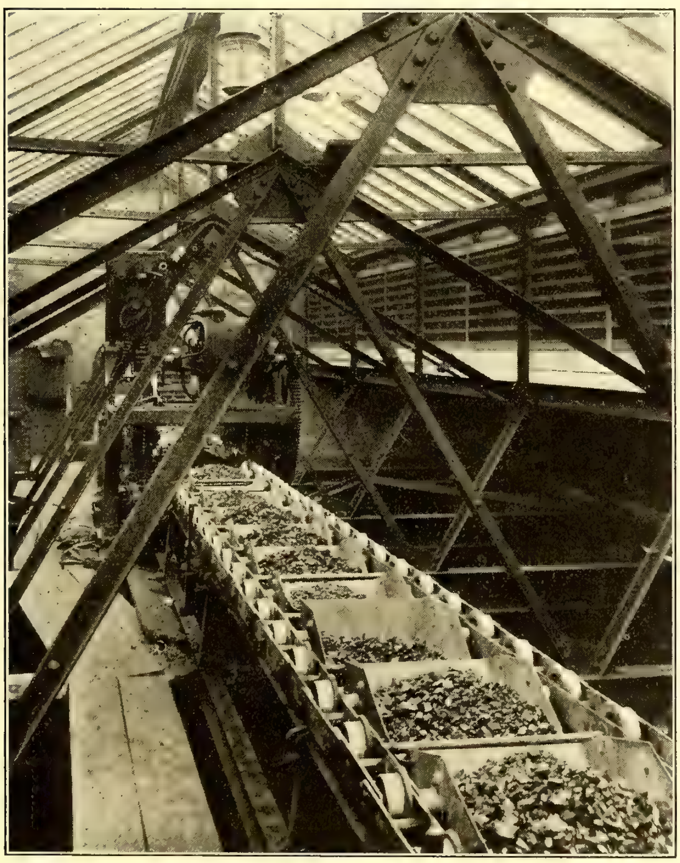
A 3-minute service will be introduced, single trips being completed in 13½ minutes, which permits four intermediate of 20 seconds each. The trains will be shuttled at the termini, thus avoiding shunting around the stations.

It is hoped to be able to maintain a 3-minute service throughout the day simply by shortening the trains, so that they may be run profitably on such short headway.

The fare between Moorgate Street and Finsbury Park is 2 pence, and some of the intermediate stations have penny fares to either of these places.

POWER STATION

The power for operating the system is supplied from a single generating station located at Poole Street, New North Road, about a mile north of Moorgate Street station. The length (3½ miles) of the line and position of the generating plant are such as to enable the system to be operated without feeding in at several points, the current being transmitted directly to the collector rails. The generating machinery also furnishes the current for lighting and the operation of the passenger elevators.



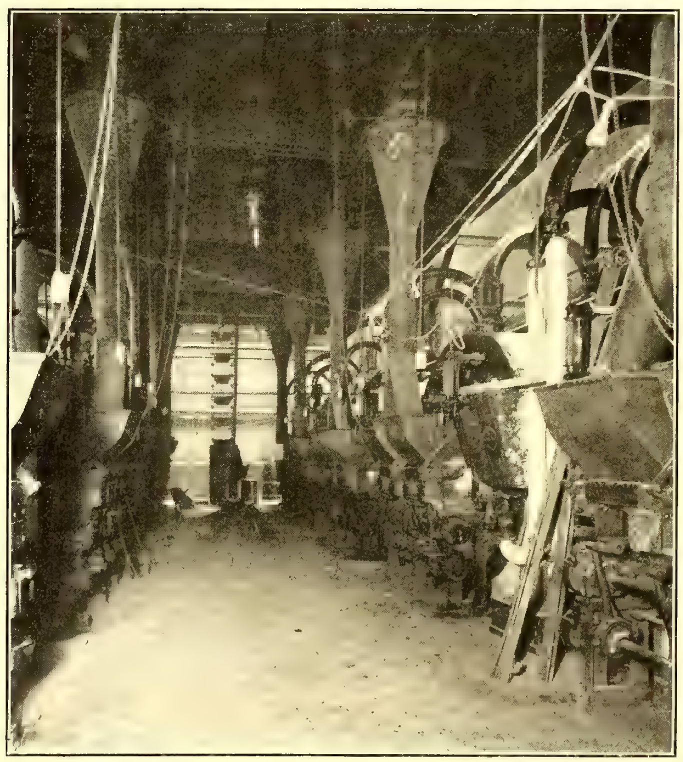
ELECTRICALLY DRIVEN GRAVITY BUCKET CONVEYOR

The site adjoins the Regent's Canal, from which water is taken for condensing and other purposes, and returned to the canal at a point 300 ft. on the down-lock side of the in-take. Its connection with the Regent's Canal also permits fuel to be delivered cheaply alongside, from whence it is conveyed to the storage bins and fires by a Hunt gravity bucket conveyor, which handles 30 tons of coal an hour.

Steam is supplied by ten Davey-Paxman "Economic" boilers, each having an effective grate area of 40 sq. ft., and capable of evaporating 11,200 lbs. of water per hour at 212 degs. F. when using coal giving 13,500 B. T. U. The boilers are fitted with Vicar automatic stokers, which are driven by two motors.

TRAILER CAR USED ON THE GREAT NORTHERN & CITY RAILWAY

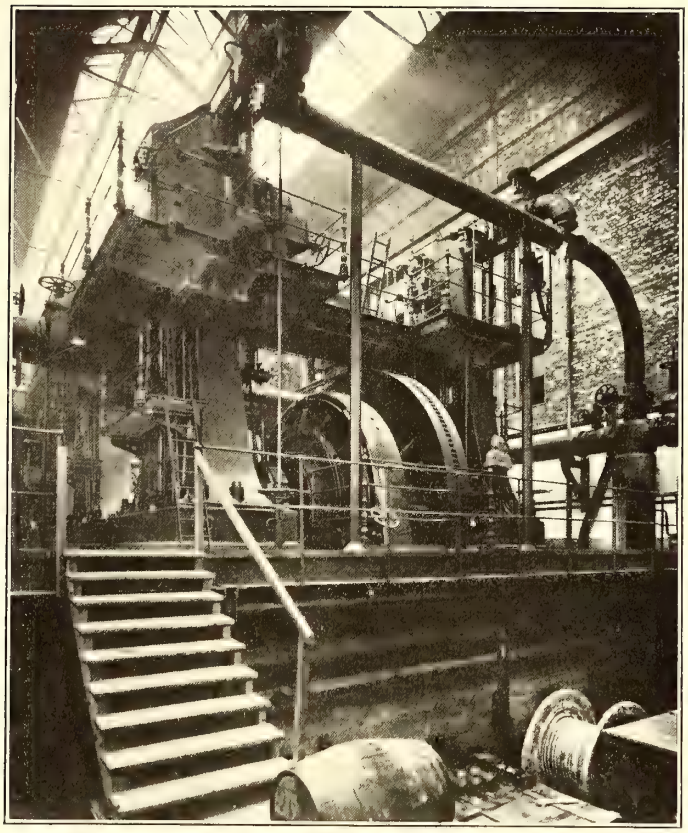
The four main engines are of the vertical cross-compound type, built by John Musgrave & Sons, Bolton. The engines give 1250 hp at 100 r. p. m. and of 150 lbs. pressure. They have fly-wheels, weighing about 45 tons each, and are capable of sustaining 100 per cent overload momentarily. They are direct connected to four railway-type generators, rated at 800 kw each, but capable of taking for 2 hours, without objectionable heating, a load up to 1200 kw. These generators are also able to carry momentary overloads of 100 per cent without injurious sparking. They are compound wound to give 525 volts at no load and 575 volts at full load.



BOILERS AND STOKERS IN POWER STATION

Two Peache engines, of the single-acting, tandem-compound type, built by Davey-Paxman & Company, drive two six-pole, 120-kw generators at 375 r. p. m. They are compound wound for the same voltages as the main generators, and have an overload capacity of 50 per cent for 2 hours. They will supply power for lighting of power house, etc., and for operating the electrically-driven auxiliary plant when it is not convenient

to take power from the main generators for this purpose. There are four Wheeler surface condensers, each having a cooling surface of 2400 sq. ft., and arranged with steam-driven



DIRECT-CONNECTED GENERATING SET IN POWER STATION

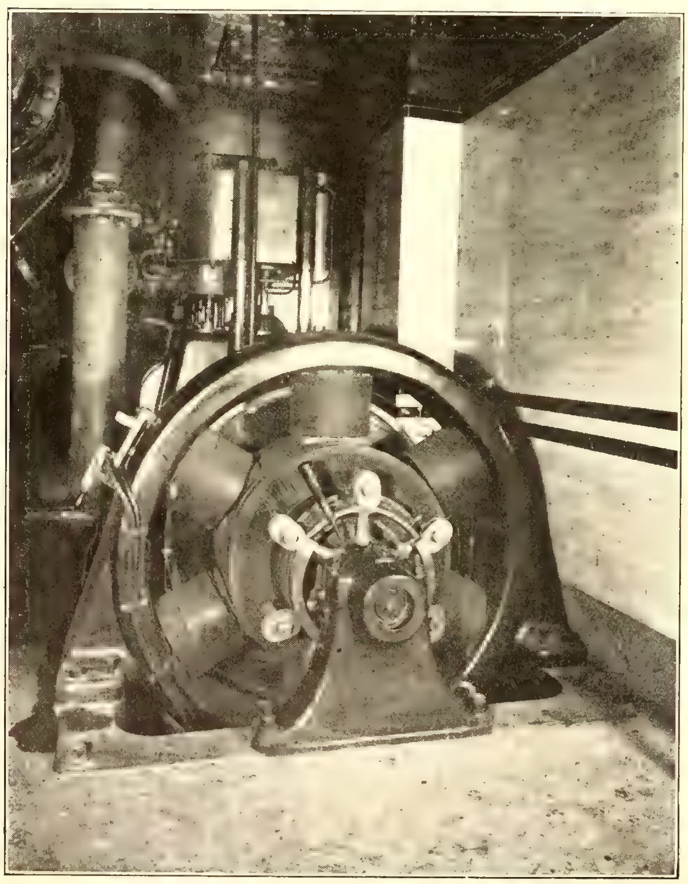
capable of handling the auxiliary plant and boiler feed pumps' exhaust. These condensers discharge into a hot well, from which the water is delivered by two three-throw vertical lift pumps of the Blake-Knowles type, driven by enclosed motors. All the condensers have combined air and circulating pumps, driven by steam.

In addition to the supply from the canal mentioned previously, water can be obtained from the city mains. A storage tank has been provided connected directly to the latter.

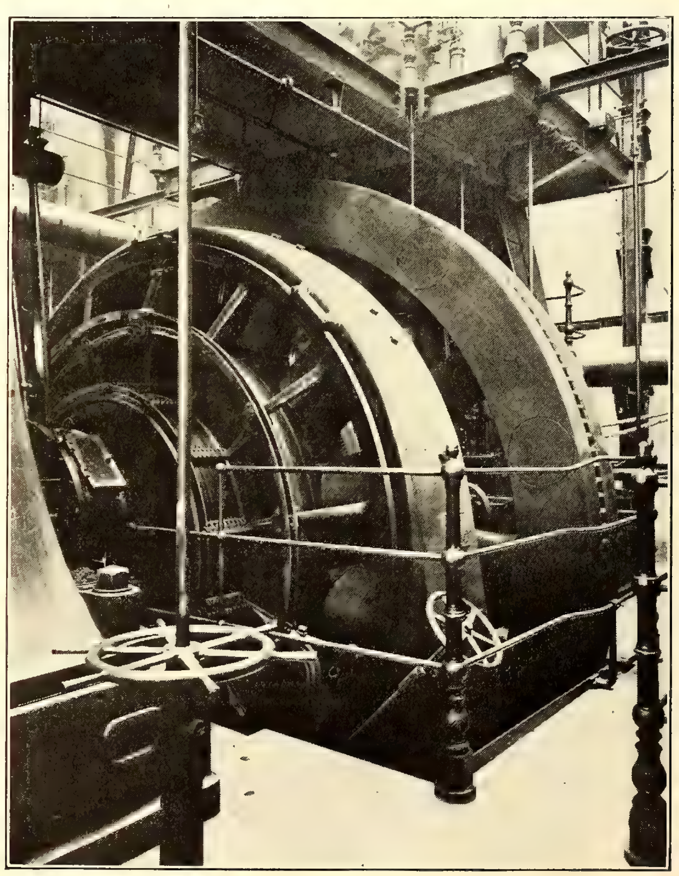
The water taken from the canal is dirty, and varies in hardness from time to time during the year by reason of floods and droughts. For softening and purifying both this and the town water, which is also variable, a Desrumaux plant, capable of treating 8500 gals. per hour, has been installed in the rear of the boiler house. This gives water having its hardness reduced to 5 degs., and alkalinity to about 6 degs., free from solids. An automatic arrangement is adjusted between the softener and storage tank, whereby the softening process is suspended and recommenced as occasion may require, thus giving a continuous supply of purified and softened water, with a minimum of supervision.

A Masson-Scott plant is installed for removal of oil and grease from the water of condensation and for the purification of the water for boiler feed purposes. This plant is capable of dealing with 10,000 gals. per hour.

The oil and grease which has passed through the steam engines is in the form of a divided emulsion, so fine in its character that it is impossible to remove it by mechanical filtration alone, chemical treatment as well as filtration being essential. The apparatus is thus a combined plant for first chemically treating, and finally filtering every gallon of water which leaves the surface condensers, producing a perfectly



AUXILIARY GENERATOR AND ENGINE



800-KW DIRECT-CURRENT GENERATOR

combined air and circulating pumps. They are capable of maintaining a 26-in. vacuum when dealing with 2200 lbs. of steam per hour.

There is also an auxiliary condenser of the same type, capable of handling the auxiliary plant and boiler feed pumps' exhaust.

clear effluent, free from grease or chemical admixtures and of a fixed degree of hardness suitable for boiler feed purposes.

A switchboard, consisting of four main-generator, four-feeder, two-auxiliary generator panels, three-auxiliary power

and three-auxiliary lighting panels, is installed in a gallery at one end of the engine room, commanding a view of all the main generators. The circuit breakers are of the magnetic blow-out type, and the measuring instruments of the astatic illuminated dial and feeder type.

Cables run from the switchboard along the outside of the boiler house wall and then down a special cable shaft into the tunnels. The bus-bars on the board are so divided that the auxiliary-generator lighting and auxiliary-motor panels can be isolated from the main generator and heavy feeder panels by the operation of one switch, insuring the uninterrupted operation of the lighting system if any accident occurs to the main power circuits. Separate paper-insulated feeding cables are provided for traction, for lighting and for elevators, and rubber insulated cables for lamp circuits and connections.

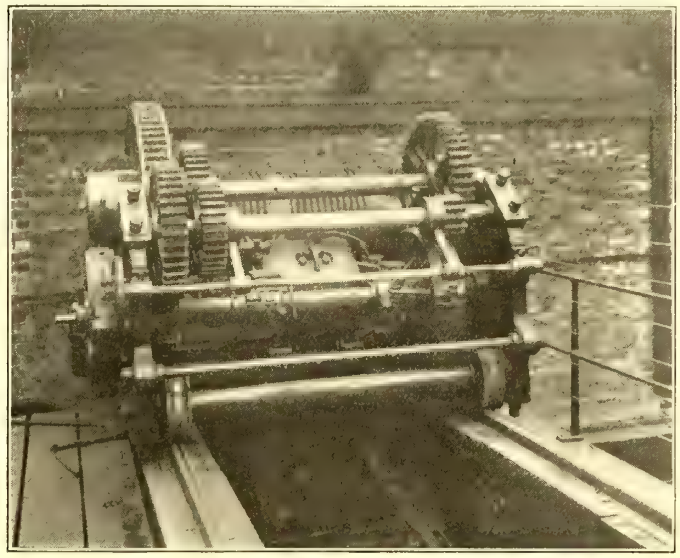
The rest of the station plant comprises steam-driven feed pumps, motor-driven economizer, two motor-driven lift pumps, storage and receiving tanks, water softening plant, one 30-ton three-motor overhead crane, etc.

POWER CIRCUITS

Two insulated conducting rails are used per track, one being for the return current. Both rails are placed outside of the running rails. The conducting rails are of channel section, weigh 80 lbs. per yard, and are rolled to about 42-ft. lengths. They are of a special quality of low-carbon steel, having a conductivity 14 per cent of that of pure copper of equal cross-section. These rails are supported on earthenware insulators, 10 ins. outside of the gage, carried on spindles supported by cast-iron brackets fixed to the ties. The system of collector rails is divided up into four sections, fed independently from the generating station. The running track is laid to standard gage, and consists of 85-lb. flanged rails laid on longitudinal stringers in the tunnels and on cross-ties in the open. As it carries no current it is not bonded.

LIGHTING CIRCUITS

All lighting circuits are carried in iron tubes, and the tunnels are provided with lamps every 100 ft. The passenger stations are lighted on the rail and street level by enclosed arc



TRAVELER OF OVERHEAD CRANE IN POWER STATION

lamps, and station switches are fixed which control the incandescent lamps in the tunnel half-way to the next station in each direction. The lamps are placed five in series, and the circuits are run so that there is never more than the voltage of one lamp between two adjacent wires in the same pipe. Special throw-over switches are provided to take the lighting current from the conductor rails when the special lighting cables are not charged.

GENERAL VIEW OF ENGINE ROOM

PERSONNEL

The chairman of the board of directors of the Great Northern & City Railway Company is Sir Charles Scotter, the other directors being the Earl of Lauderdale, Sir Henry Burdett, K. C. B., Lord Knollys, G. C. V. O., and Charles Steel, who has recently joined the board, and was formerly the general manager of the Great Northern Railway, and, therefore, brings special experience to bear upon the traffic problems connected with this line.

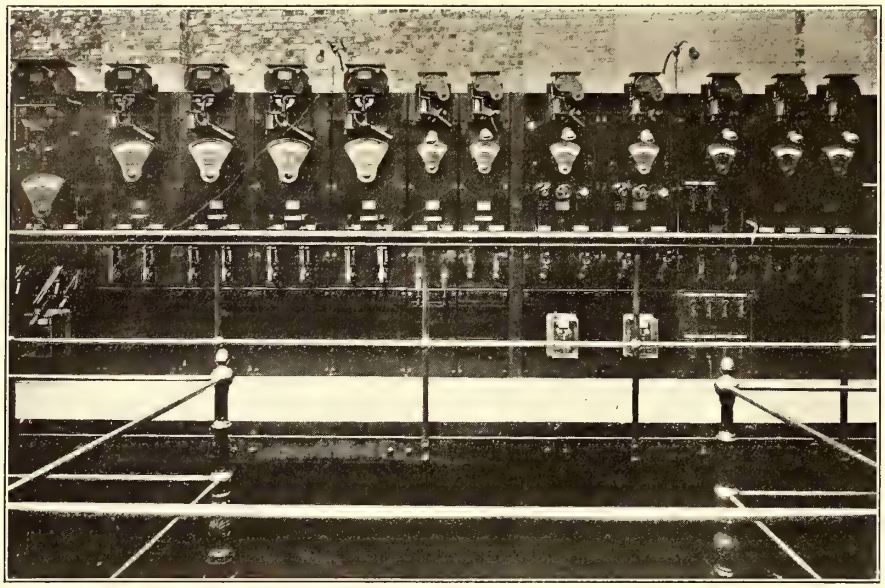
The line from its southern end to Drayton Park has had for its engineers Sir Douglas Fox & Partners, represented by Daniel L. Hutchinson; from Drayton Park to Finsbury Park, including the repair shops and carriage sheds carried out by the Great Northern Railway Company, has had for its engineer Alexander Ross, chief engineer of the Great Northern Railway, and W. H. Sadler.

E. W. Moir, one of the directors of S. Pearson & Son, Ltd., the general contractors for the whole of the railway, has had charge of the line, on their account, during its progress.

The general control and the engineering of the running line has been taken up by R. P. Brousson, who has had considerable experience in the electric traction installations, both in connection with the Central London Railway and during the construction of this work.

Messrs. Pearson's agents in charge of the southern and northern ends of the work, respectively, have been B. Everett and H. Japp.

The whole of the engineering work for the British Thomson-Houston Company, Ltd., was under the direction of A. H. Walton, manager heavy traction department, assisted by Messrs. Winkfield, Dundas and Thomas.



SWITCHBOARD IN POWER STATION

TERMINALS AT THE ST. LOUIS EXPOSITION

The St. Louis Transit Company has decided upon the location of its various terminal loops at the Louisiana Purchase Exposition grounds for handling the immense crowds of the Exposition. The map herewith shows the constructed and authorized lines of the St. Louis Transit Company, the location of the World's Fair grounds at Forest Park, and the terminal loops which will be operated by the St. Louis Transit Company during the fair; the latter are indicated by dots. As will be seen there will be six of these, four on the northern boundary nearest the principal buildings, and two on the southern boundary. To the four northern loops access is had over four routes. The two southern loops are served by one route. The arrangement of the St. Louis Transit Company's system is such that it will be quite feasible to route cars over all portions of the city to the fair grounds, because of the several cross-town lines. The miles of street occupied by the company's tracks are 176.41. The miles of single track are 358.65. But little additional track will be laid this spring, and that will be confined mainly to the vicinity of the fair grounds. It is estimated that passengers can be handled at the rate of 50,000 per hour at the six terminal loops, which is probably a very conservative estimate.

The plans for all the terminal loops have not been fully decided upon at the present writing, but the plans for the two loops nearest the main entrance have been worked out and are shown on this page, through the courtesy of C. A. Moreno, chief engineer of the company. These are both double-track loops, and one is provided with an extra storage track. These loops will be fenced in and provided with turnstiles, so that incoming and outgoing passengers can be kept separate. In order to provide for simultaneous loading of a large number of cars when people are leaving the fair, a movable fence will probably be provided, by which it will be possible to change the relative size of the loading and unloading compartments. Thus, in the morning and early evening, when people are arriving at the grounds in large numbers, there will be a necessity for considerably more track space on which cars can stand to unload passengers than for loading track space, as but few persons will be leaving the grounds at such times, and cars can load so quickly that they will not need as much standing room as they will late in the evening when there is a great crowd leaving. When the crowd begins to leave, the fence can be moved along so as to use the greater part of the loop trackage as a loading track. The company now operates on maximum schedule 893 cars, and it is expected to increase this to 1500 cars when necessary during the Exposition.

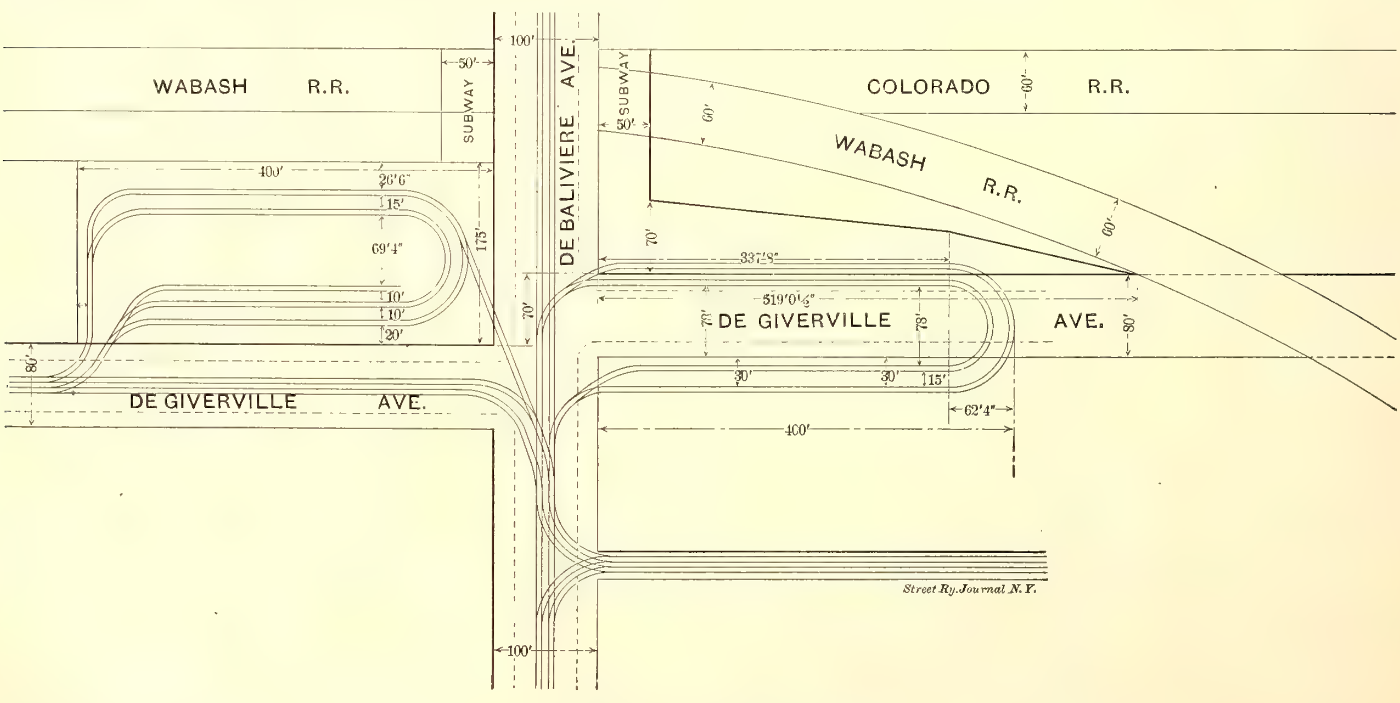


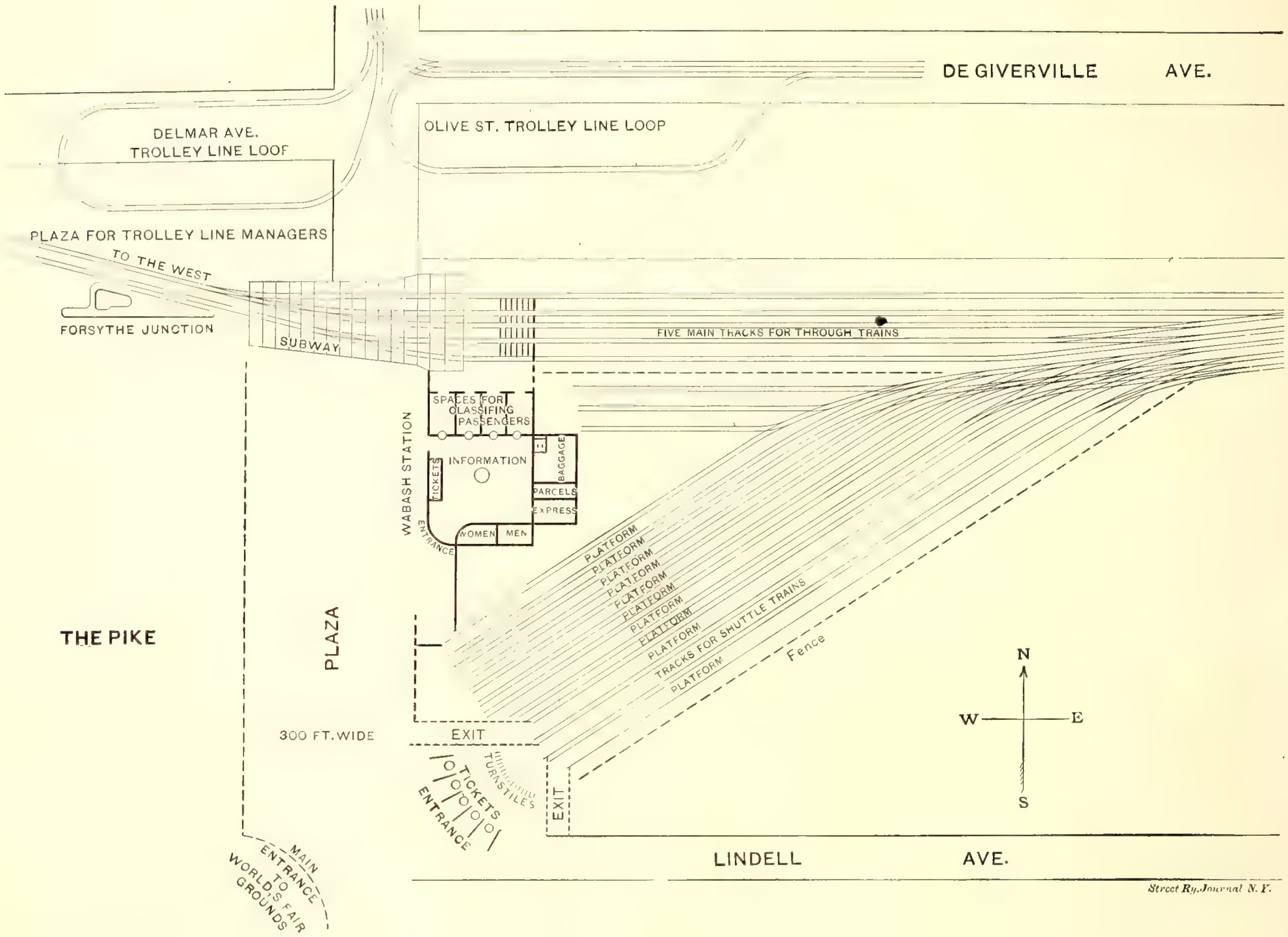
DIAGRAM SHOWING PROPOSED LOOPS OF THE ST. LOUIS RAPID TRANSIT COMPANY IN FRONT OF MAIN ENTRANCE TO WORLD'S FAIR GROUNDS

It will be noticed on the map that the Wabash Railroad is between the principal terminal loop shown in the diagram and the main entrance. To avoid a grade crossing at this point a

TERMINAL LOOPS FOR EXPOSITION SERVICE SHOWN THUS ●

subway is to be built under the Wabash tracks, so that passengers leaving the transit company's loop need not cross the steam railroad tracks at grade.

The plan below shows the arrangement of the Wabash Railroad terminal at this same point, and also the location of the subway just spoken of. Just south of the Wabash terminal, devoted to shuttle trains, is to be one of the loops of the Suburban Railway Company. The Suburban Railway Company will also have three other loops reaching the north and west side of the grounds. From this it will be seen that the Wabash Railroad is making extensive operations to handle through and local traffic at the main entrance of the grounds. As compared to previous Expositions, however, the steam railroad service will be at a disadvantage, because of the distance of the Union Depot from the business center. Nevertheless, the Wabash will undoubtedly carry many people who are so located as to be conveniently near the Union Depot or some other station on the way to the Fair grounds. The Wabash Railroad is spending about $60,000 on its World's Fair terminal, and expects to be able to handle about 25,000 passengers per hour by means of suburban trains running between the Exposition grounds and the Union Depot. Both this terminal of the Wabash and the Union Depot are to be elaborately fitted up with classification compartments, so that passengers for a certain train can be admitted into the particular compartment for that train before the train arrives, which will save considerable confusion which might arise in an attempt to load a through train hurriedly.



GENERAL PLAN OF WORLD'S FAIR TERMINAL STATION, ST. LOUIS, SHOWING WABASH RAILROAD TRACKS IN FRONT OF MAIN ENTRANCE, ELECTRIC RAILWAY LOOPS AND SUBWAY

The St. Louis Car Company is planning to exhibit at the Louisiana Purchase Exposition the handsome private car which it is now constructing in its shops for President John I. Beggs, of the Milwaukee Electric Railway & Light Company.

WEAR OF BEARINGS IN ELEVATED SERVICE

Master mechanics of surface lines will look with envy on the records of bearing wear made by motors in elevated service. A motor car of the Metropolitan West Side Elevated Railway, of Chicago, was recently taken into the shop for general overhauling and renewing of bearings after a service of nearly one year, and it was not on a tripper run, either. On surface roads it is customary to consider that the length of time or the mileage that a motor car can run without overhauling is determined principally by the wear of the armature bearings. In other words, the motor can be allowed to run without a general overhauling as long as the armature bearings will last. When these bearings have worn out, since the motor must be taken to the shop anyway, it is customary to give it a general overhauling. The long life of bearings in elevated service, as compared to service on the street surface, where bearings last only one-sixth to one-half as long, is probably due partly to the use of oil instead of grease by the elevated roads and to the freedom from dust and dirt. It has been observed by managers of large city systems that there is considerable difference in the bearing wear on different routes of the same system. This is accounted for by the kind of street surface over which the motors run.

The Boston Elevated Railway Company is trying to prevent the improper use of free transfers. The chief offenders against the company are the small boys, who secure the tickets of passengers who are not going to use them, and sell them to would-be passengers. Some sections of Boston are at present anxious to secure additional transfer privileges from the company, but in the face of present abuses, which greatly reduce the legitimate income of the company, it is impossible to make further concessions.

PACIFIC ELECTRIC RAILWAY COMPANY'S SYSTEM—II

In the last issue of the Street Railway Journal an article was published on the main features of the extensive system of interurban roads in the neighborhood of Los Angeles, and the track construction of these roads was described in detail. It is the intention in the present article to take up the overhead construction and passenger stations and give some particulars of the Mt. Lowe branch, leaving for subsequent articles the power station, car houses and particulars of the operating practice.

OVERHEAD CONSTRUCTION

The overhead system of the Pacific Electric Railway is practically a standard overhead center-pole construction, wherever center poles can be used, which includes all private rights of way and practically all of the line excepting some few streets entering cities or towns. The center-pole construction comprises a transmission line, feeder line and the trolley line. The poles are set 115 ft. apart on straight track and at appropriate distances on curves. For the standard construction adopted for new work 40-ft. Oregon or Washington cedar poles are used, with two cross-arms at the top, which carry on glass insulators the usual six-wire, high-tension transmission system, the wires being arranged on the equilateral triangle form, approximately 3 ft. apart. The transmission standard is three-phase 50-cycle, 15,000 volts; 4 ft. below the lower cross-arm of these two is placed the cross-arm which carries the feeders and telephone

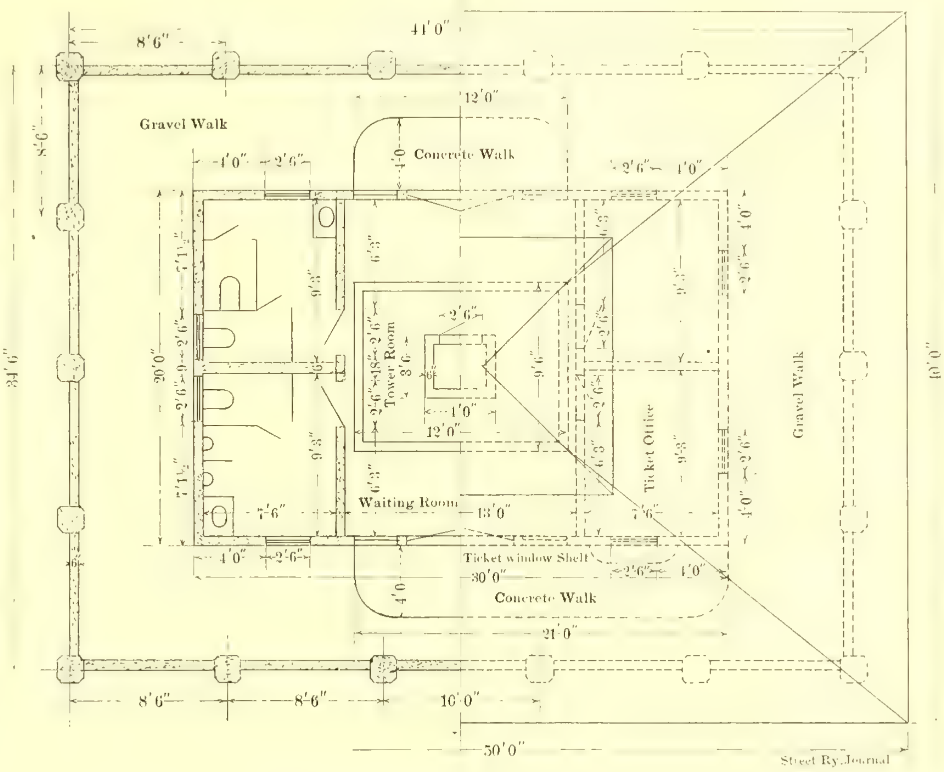


FIG. 2.—PLAN OF COMBINATION WAITING AND SUB-STATION BUILDING

wires, and 4 ft. below this is carried the usual gas-pipe cross-arm which supports the two trolley wires. All of the devices are extremely simple, the trolley wire, which is No. 000 grooved, being carried on a span below the pipe, which gives it the required flexibility. The pipe is usually run through the pole, but in some cases is supported by special socket castings, secured to the pole. The end castings, or pendants which support the span wire, are of cast-iron, but hereafter a light malleable casting is to be used.

The poles are set approximately one-seventh of their length in the ground as usual. They are painted with pure white coating above the base line, and to a height of about 5 ft. above the rail they are painted the bright red color which is used throughout for designating Pacific Electric cars and apparatus. No treatment has been generally employed for the butts of the poles, but 200 poles have been treated for testing the usefulness of certain iron and wood preserving compounds. The cross-arms are painted red, and where they carry any lines but those used for telephone purposes they are marked with white below the pins.

A standard line contains six No. 3 wires for transmission purposes, mounted on No. 17 Locke insulators, with porcelain bases and iron pins. The porcelain bases are suspended on curves by cast-iron bases. The standard feeder for suburban work where stations are about 8 miles or less apart is 600,000 circ. mils bare copper. Two telephone lines are run throughout—one of which is connected directly to the engine room and sub-stations for the use of the power department, while the other is connected to the despatcher's office and all the several conductors' telephones along the line.

In Fig. 1 is illustrated a board of seventy-four parts used in the standard overhead construction on the Pacific Electric Railway Company's lines. Outside of the special end castings for the iron pipe trolley bracket, the emergency ear, and the 22-in., 18-screw trolley-wire splice, which are of the company's

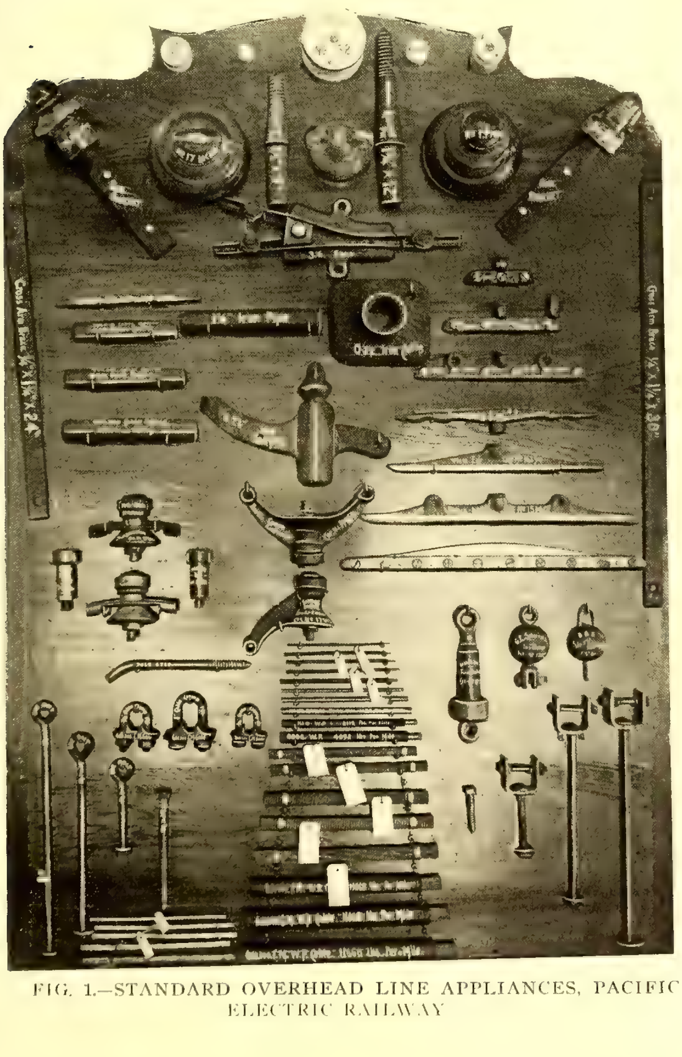


FIG. 1.—STANDARD OVERHEAD LINE APPLIANCES, PACIFIC ELECTRIC RAILWAY

own design, the fittings are of standard manufacture. The views of the track construction on the Monrovia line, Figs. 5, 8 and 19, in the last issue, show the standard overhead construction. The views of the Long Beach line work, Figs. 10, 11 and 18, also in the issue of Feb. 27, show 35-ft. poles with six high-tension wires on one cross-arm. In the city of Long Beach, as may be seen in Fig. 12, the poles are of square sawed redwood.

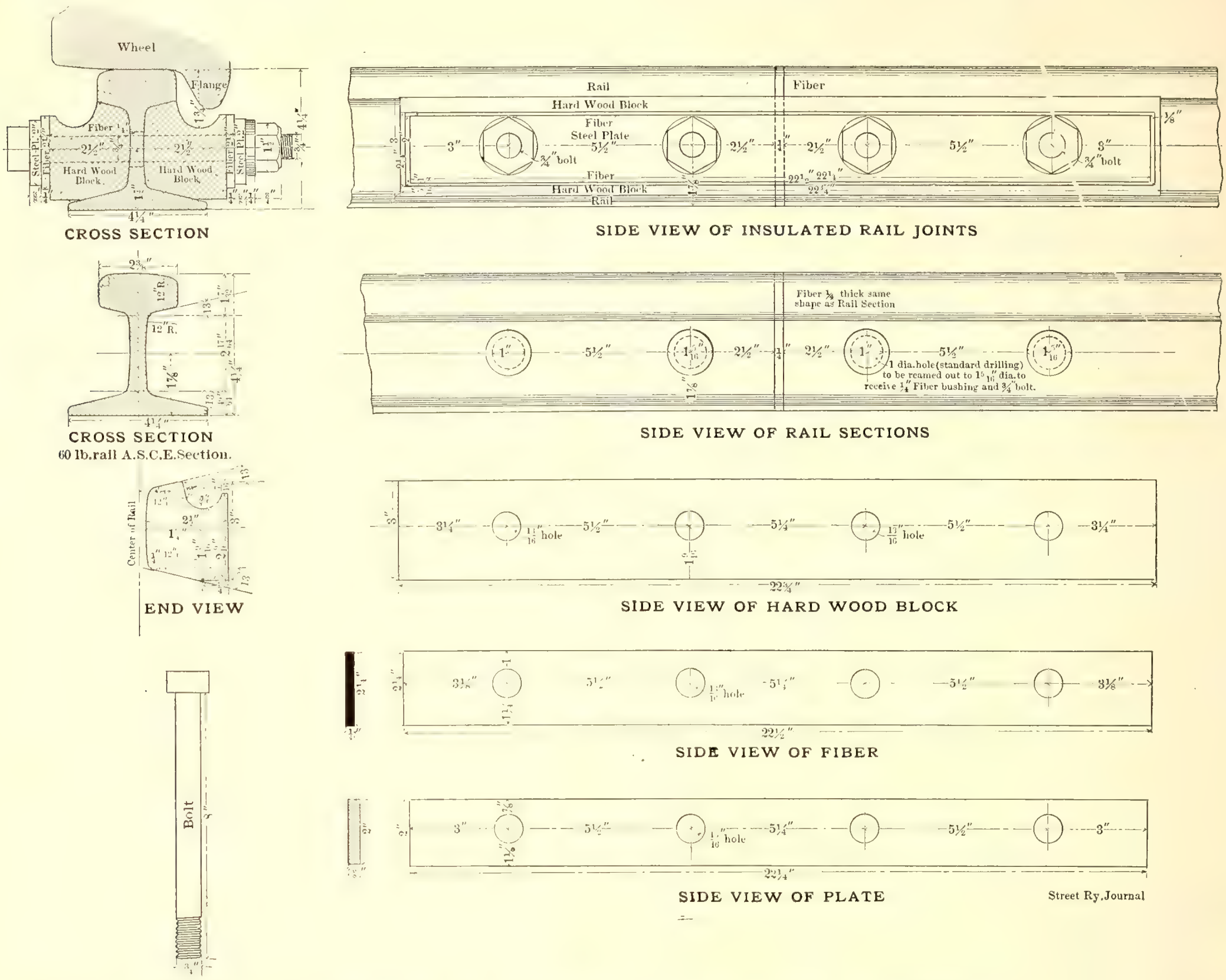


FIG. 3.—INSULATING RAIL JOINTS USED IN CONNECTION WITH THE ALTERNATING-CURRENT BLOCK SIGNAL SYSTEM

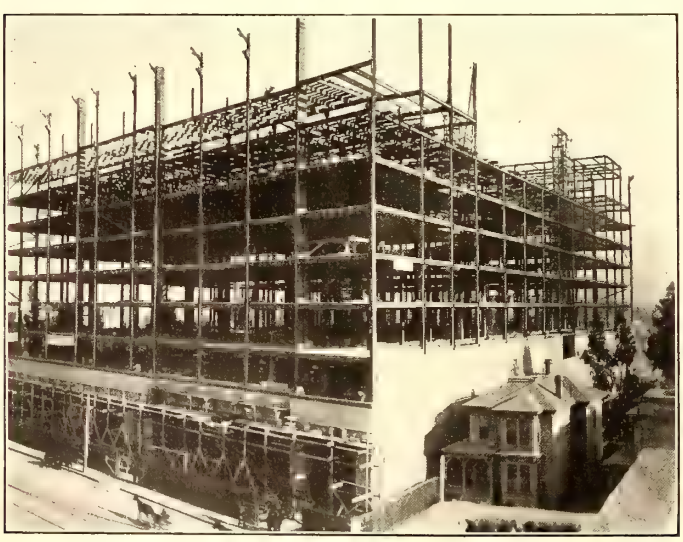


FIG. 4.—VIEW OF TERMINAL STATION BUILDING, TAKEN DURING CONSTRUCTION

BLOCK AND STATION SIGNALS

In order to ensure safe operation of trains and to provide for the convenience of the passengers, the company is working out, under the direct supervision of R. S. Masson, electrical engineer, an interesting system of block signals as well as special car-signalling apparatus for the use of passengers at stations. The block signal system will be unique, in that it will be centrally energized, alternating current being used. It will be installed on all the interurban lines, standard signal stands with semaphores and lamps for home and distant signalling being used, with blocks averaging a mile in length. The system of signals to be adopted is the same that is used by the large trunk steam roads. Alternating current will be used for the semaphore movements, and no direct-current motors and batteries will be installed in the signal stands, the entire system being operated from a central source of power. One rail is to be used for the signal system, the different blocks being set off by the form of insulated rail-joint illustrated in Fig. 3. The insulation between rail ends in this joint is fibre, ¼ in. thick, and the joint is made by two hardwood blocks, 22¾ ins. long and 2½ ins. thick, and two ¼-in. fibre strips, 22½ ins. long, the whole being held in place by steel plates with four ¾-in. bolts.

For the present but one rail will be employed for the direct-current track return, but with the introduction of choke coils it is believed the signal rail may be used for carrying both the alternating current and the return direct-current. The system will be automatic in the usual sense, and it will also be arranged so that in case of unusual conditions on the line the chief despatcher can throw all the signals to caution, thus compelling

all cars to proceed at half-speed, or, if necessary, he can throw all signals to danger position, thus stopping all cars and tying up the system. Then, afterward, the signals can all be thrown to clear position by the despatcher, thus allowing the service to be resumed. This signal system, in connection with the telephone lines, will enable the company to operate its cars with the highest degree of safety and also with maximum economy and efficiency. The block signals at the Southern Pacific crossing on the Long Beach line, and illustrated in Fig. 11 in the last issue, were installed by the Southern Pacific Company, and are of the Taylor type.

DESTINATION SIGNS

On portions of the company's systems, such as the Long Beach line and the Pasadena Short Line, cars of different routes are operated, and at night a passenger who wishes to signal a car has no means of knowing which one is his, so he has to signal every car that approaches until he gets the right one. Illuminated signs have been suggested as a remedy for the difficulty, but the expense of equipping all the cars with these signs and of keeping them lighted would not be a small one. It is doubtful also if the signs could be distinguished on account of the brilliant arc headlights which are used on the cars. The plan that has been adopted is to install at each

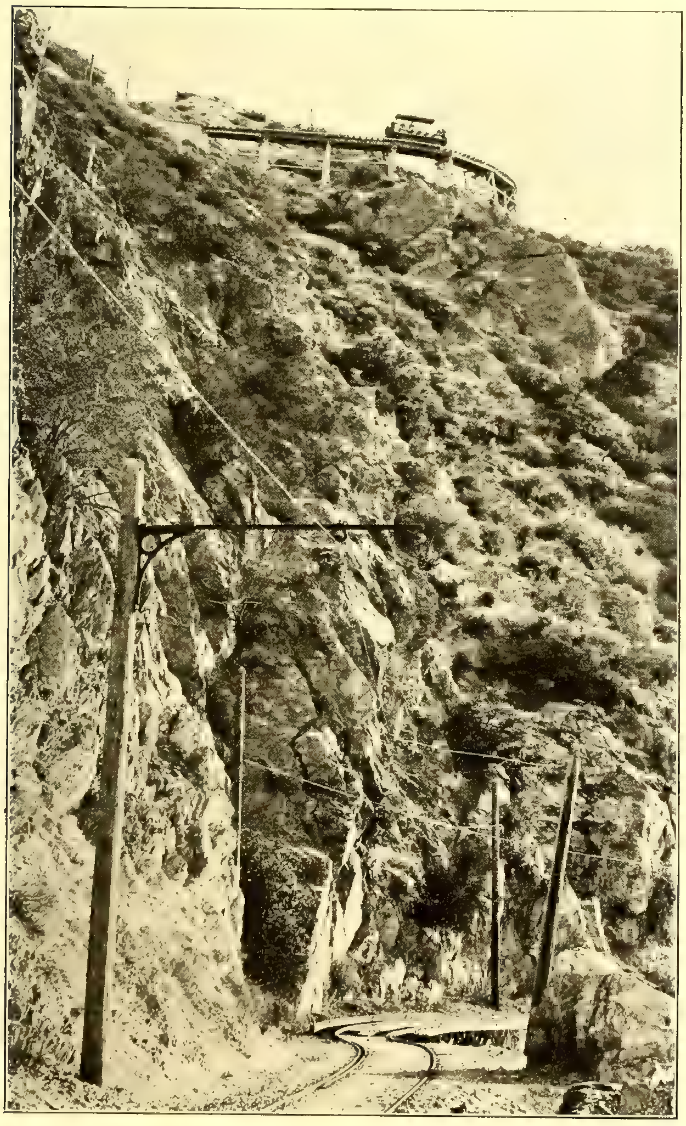


FIG. 5.—SCENE ON MT. LOWE DIVISION, SHOWING CIRCULAR TRESTLE ABOVE

station where cars of two or more lines pass, a stop signal of special construction. This signal will be provided with different-colored lights, as many as four colors being practical. Each colored light will indicate a certain line of cars, and the motormen will be able to distinguish the lights at a distance, so that he can readily come to a stop. For each light there will be arranged a lever, properly labeled, and when a person at the station wishes to board a car he pulls the proper lever, and thus lights the proper lamps, when he sees a car approaching.

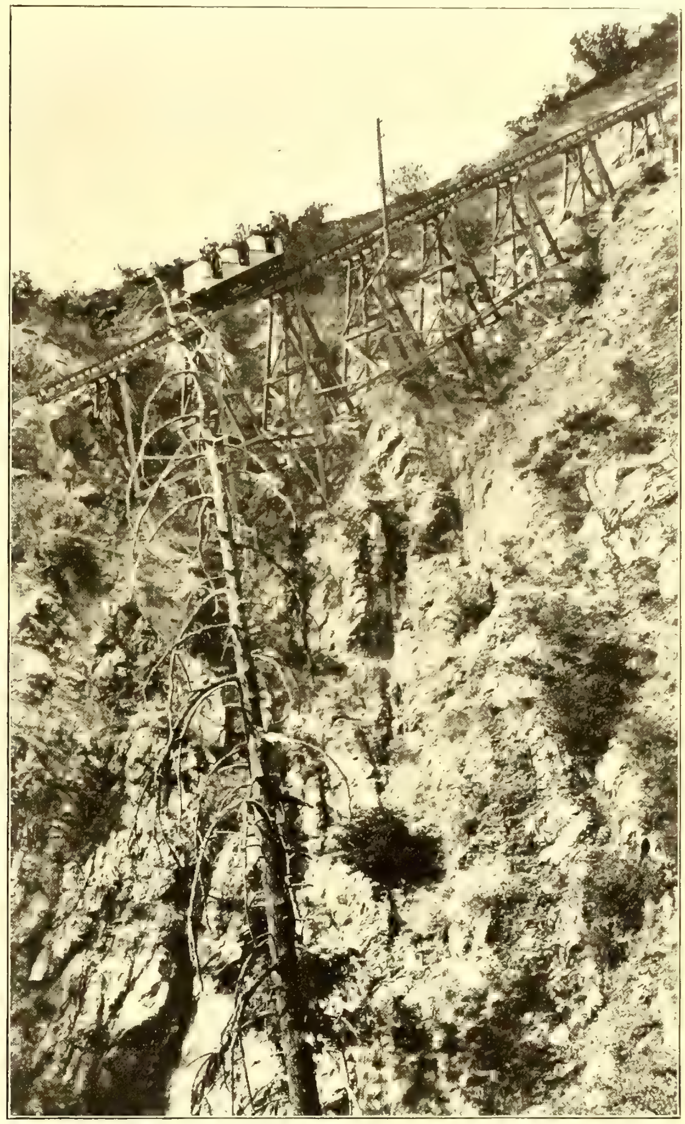


FIG. 6.—LONG BRIDGE ON CABLE INCLINE BETWEEN RUBIO CANYON AND ECHO MOUNTAIN, SHOWING CAR WITH INCLINED SEATS

If the car is the right one the motorman stops, and if not it passes by without losing any time. These levers will be held in normal position by springs, and as the small boy is apt to meddle with them, the springs will be strong enough to prevent children from operating them.

Signals will be arranged on a wooden pole beside the track. There will be (for a three-route line) three colored incandescent lamp signals, side by side, at the top of the pole, and below that three semaphore arms of corresponding colors arranged one below the other. When a passenger pulls the proper lever at the base of the pole, the corresponding semaphore arm comes to a horizontal position and the lamp of the same color is lighted. The lever is held in that position until the motorman acknowledges that he has seen it by blowing his air whistle. The system will be similar to the one in use on the Seattle-Tacoma Interurban Railway.

As the signals must necessarily be placed where any one can operate them, the public will be warned that any malicious interference with them will result in their removal, and it is believed, with proper precautions in the instructions for operating the first one, the people will soon be educated to regard them as they do the government mail boxes.

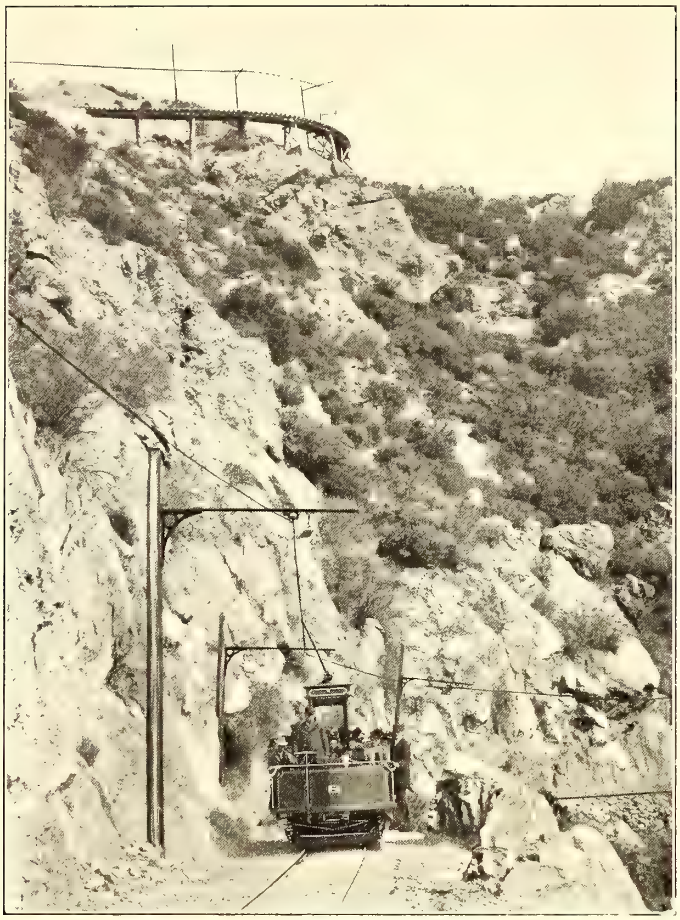


FIG. 7.—TROLLEY CAR ON ALPINE DIVISION, CIRCULAR TRESTLE ABOVE

TERMINAL STATION BUILDING

On the southeast corner of Sixth and Main Streets, Los Angeles, the Pacific Electric Railway Company is erecting a combined terminal station and office building. This structure will be nine stories high on Main Street, and ten stories on Los Angeles Street, which runs parallel with Main. The building extends 285 ft. on Sixth Street, and has a frontage on Main Street of 211 ft. Nearly all of the first story of the building, which has a clear height of over 25 ft., will be given up to station purposes, serving as a union depot for all the interurban lines of the Pacific Electric and Los Angeles Interurban Railway Companies. These lines now start in front of a temporary station across the street from the new building. In the new quarters there will be a train house, 80 ft. x 285 ft., in which there will be two tracks running practically the entire length of the building, connecting with the Main Street tracks by Y's. For the accommodation of the public there will be a general waiting room, 80 ft. x 100 ft.; a ladies' waiting room, 40 ft. x 60 ft., both provided with all modern conveniences; a dining room, 80 ft. x 100 ft., with lunch counters adjoining, and three store rooms, each 24 ft. x 80 ft., which will be leased to merchants. There will also be provided the necessary ticket offices, newsstands, check rooms, information bureau, etc., as well as the chief despatcher's office, from which all car movements will be governed. Ample space in the train house will be provided for keeping extra cars in constant readiness for emergencies and for occasions such as trolley parties, etc.

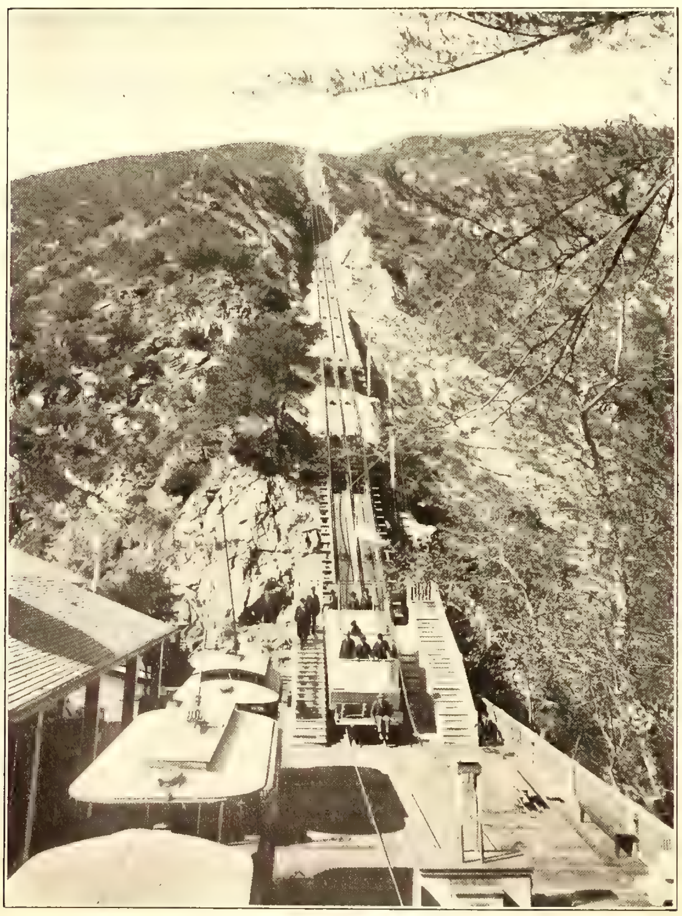


FIG. 8.—BASE OF CABLE INCLINE RAILWAY

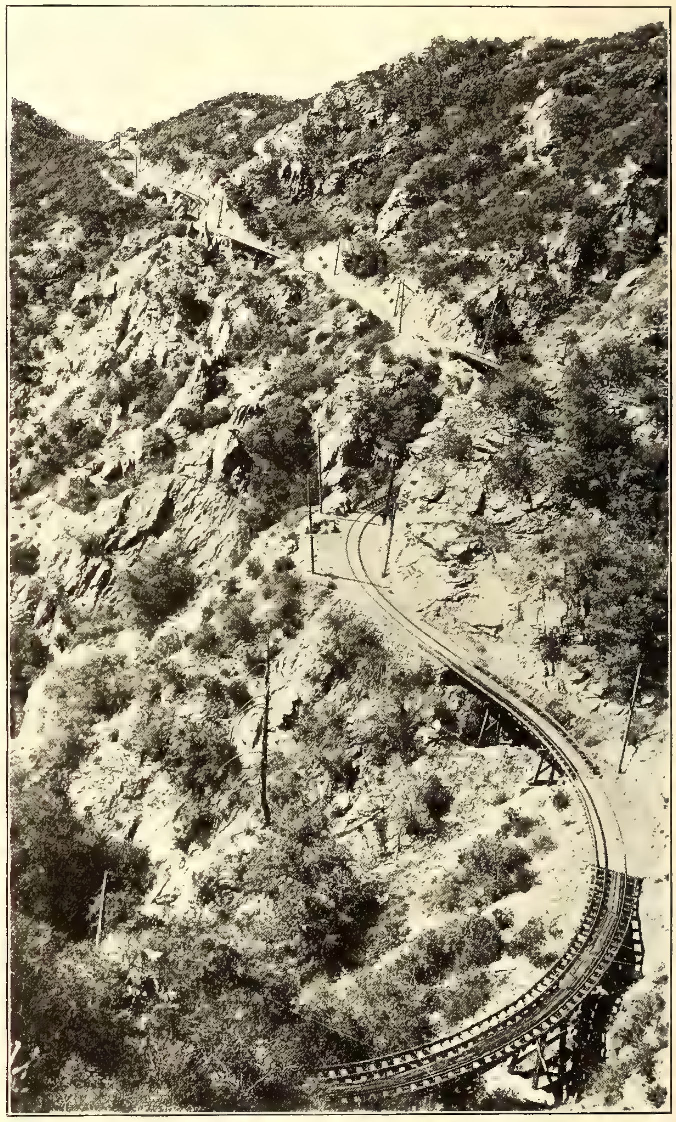


FIG. 9.—BIRD'S-EYE VIEW OF PART OF ALPINE DIVISION

The building will be entirely fireproof, the construction consisting of a steel structural framework, with concrete for foundations, basement walls, floors, etc. A reddish buff brick with terra-cotta trimmings will be used for the exterior walls,

the general design being plain and simple, with a dignified and substantial appearance. Fig. 4 is a view of the structure

FIG. 10.—TYPICAL CURVES ON MT. LOWE LINE

taken in December, and hence is somewhat incomplete, but is presented as showing the steel framework. The eighth and ninth floors of the building will be devoted entirely to the quarters of the Jonathan Club, one of the features of the eighth floor being a roof garden, covering an area of approximately 10,000 sq. ft., between the two light wells. On the seventh floor will be located the offices of the railway companies and various other corporations in which Henry E. Huntington is interested. Parts of the sixth floor and all of the fifth, fourth, third and second floors will be fitted up in the most modern manner and rented as offices. The interior finish will be made as nearly fireproof as possible. The building will be lighted throughout by electricity, and will be heated by low-pressure steam by means of the Paul system. There will be eight electric elevators, six on the Main Street side and two at the Los Angeles Street entrance. The building will cost upward of $1,000,000, and its floor area is said to be greater than that of any other building west of Chicago.

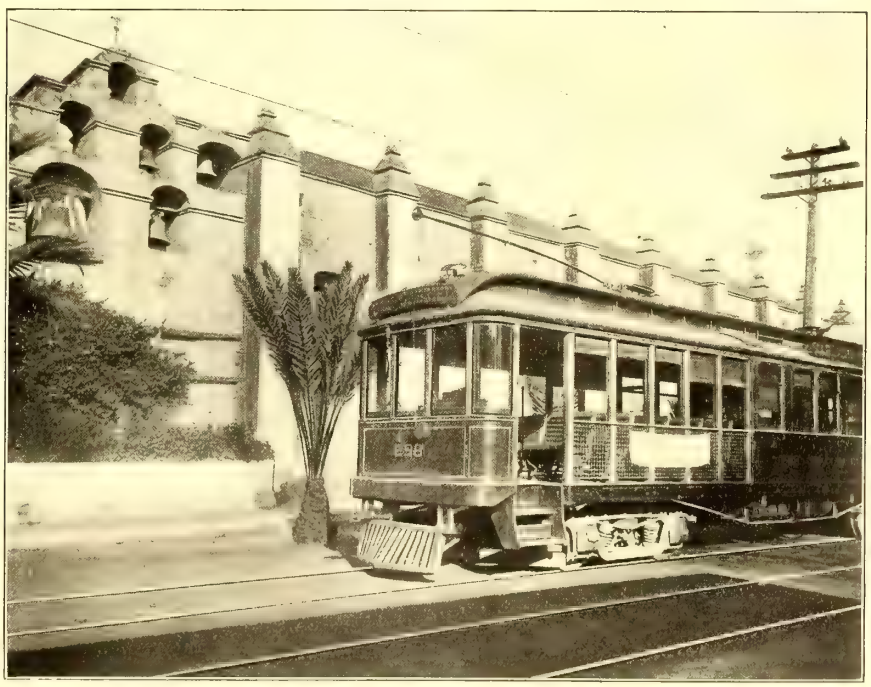


FIG. 11.—TROLLEY CAR PASSING ST. GABRIEL MISSION

SUBURBAN STATIONS

At important stations on the interurban lines the company is planning to erect depot buildings for the convenience of the public. As the company handles no freight, each of these stations will practically consist of a waiting room and ticket office. Fig. 2 shows the plan adopted for buildings to be erected at junction points. It consists of a 20-ft. x 30-ft. building, with projecting roof, supported by Mission style arches.

The extreme dimensions of the roof will be 40 ft. x 50 ft., and of the outside wall 34 ft. 6 ins. x 44 ft. The entire structure will be built of concrete, and a gravel walk will surround it under the projecting roof. In front of the two doors and under the ticket window will be concrete walks. A small room, 9 ft. 6 ins. x 12 ft., will be provided in the tower of the building for the use of the assistant despatcher if necessary.

FIG. 12.—TROLLEY CAR ON CIRCULAR RAILWAY, MT. LOWE DIVISION

MT. LOWE LINE

The branch of the Pacific Electric Railway which ascends Mt. Lowe contains some interesting bits of track construction. The road was built about ten years ago by Professor T. S. C. Lowe, and the property was acquired by the present owners two years ago, when the Los Angeles & Pasadena Railway and other lines were absorbed. The Mt. Lowe cars start from Los Angeles and pass through Pasadena to Altadena, where they enter upon a private right of way, and ascend the foot hills on grades as high as 8 per cent to Rubio Cañyon. This line, between Altadena and Rubio, has recently been changed to broad gage and improvements made in the alignment. The large double-truck cars on this portion of the line have recently been equipped with Westinghouse magnetic traction brakes, which increase materially the safety of operation of the cars on the heavy grades.

At Rubio Cañyon change is made to an inclined cable railway, which carries the passengers to the top of Echo Mountain, at an elevation of 3500 ft. A view of this road is shown in Figs. 6 and 8. This cable track has a horizontal length of 2250 ft., and a slope of 2581 ft., giving a vertical rise of 1265 ft., with grades varying from 48 per cent to as high as 60 per cent. At one point there is a bridge 200 ft. long, the ends of which have a difference in elevation of 120 ft. The cars have inclined seats, as may be noted in Fig. 6. The cable is operated by an electric motor on Echo Mountain, where is also located a sub-station for the upper trolley line.

FIG. 13.—TYPICAL SCENE AT LONG BEACH ON THE PACIFIC

Change is made at Echo Mountain to the narrow-gage electric trolley line, which, in its 4 miles of length, ascends to an elevation of 5000 ft., the terminus being Alpine Tavern, a picturesque structure built in the Swiss style. This electric line is constructed on a uniform grade of 7½ per cent, with many curves and loops. With the exception of the track at the Echo Mountain end the longest piece of tangent track on the whole line is but 227 ft. long. The sharpest curve has a radius of 60.1 ft., with 264 degs. 39 m., and forms one end of a loop. A

number of views of this line are presented in Figs. 5 to 10, while Figs. 5 and 12 show unique features on the line, consisting of a circular bridge. This bridge is built on a radius of 60.1 ft., and is 252½ ft. long, the curve having 246 degs. 38 m.

PACIFIC LINES

Fig. 11, which is of a 49-ft. trolley car on the electric line passing San Gabriel Mission, is typical of the change that has

FIG. 14.—SALT LAKE STATION AT LONG BEACH

been wrought by the electric railway in Southern California, and fairly represents the old and the new. The San Gabriel Mission was founded in 1777 by Franciscan Fathers, is one of the most interesting points in Southern California, and is visited by many tourists yearly.

Fig. 12 is a typical scene at Long Beach, on the Pacific Electric Railway Company's system. This is one of the most popular resorts in the vicinity of Los Angeles, and the pleasure traffic to this resort is a source of considerable profit to the company. Fig. 13 is a view taken from the pleasure wharf at Long Beach, showing one of the standard cars.

NEW K-28 CONTROLLER FOR THE ST. LOUIS TRANSIT COMPANY

In the STREET RAILWAY JOURNAL of Feb. 6, 1903, a description was given of the new Westinghouse No. 95 motors, designed specially for the St. Louis Transit Company's 450 new cars. In connection with these motors a new type of controller, also including some improvements specified by the St. Louis Transit Company, is being used. This controller is known as the K-28 controller of the General Electric Company, and is a modification of that company's former four-motor controllers.

In this new controller insulating rings are placed between the contact fingers of the reverse drum. These insulating rings are the same molded insulation used elsewhere in the type-K controllers. The object of these rings is, of course, to do away as far as possible with flashing across between the contact fingers on the reverse drum when the reverse is improperly used by the motorman. It has been a frequent source of complaint with

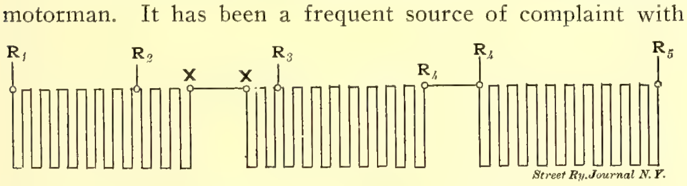


FIG. 2.—CONNECTIONS OF GRID RHEOSTATS FOR USE ON CAR EQUIPPED WITH FOUR W-95 MOTORS AND K-28 CONTROLLERS

four-motor equipments that the reversing cylinders are burned out because of their use in the following manner: The motorman, desiring to make an unusually quick stop, will turn off the current and pull the reverse lever, which, on a four-motor equipment, will cause the motors to act as generators without using the main controller drum. Although terribly hard on the motors this would not injure the controller were it not that the motorman frequently throws the reverse handle back to forward position before the motors have come to a standstill. The result is a very severe arc between the contacts on the reversing drum, which is likely to injure the controller.

In this new controller all contacts which carry the full current to the four motors in multiple are made double width, and have two of the standard contact fingers instead of one. The adjusting screws for the contact fingers have been done away with entirely, as they are believed to be unnecessary if the controller is properly put together in the first place, and only add

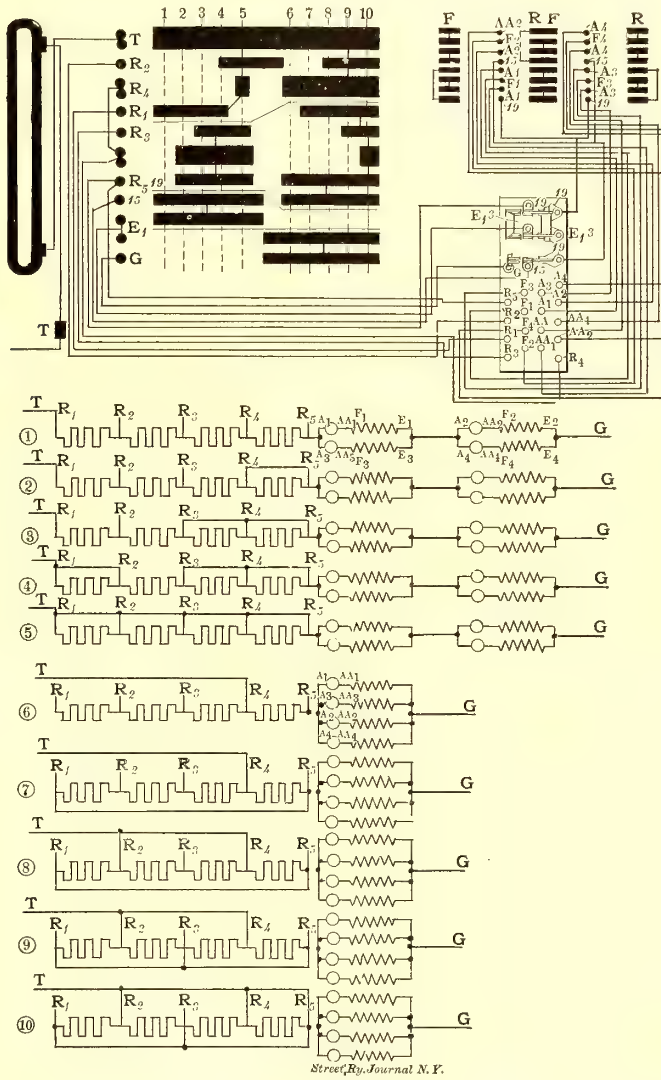


FIG 1.—DEVELOPMENT AND CONNECTIONS OF K-28 CONTROLLER

an unnecessary complication. Fig. 1 shows the development of connections of this controller. It will be noticed that a novel method of connecting the resistance has been employed on the seventh, eighth and ninth points. On these points a part of the resistance is used in parallel with another part in such a way as to avoid breaking up any one set of resistance into a small number of parts, and also to dissipate the heat through a large part of the resistance instead of confining it to a short section. The resistance of the various parts of the rheostat and also the resistance in circuit on the various points are as follows, with either the Westinghouse No. 95 motor or the G. E. No. 54 motor:

RESISTANCE APPROXIMATE

Ohms	Ohms	Ohms
R 1 — R 2 = .96	1 = 3.99	6 = 1.18
R 2 — R 3 = .81	2 = 2.80	7 = .83
R 3 — R 4 = 1.03	3 = 1.77	8 = .53
R 4 — R 5 = 1.18	4 = .81	9 = .24
	5 = .00	10 = .00

The connections of the grid rheostats are shown in Fig. 2. The St. Louis Transit Company is having its own cast-iron resistance grids manufactured at a foundry in St. Louis.

THE MANX ELECTRIC RAILWAY

Among the many pleasure resorts in Great Britain and its immediate neighborhood which attract the summer tourist, it would be difficult to find one which is more beautiful or more popular than the Isle of Man. Some slight idea of its popularity may be gained from the fact that for the last four years between 350,000 and 400,000 visitors from the British ports have been landed annually in Douglas and Ramsey from May to September of each year. The actual figures taken from the Harbor Commissioners' returns are as follows:

	Visitors
1900	351,300
1901	390,100
1902	365,500
1903	391,300

A very large number of excursionists cross over to the island from Liverpool, and to meet the demands of these the Isle of Man Steam Packet Company has put into service two or three magnificent paddle-boats, supplemented by a second fleet of smaller and somewhat inferior vessels.

That the little island is deservedly an attractive summer resort will be readily admitted by anyone who has visited the place when holiday making is in full swing. Side by side with scenery which can hold its own with any to be found elsewhere in the British Isles, there are to be found modern recreations and amusements of all descriptions, while the visitor can travel with ease and celerity to the spots he wishes to explore, by means of the electric railway described in the following pages. By this modern method of transport a very large number of places of interest and entertainment are placed within easy reach of those who elect to lodge in Douglas, the chief town of the island. This railway has rendered the very greatest service in making accessible the most picturesque parts of the little island, and it contrives to do this without in any way spoiling the beauty of the country through which it runs. Hall Caine, the well-known novelist, in a letter to the general manager of the railway, has expressed himself as follows: "So far as I can see the charm is in no way disturbed. Your safe and commodious cars which traverse a piece of coast and mountain scenery that suggests the great new road from Sorrento to Amalfi (and in parts is only second to it in beauty) are, in my view, great contributors to the education and happiness of the hundreds and thousands who make the Isle of Man their annual resort."

This interesting and picturesque railway had its beginnings at a time when electric traction, as far as the United Kingdom was concerned, was quite a novelty. The formal opening took place in July, 1894, when the line from Douglas to Laxey was completely finished, but cars had been running during the previous year, as far as Groudle. Excluding the Brighton Beach and Ryde Pier lines, the only electric tramways open for traffic at that time, which could claim precedence over the Isle of Man Tramway (as it was originally called) were: Giant's Causeway, in Ireland, opened March, 1883; Blackpool Corporation, opened October, 1884; Bessbrook & Newry, opened October, 1895; Birmingham & Bournebrook, opened August, 1890. Thus this railway may justly pride itself upon being one of the earliest pioneers of the enormous development which has taken place in electric tramways and railways.

The history of the line may be briefly epitomised as follows: In 1893 cars were running as far as Groudle, the complete route through to Laxey being finished in the following year. At that time there were two main stations, one at Portevada, Douglas, and the other at Laxey, with a battery sub-station at Grudle. In 1895 a line was built running from Laxey up to the summit of Snaefill Mountain; this line was originally operated by a separate company, but was eventually purchased by the Isle of Man Tramway Company. Power for this line was supplied by a power station situated approximately half way up to the summit, assisted by a battery sub-station at Laxey. In 1897-1898 the present extension of the line to Ramsey was carried out, with a new generating station at Ballaglass, and some fresh plant at Laxey, to supply the additional power required. In 1898 there was also erected at Laxey a small water-power plant, utilizing the fall of water in the River Laxey.

In 1901 Dumbell's Bank failed, and brought with it the failure of the tramway undertaking in which it was heavily

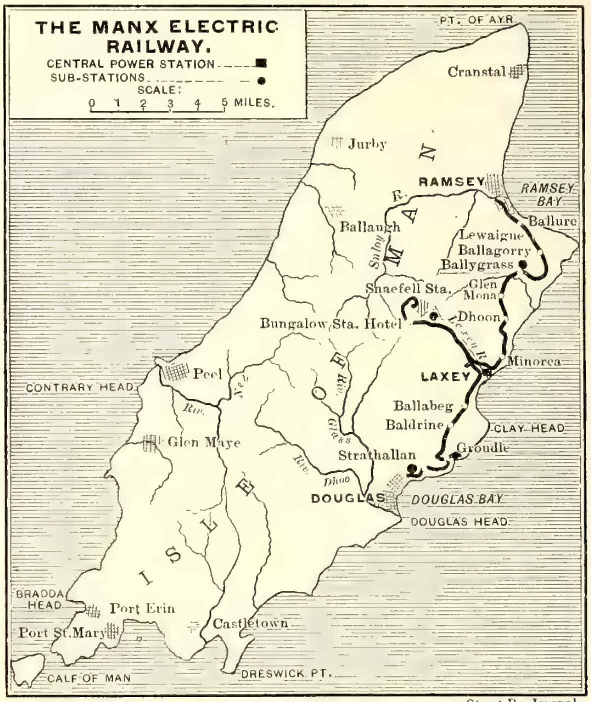


FIG. 1.—MAP OF ISLE OF MAN, SHOWING ELECTRIC RAILWAY

interested. The whole concern thereupon went into the hands of a receiver, and the portion outside the town of Douglas, which was electrically equipped, was taken over by the present company, the horse line and cable road within the town of Douglas being purchased by the corporation. The new company which took over the electrical undertaking carefully investigated the condition of it, and after having several reports presented to it by various elctrical experts, decided on the scheme worked out for them by its engineers, Messrs. Kincaid, Waller, Manville and Dawson, which has now been carried out. The main idea was to centralize, as far as possible, the various scattered power stations under one roof at Laxey, which is near the center of the whole system, and which, from all points of view, both as regards the facility of bringing coal to the power stations and the water supply, is the most suitable site.

The undertaking, as shown above, having grown to its present size from very small beginnings, was naturally a somewhat patched up affair, with the consequence that the working was not at all economical, the number of separate stations being a great disadvantage. The whole railway needed thoroughly remodeling, and a careful investigation of the condition of affairs soon showed that very little could be done by any further patchwork. New plant was obviously required, and this it was eventually decided to obtain, dispensing with such of the old plant that was thus superseded, but retaining those portions which could usefully be worked into the centralizing scheme. Not only was much of the old plant out of date and wasteful, but the total amount of power required at times of heaviest load was so great that the plant was dangerously overloaded. The whole of the additions and alterations made by the new company are given in full elsewhere.

The Manx Railway possesses many points of interest, not only from an engineering point of view but from the picturesque

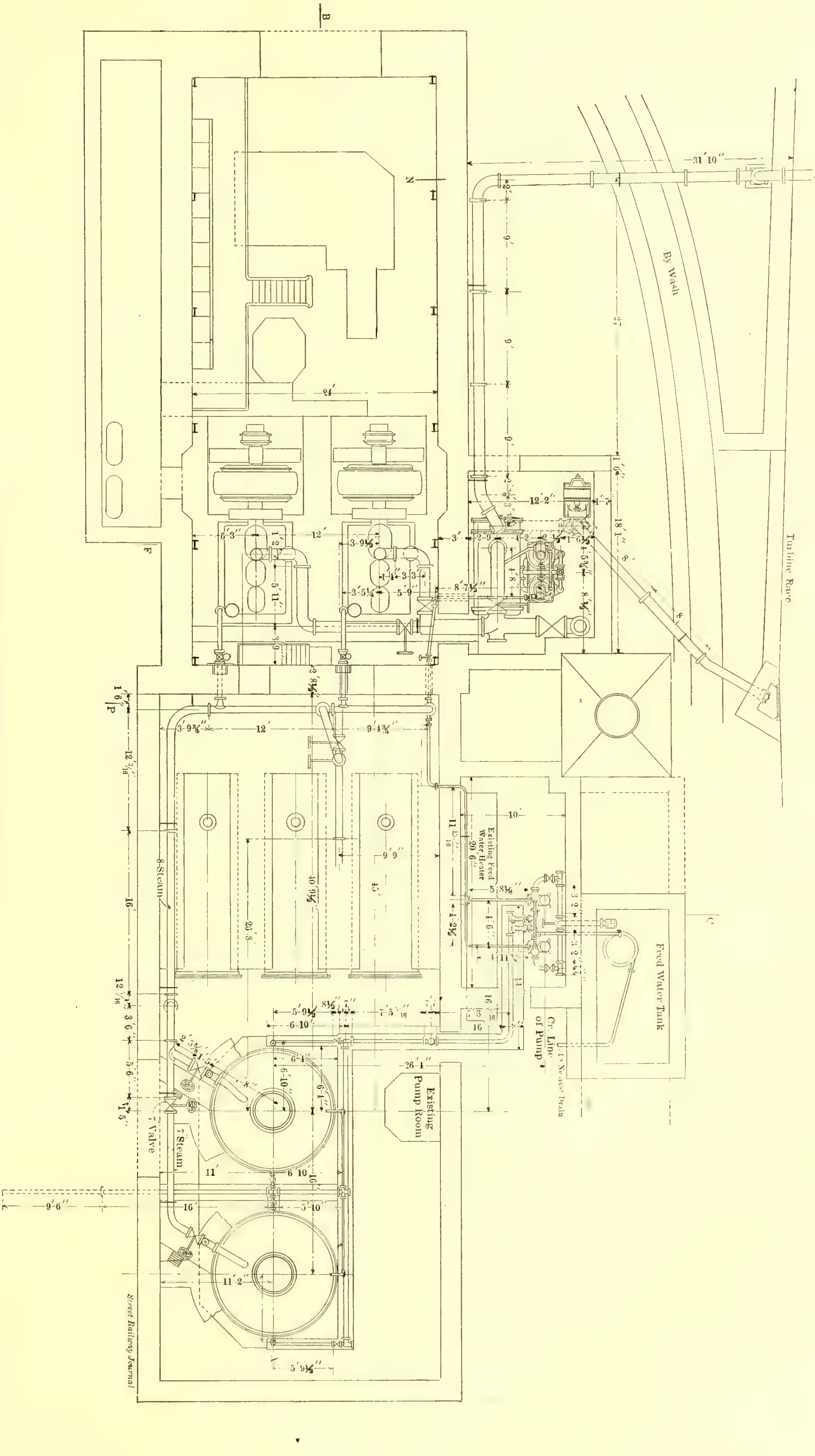


FIG. 2.—GENERAL ARRANGEMENT OF LAXEY STATION

and interesting nature of the route. It has formed a considerable additional attraction to Douglas in the eyes of the traveling public, and has done much to enhance the success of that popular holiday resort.

Quite apart from the electrical equipment the construction of the line was an engineering achievement of no small merit, and very serious difficulties were encountered, and innumerable obstacles had to be overcome. For a considerable portion of the distance between Douglas and Laxey, the line runs along the sea coast, and it was necessary for the track to be cut out of hard slate rock, along the face of the cliffs overhanging the sea. The work of construction was rendered especially arduous by the fact that it was necessary to construct a carriage and footway along the line until it meets the North Road.

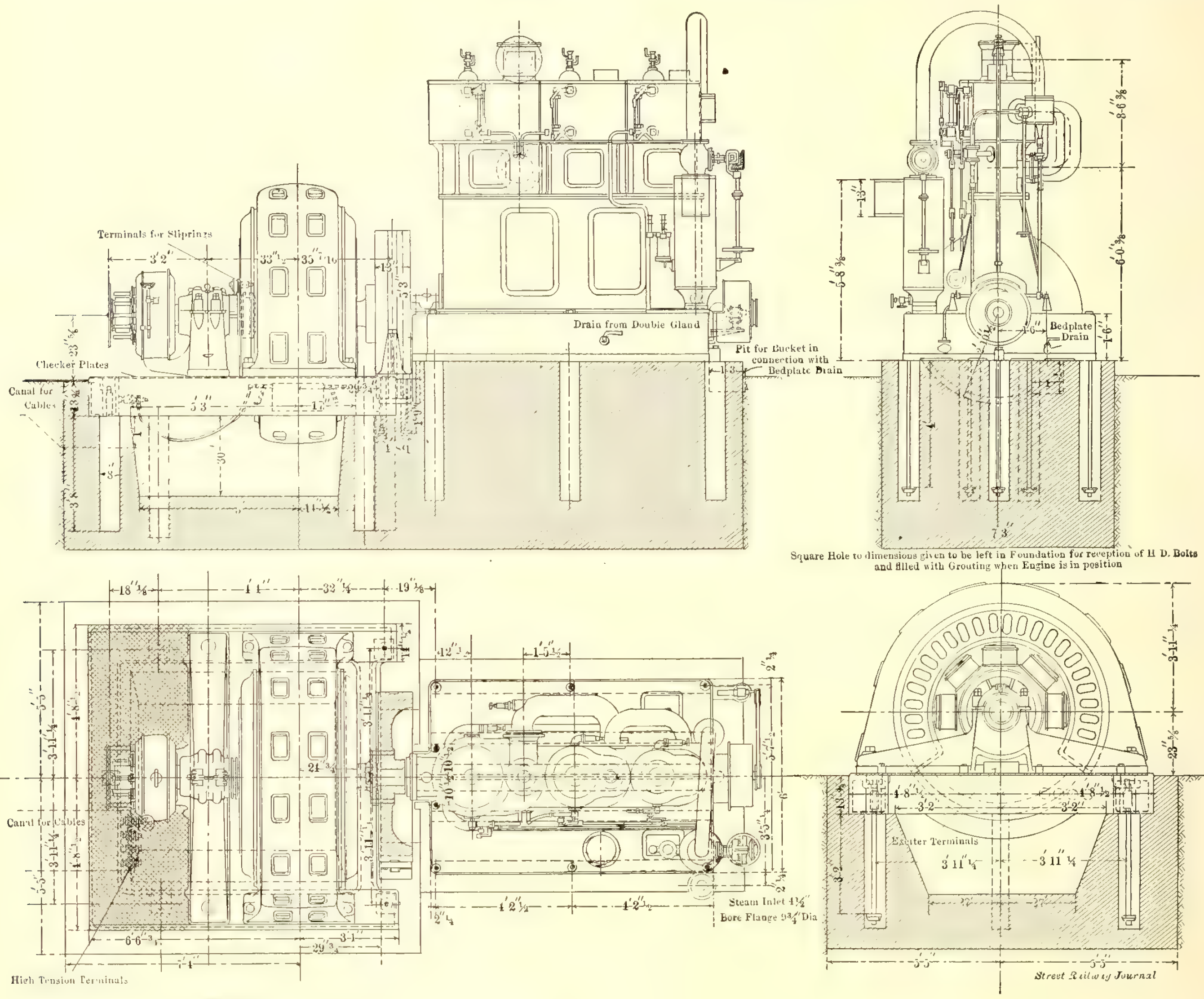
The route is by no means an easy one for the cars to negotiate, as the grades are continuous and often severe. Between Derby Castle and Onchan Head the line climbs steadily upward for 200 ft., the average grade being a little over 4 per cent. The line operates over its own right of way, and several bridges were built.

The original Douglas and Laxey line, which was opened in 1894, starts from Portevado, at the end of the Douglas promenade, and rises by a 4 per cent grade to Lagbirraph, which is nearly 260 ft. above sea level. From this point the line goes inland to Groudle Glen, in the course of which it descends about 130 ft. It passes the Groudle Hotel and the entrance to the Glen, and crosses a stream by means of a bridge 60 ft. high, climbing an average grade of 3¾ per cent to the point where it crosses the Douglas and Laxey main road. This is the highest point in the line, being some 330 ft. above sea level. For some distance the line runs alongside the high hoad, but never leaves its own specially constructed right of way; there is a run down to Garwick Glen, a steady rise to Ballabeg, and then another run down to Laxey.

The total length of the line from Douglas to Laxey is exactly 7 miles, double track throughout, the gage adopted being 3 ft.

The whole of the electrical equipment for this preliminary portion of the undertaking was carried out by Messrs. Mather & Platt, to the design of Dr. Edward Hopkinson, who acted as consulting engineer to the company. There were two power stations, one at Portevada, Douglas at one extremity of the line, and one at Laxey at the other end. The Douglas power station was furnished with three Lancashire boilers, 20 ft. long and 6 ft. in diameter, working at a pressure of 120 lbs. to the square inch. The engines were three in number, of the cross-compound vertical type, indicating 80 hp each, condensing. The generators consisted of two Manchester-type machines and one Mather-Platt type, driven by link belts with jockey pulleys. The output of each machine was 100 amps. at 500 volts. The station at Laxey was very similar to that at Douglas, except that there were only two instead of three generating sets, and the engines were run non-condensing.

One of the distinguishing features of the original line was the use that was made of accumulators, which were situated in a separate station at Groudle, some 2½ miles from Douglas.



FIGS. 3 AND 4.—300-KW HIGH-TENSION GENERATOR SET AT LAXEY

This station contained 256 chloride-type cells. In ordinary operation the battery was connected in parallel with the two generating stations on the line, charging and discharging according to the state of traffic. A motor generator in the accumulator station assisted in the charging process.

In the early days of this railway the storage battery was found particularly useful during the winter months, when very few cars were running, and those at long intervals. The line, as has been remarked before, was intended essentially for pleasure traffic during the summer months, but the Manx authorities would not allow the company to shut down entirely during the winter, and compelled it to run at least two cars each way every day of the year. The expense of keeping a steam generating station in operation for this minimum service would be excessive, so the accumulator station was installed to obviate this.

At present, although the schedule is not nearly so frequent during the out-of-season months, a very satisfactory regular service is maintained between Douglas and Ramsey, while special late cars are frequently put on to suit the convenience of passengers on the occasion of large social or other gatherings at places served by the line. These special arrangements are a very great credit to the energy and enterprise of the present manager, Harold Brown.

The Snaefell Railway being a pleasure line, pure and simple, only runs during the season, and is shut down altogether for the rest of the year.

The original Isle of Man Tramway Company was, as already stated, not financially successful, and went into liquidation, and was eventually purchased by the Manx Electric Railway Company, Ltd., which now owns and operates the lines. At the time of purchase the state of affairs was as follows:

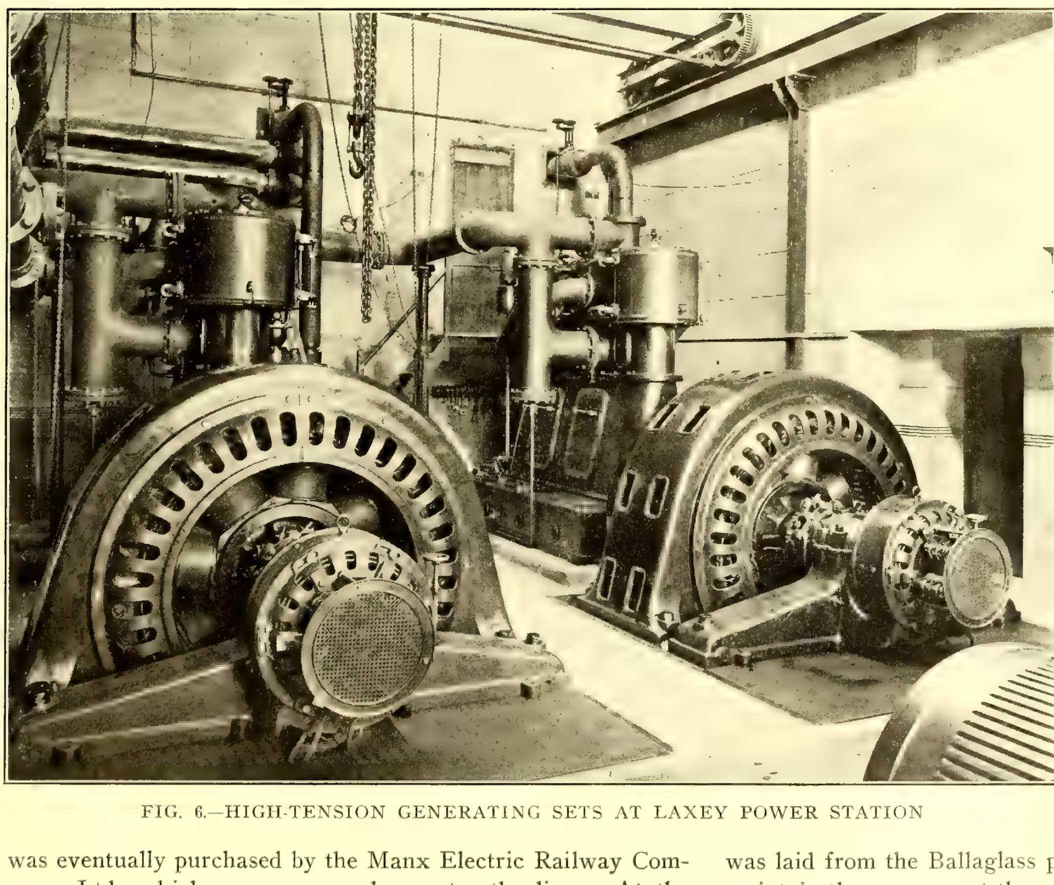


FIG. 6.—HIGH-TENSION GENERATING SETS AT LAXEY POWER STATION

The lines electrically equipped consisted of those running from Douglas to Ramsey, via Laxey, and the Snaefell Mountain line, which has a junction with the former line at Laxey. There is no physical connection between the Snaefell line and the Douglas and Ramsey line, this being quite out of the question on account of the difference in gage (one being 4 ft and the other 3 ft.), if for no other reason. The length of the main route from Douglas to Ramsey is 17 miles, 7 furlongs; the track is 3-ft. gage and is double throughout. Fig. 1 shows a map of the island, giving the route taken by the railway.

The Douglas and Laxey section was constructed in 1893 and 1894, is 7 miles long, and was laid with 56-lb. T-rails. The section from Laxey to Ramsey was constructed during 1897 and 1898, and is laid with 62½-lb. T-rails. In both cases creosoted ties, spaced 3 ft. apart on the average, were used.

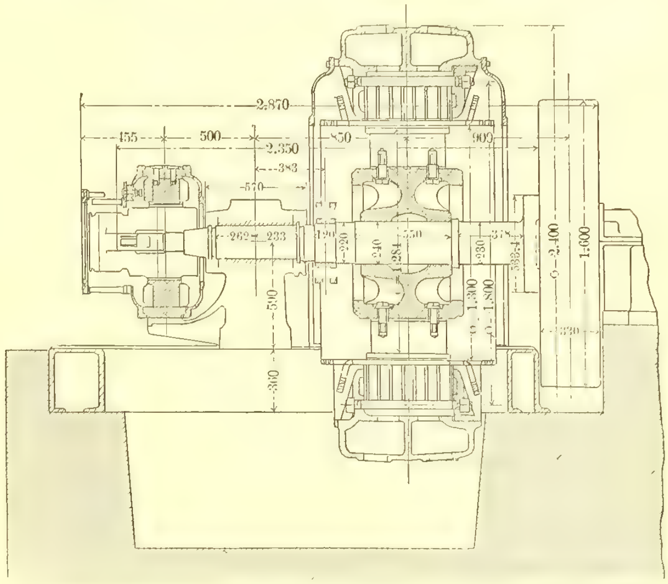


FIG. 5.—ALTERNATOR AND EXCITER

The rails on the Douglas and Laxey section were originally bonded with flat copper-strip bonds, but in 1900 one-half the track, and all the cross bonding, was done again with Columbia bonds, leaving the old bonds in position; the Columbia bond is used throughout on the more recent section of the line.

The line was equipped with No. 0 B. & S. trolley wire, flexibly suspended from steel bracket poles. The usual double insulation was employed throughout except for about half a mile, which, being exposed to the action of the sea water, was provided with quadruple insulation.

An underground cable was laid from Douglas power station to Ramsey and looped into the various power stations enroute. An additional feeder cable, 2½ miles long, was laid from the Ballaglass power station toward Ramsey, to maintain the pressure at the end of the line. The whole of the feeder cable was 37-14, lead sheathed and armored (Callender's make), and laid directly in the ground between the two tracks. There was an underground telephone and pilot cable laid between Laxey and Ramsey.

Feeder pillars connecting the feeders to the overhead wires were fixed about every half-mile along the route.

The Douglas power station is situated at Portevada, about 280 yds. from the Douglas terminus. The boiler house is a stone building, 49 ft. 6 ins. x 42 ft.; the roof is of corrugated

iron, and one side of the building is closed with wood to allow for extension. The original plant consisted of three Lancashire boilers, built by Galloways, each boiler measuring 20 ft. long and 6 ft. in diameter; space was provided for one additional boiler. There was a Mather & Platt jet condenser, capable of

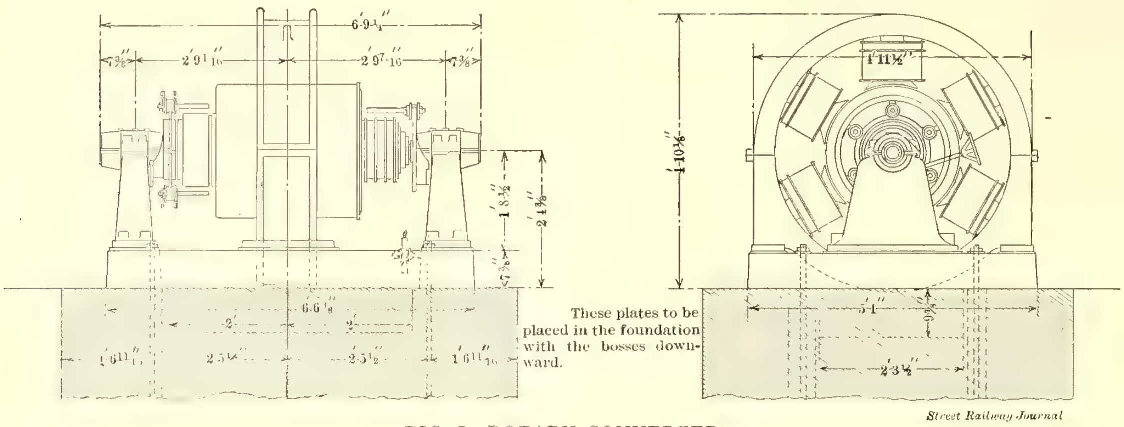


FIG. 7.—ROTARY CONVERTER

condensing the steam from all four engines in the engine house, and there was also an underground tank holding 33,500 gals. adjoining the boiler house, from which the feed and circulating water was drawn; this tank was fed by two independent streams. The stack was of iron on a concrete base, 12 ft. sq. and 7 ft. high. The shaft was 60 ft. high and 5 ft. in diameter.

The engine room is also of stone, with a boarded roof, covered with corrugated iron. The building contained three Galloway vertical compound engines, indicating 90 hp, at 150 r. p. m. and 120 lbs. steam pressure. The high-pressure and low-pressure cylinders measured 10 ins. and 20 ins. in diameter, respectively, with a stroke of 18 ins.; the fly-wheel measured

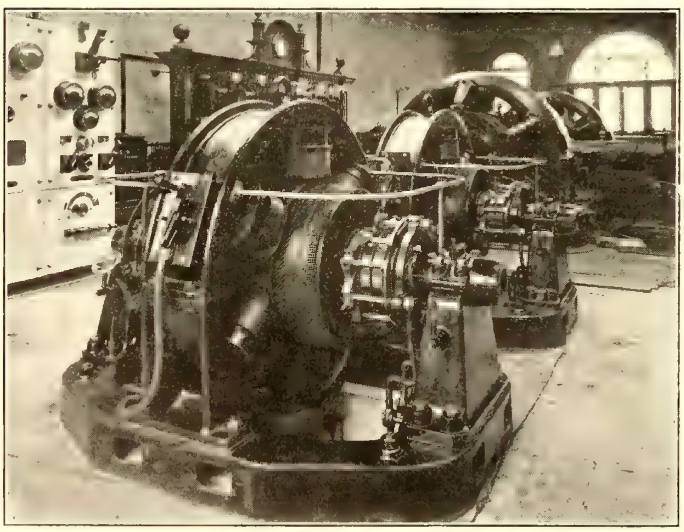


FIG. 8.—BALLAGLASS SUB-STATION

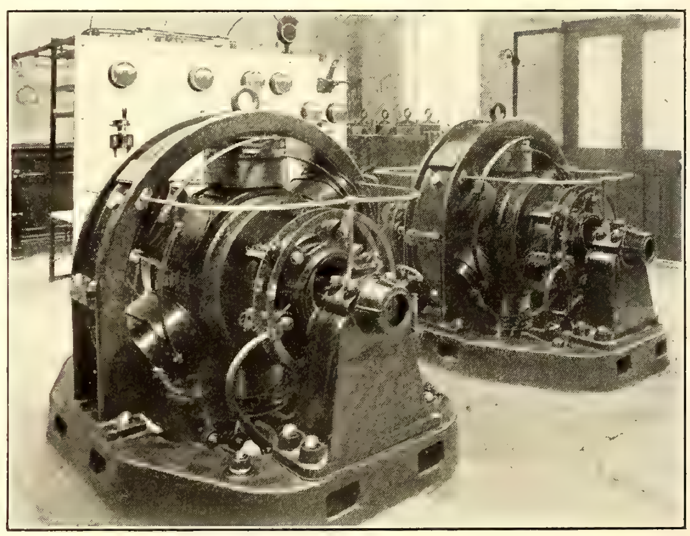


FIG. 9.—BALLAGLASS SUB-STATION

9 ft. in diameter. The generators, of the shunt-wound type, were supplied by Messrs. Mather & Platt, and had an output of 100 amps. at 500 volts, when driven at the speed of 700 r. p. m.

The traction switchboard consisted of five panels, one for each generator, one for the circuit and test purposes, and one spare.

The electric lighting plant consisted of one Bellis high-speed engine of 75 hp, direct coupled to a 50-kw Mather & Platt alternator, having an output of 50 amps. at 1000 volts, at 415 r. p. m. There was also a motor alternator giving 30 amps. at 1000 volts, the motor being supplied with current at 500 volts from the traction sets. These machines had their own separate high-tension switchboard, with the necessary switches and instruments for running either of the two, on two main circuits.

The main steam pipes were of cast-iron, duplicate lines being supplied for each engine. Arrangements were made whereby the engines could work either condensing or non-condensing, as desired.

The Groudle battery sub-station, situated about 2 miles from Douglas, was a wooden building, 61 ft. long, 17 ft. wide and 9 ft. high to the eaves. The battery consisted of 256 cells of the chloride R-type, with a capacity of 140 amps. for 4½ hours. The building also contained a booster of 12-kw capacity for charging purposes.

The Laxey power station, 7 miles from Douglas, is also a stone building with a corrugated iron roof. The steam raising plant consisted of two Lancashire boilers, similar to those at Douglas, and one Galloway boiler, 20 ft. x 6½ ft., which was installed at a later date. A feed-water heater, using exhaust steam, is fixed adjoining the boiler house, and a concrete tank, 15 ft. long, 7 ft. wide and 4 ft. deep, supplied the feed water. The stack was similar to that at Douglas.

The engine room plant consisted of two Galloway engines belted to two Mather & Platt 50-kw generators, identical with those installed at Douglas. This formed the original equipment, which in 1898 was supplemented by a Robb Armstrong (Canadian) tandem compound horizontal engine, direct coupled to an E. C. C. multipolar generator, giving an output of 240 amps. at 500 volts, at 175 r. p. m. This engine indicates 180 hp when supplied with steam at 120 lbs per square inch, and running at 175 r. p. m. The cylinders measure 13 ins. and 20 ins., by 20-in. stroke, and the fly-wheel is 7 ft. in diameter.

This station also contained a 12-kw booster for charging the Snaefell battery and for raising the pressure on the different feeder cables.

The switchboard contains seven slate panels, each measuring 7 ft. x 2 ft. Three of these were provided for controlling the current from the three generators; two were for distributing the current on the various circuits, and for testing purposes, and the remaining two were for controlling the water-power plant at Laxey, which is described later on.

Duplicate lines of steam pipes were provided for each

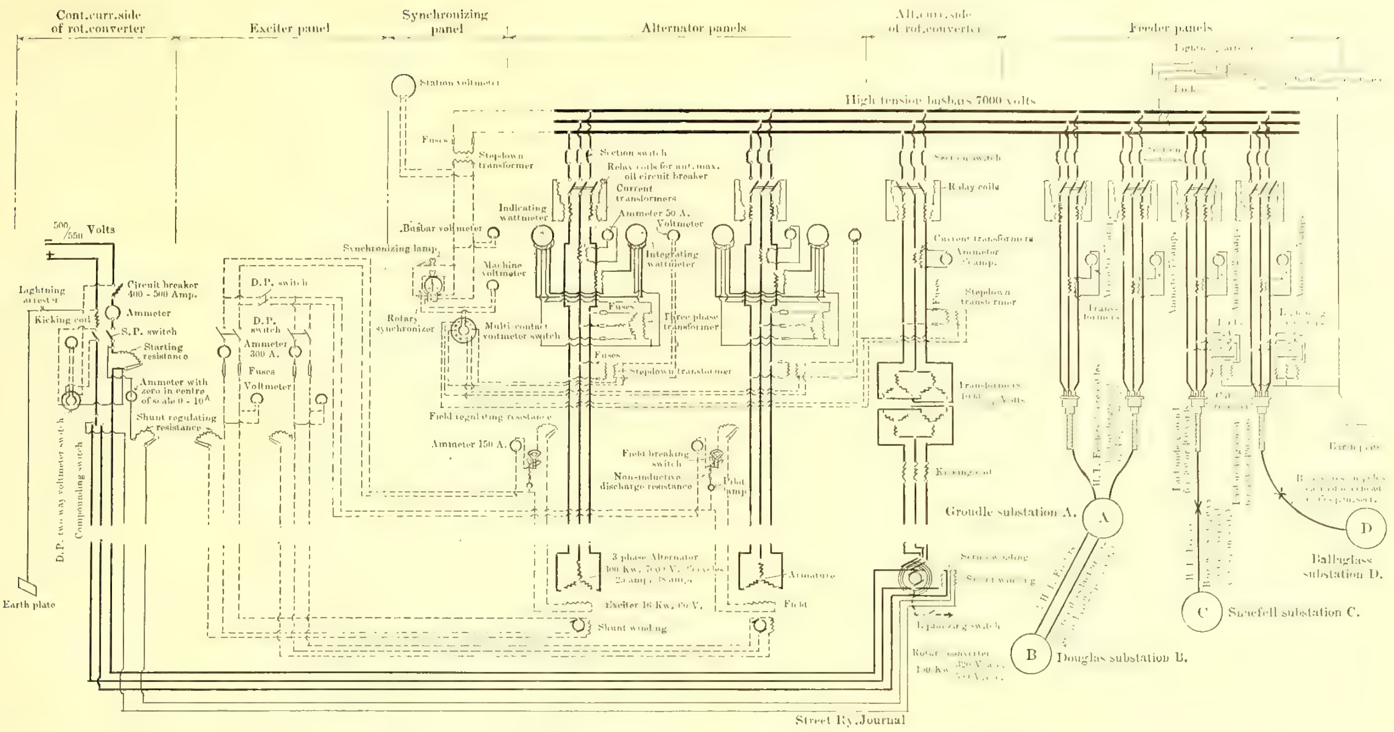


FIG. 10.—DIAGRAM OF SWITCHBOARD CONNECTIONS AT LAXEY GENERATING STATION

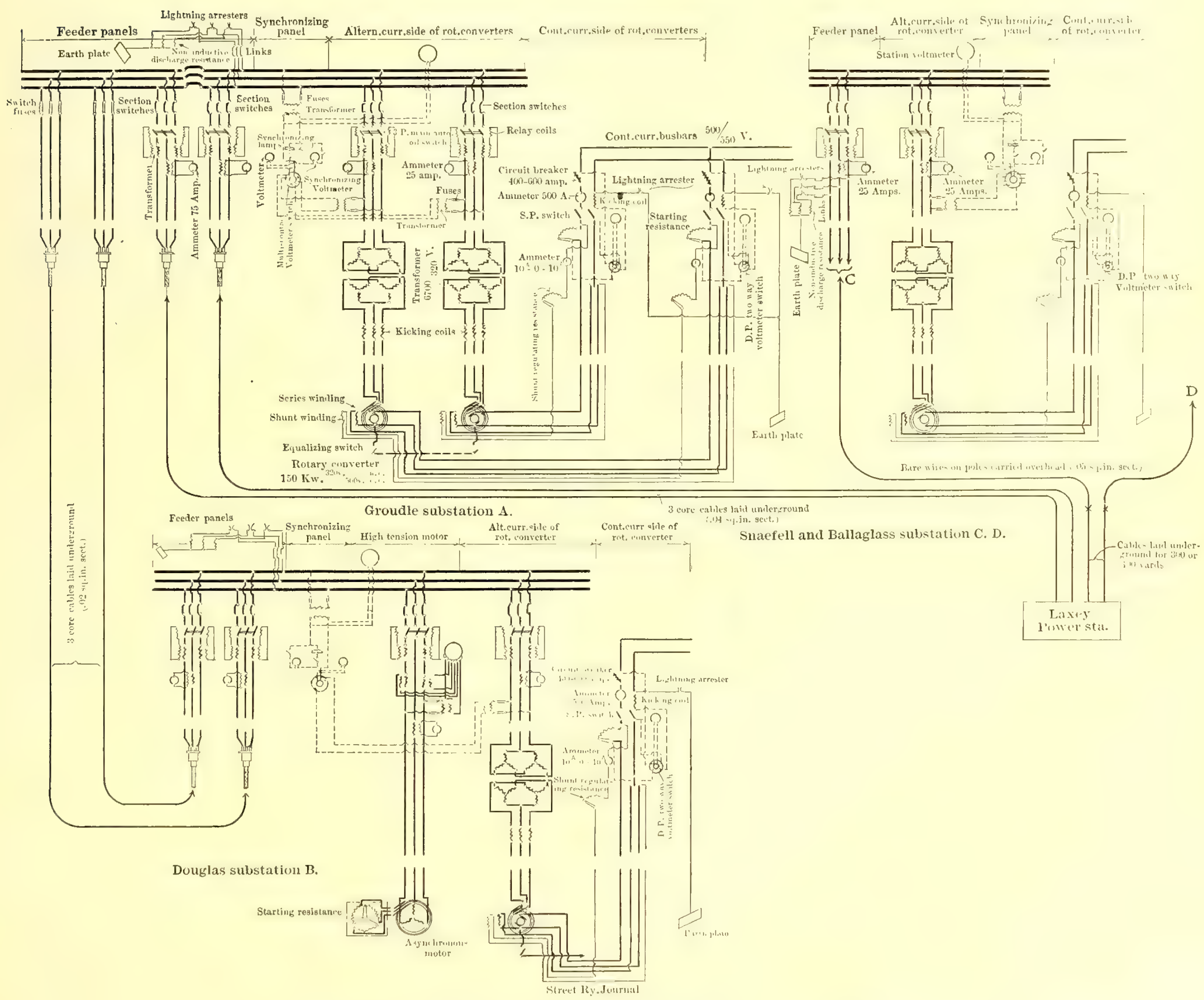


FIG. 13.—DIAGRAM OF SWITCHBOARD CONNECTIONS AT BALLAGLASS SUB-STATION

engine, as at Douglas, the pipe being of cast-iron. The pipes for the feed pump and injector, also in duplicate, were of cast-iron.

There was also erected at Laxey in 1898 a water-power plant which utilizes the fall of water in the Laxey River. The power house is situated on the banks of Laxey River, about 430 yds. below the steam-driven station. The building is of stone, and contains two Victor turbines, of the horizontal type, in one flume case, with shafts direct coupled. These turbines develop some 140 hp at 720 r. p. m.

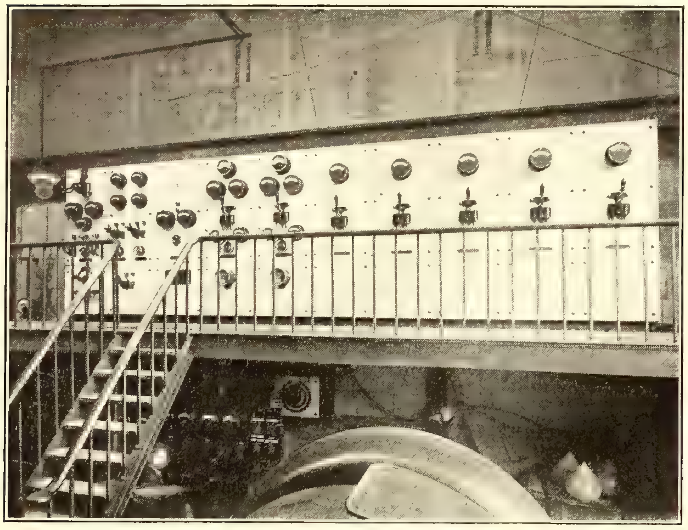


FIG. 11.—LAXEY SWITCHBOARD

The electrical generating plant consists of a combined bipolar dynamo and booster, the generator having an output of 160 amps. at 520 volts, and the booster 160 amps. at 100 volts to 200 volts. This combined machine is coupled direct to the turbines.

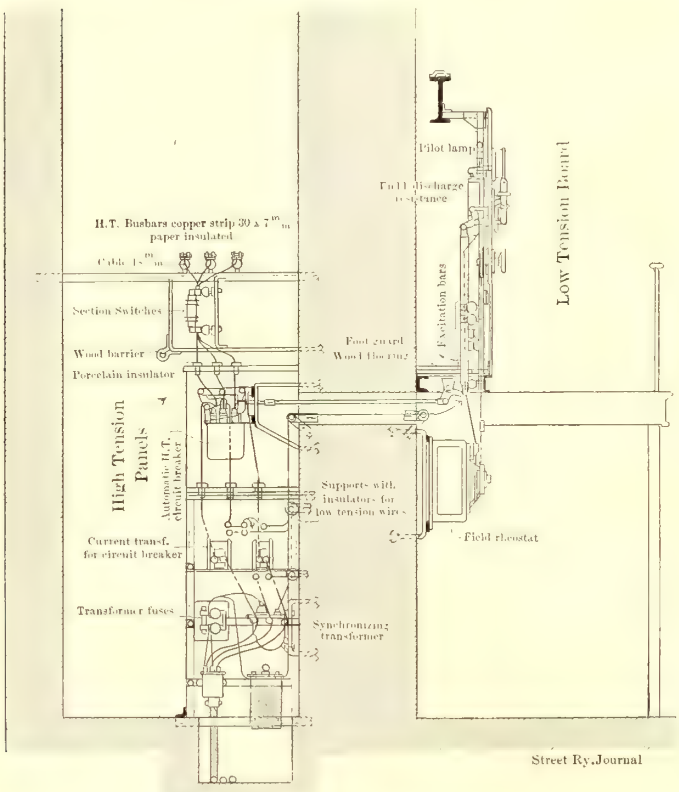


FIG. 14.—SECTION THROUGH ALTERNATOR PANEL AT LAXEY

Two Lundell ¼-hp motors are used for opening and closing the gates, and are operated from the Laxey engine house. The weir across Laxey River is 42 ft. long and 4 ft. 6 ins. high. At one end are two masonry arches, 5 ft. wide and 9 ft. high, each fitted with a sluice gate with the necessary raising and lowering gear. The head race is constructed of masonry and concrete, and consists of 812 ft. of trench, 5 ft. wide, followed by 481 ft. of trench, 3 ft. 6 ins. wide, the depth being 4 ft. 6 ins. The head box is built of masonry, 8 ft. x 11 ft. x 7 ft. 9 ins. deep, from which the water is conveyed to the turbines by means of 820 ft. of steel piping, 3 ft. in diameter. The tail-race is 624 ft. in length, 10 ft. wide and 13 ft. 3 ins. below the turbine house floor.

The Ballaglass power station is situated 12½ miles from Douglas, and is a stone building like the other stations. In the boiler house there are two Galloway boilers, which measure 26 ft. x 6 ft. 6 ins. The condensing plant consists of two Ledward ejector condensers, with two centrifugal circulating pumps, direct coupled to a 10-hp E. C. C. electric motor of the enclosed type. The chimney, as in the case of the Douglas and Laxey power stations, is of iron, measuring 60 ft. in height and 5 ft. in diameter.

In the same building there is an accumulator room containing a battery of 260 chloride cells, having a capacity of 140 amps. for 6 hours, or 70 amps. for 12 hours. There is a coal store, 56 ft. x 31 ft. x 17 ft. high, adjoining the boiler house.

The engine room contains two Robb Armstrong horizontal tandem compound engines, direct coupled to Mather-Platt multipolar generators. Both sets are precisely similar to the direct coupled set at Laxey. There is also a booster, consisting of one 500-volt motor, one 150-volt shunt generator for charging the accumulators, and one 150-volt series generator for raising the pressure on the additional feeder mentioned above.

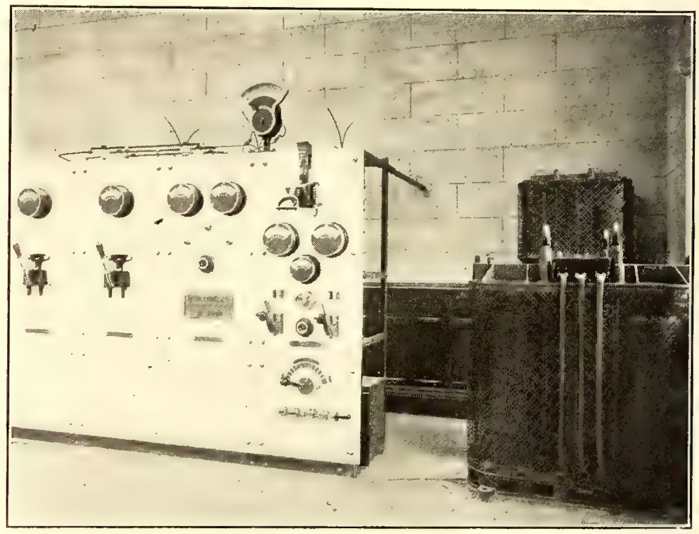


FIG. 12.—BALLAGLASS SWITCHBOARD

The switchboard contains seven slate panels, each 7 ft. high and 2 ft. wide. There are two panels for the two generators, one for operating the booster and two for the accumulators, while the remainder are for circuits and testing purposes.

The rolling stock consisted of twenty-two motor cars, twenty-three trailers, one locomotive and twelve freight cars. Thirteen of the motor cars were fitted with two 25-hp motors, supplied by Mather & Platt, the other nine cars were equipped with four 20-hp E. C. C. motors each. Of the twenty-three trailer cars, eighteen held forty-four passengers each, four held fifty-six passengers each, and one held eighteen passengers. With the exception of the last, which was a closed saloon car, all the trailers were open cars. All cars, whether motor or trailer, were of the double-truck type. The twelve freight cars comprised eight open cars and four closed cars, each of 6 tons capacity. Each motor car was supplied with two circuits of five 16-cp lamps, and each of the nine trailers with one circuit of five lamps.

The company possesses five car sheds. No. 1 accommodates nine motor cars and has pits for six cars; No. 2 accommodates eight motor cars, No. 3 accommodates six motor cars, No. 4 accommodates fifteen trailers. There is also a car shed at Ramsey, close to the terminus, having accommodation for six cars.

Besides the supply of electric power for traction purposes the company also provide a certain amount of alternating current for public and private electric lighting. The requisite power is derived from two alternators in the Douglas station,

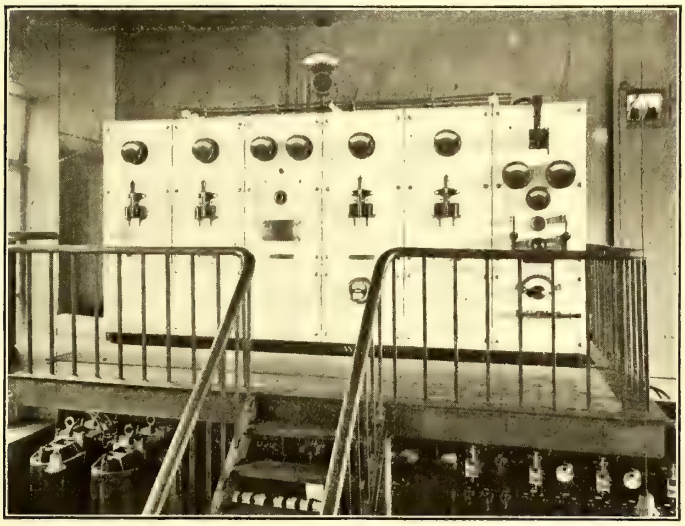


FIG. 17.—DOUGLAS SUB-STATION

one being steam driven and the other motor driven. At various points along the route from Douglas to Ramsey there are ticket offices and waiting rooms, etc.

We now come to the railway running from Laxey to the summit of the Snaefell Mountain.

This line comprises a double line, 4 miles 5 furlongs long, and 3-ft. 6-in. gage, and was constructed in 1895. It starts from Laxey Station, crosses the high road from Douglas to Ramsey, and thence goes up the valley of the Laxey River to the summit of Snaefell.

The track is laid with 56-lb. T-rails, and a center rail, which is used for braking purposes, weighs 65 lbs. per yard. The heaviest grade is 8½ per cent, the majority of the line being

FIG. 16.—TYPICAL OVERHEAD CONSTRUCTION

at that slope. The rails are bonded with flat copper strip, riveted to the rails.

The line is equipped on the overhead system, No. 0 B. W. G. trolley wires being employed, which are hung from the bracket arms by means of "Ætna" bell insulators. Steel poles, measuring 6 ins. in diameter at the base and tapering to 3 ins. at the top, are employed. These are fixed in concrete foundations about 6 ft. deep.

The summit of Snaefell is connected with the car house at Laxey by overhead telephone wires carried on the tramway poles.

A 37-14 underground feeder cable connects the Snaefell power station with the accumulator station at Laxey, feeding into the overhead wire through feeder pillars placed every mile along the route. A similar cable joins the accumulator house with the Laxey power station, and is looped into the stationmaster's office at Laxey, at which point a small switchboard has been erected. These cables are of Callender's make, lead sheathed and armored.

The original Snaefell power station, erected when the line was an independent concern, is situated 2 miles 5 furlongs from Laxey. In the boiler house there were four Lancashire boilers, working at 120 lbs. pressure, and feed pump and injector. The stack, which is iron, is 60 ft. high and 5 ft. in diameter. A temporary coal shed, built of wood, adjoins the boiler house.

The engine house contains five horizontal compound engines, built by Messrs. Mather & Platt, indicating 120 hp each when

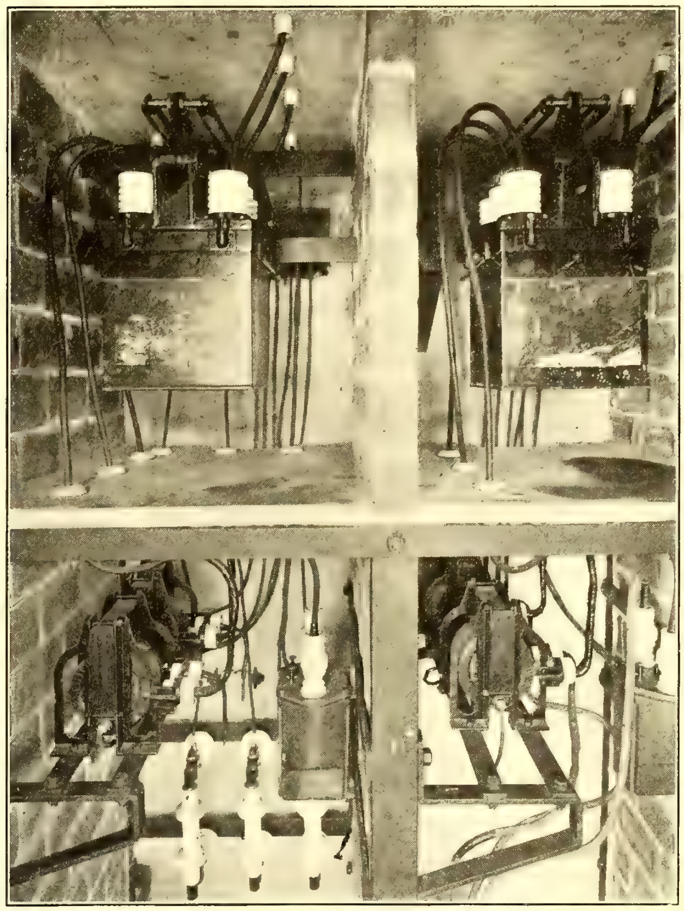


FIG. 15.—HIGH-TENSION OIL SWITCHES IN BRICK CELLS AT LAXEY POWER STATION

working at 120 r. p. m. The cylinders measured 20 ins., and 12 ins. in diameter by 16-in. stroke. Each engine drives a 60-kw Mather & Platt generator, by means of link leather belts.

A concrete tank, 29½ ft. x 19 ft., and 7¾ ft. deep, supplies the feed water. The tank is fed by a pumping station situated on the Sulby River. This building, which is of corrugated iron, contains one 4-hp vertical boiler, fitted with Galloway's patent cross tubes and one double-action plunger pump with engine attached, made by Tanges. This supplies water to the tank through a 2-in. iron pipe. The feed water is supplied to the boiler by a donkey pump attached to the side.

The car house is situated near the Laxey terminus, and has accommodation for six cars in two rows. Pits are provided for six cars.

The accumulator house was situated about 176 yds. up the line from the car house, and is a wooden building containing

250 chloride cells. The capacity of the battery was 140 amps. for 4 hours.

The rolling stock consisted of six closed motor cars, built by G. F. Milnes & Company, each car being capable of seating forty-six persons. The motor equipment consisted of four 25-hp motors per car; the Hopkins current-collecting gear is used instead of the ordinary trolley.

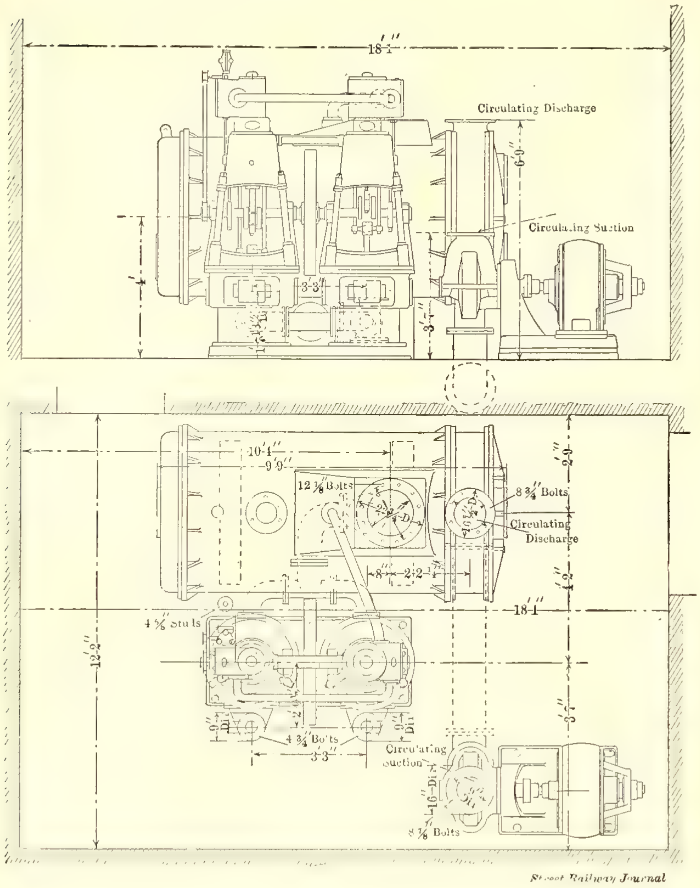


FIG. 18.—PLAN AND END ELEVATION OF CONDENSER PUMPS

There is a station at the summit of Snaefell, built of wood, and comprising waiting room, stationmaster's office and lavatories.

As mentioned above, the chief work of the new company on taking over the tramway from the liquidator has consisted in centralizing the power supply and dispensing with some of the numerous separate generating stations which were in existence at that time. New rolling stock has also been supplied, and the whole of the line has been generally overhauled and brought up to date.

The new generating plant, details of which are given elsewhere, consists of two 300-kw direct coupled sets for the existing station at Laxey, the steam being supplied by two Climax boilers. Two direct-acting feed pumps and a surface condensing plant have also been added. Some of the old plant will, for the present, at least, be retained, i. e., the Robb Armstrong and E. C. C. engine and generator and the three Lancashire boilers. The turbine-driven plant at Laxey will also be retained. There has also been installed at Laxey one 150-kw rotary converter, two static transformers and a new high-tension switchboard.

The sub-stations have been equipped as follows:

Groudle Sub-station.—Two 150-kw rotary converters, with static transformers and additions to the existing battery of accumulators at this station.

Douglas Sub-station.—One 150-kw rotary, with static transformers in the old power house.

Snaefell Sub-station.—One 150-kw rotary converter. The Ballaglass station has also been increased by the presence of two similar rotaries and a new high-tension switchboard.

These additions have enabled a considerable portion of the old, and in some cases obsolete, plant to be dispensed with. Thus at Laxey the original Galloway and Mather & Platt sets have been removed to make room for the new high-tension plant. The battery-charging booster for the Snaefell substation has also been taken out, since the abolition of the latter rendered its retention unnecessary. The space it occupied is now taken up by the rotary converter. The Douglas steam plant is now no longer used, but has not yet been disposed of. The original plant at Ballaglass remains unaltered.

As regards the rolling stock, thirteen of the old motor cars have been, or are being, provided with new four-motor equipments and Christensen air brakes, and nine other cars are also being supplied with four-motor equipments.

The Manx Electric Railway Company, since taking over the undertaking, has added four motors, four trailers, two light parcel vans (trailers) and one motor cattle car truck.

NEW PLANT AND EXTENSIONS

The chief additions to the generating plant have been made at the Laxey power station, where there have recently been installed two boilers, two direct coupled high-tension generating sets, two feed pumps, a surface condensing plant, one rotary converter, with two transformers for reducing the pressure, and the requisite switch gear for the new plant. Fig 2 shows the general arrangement of the present power station.

The boilers are of the Climax type, supplied by B. R. Rowland & Company, this style of boiler being chosen chiefly on account of the small amount of floor space available, and the very simple design of the flues and chimney required for them. It was necessary to raise the roof of the boiler house in order to accommodate them, but this was a simpler matter than extending in any other direction. The boilers have a rated capacity of evaporating 12,000 lbs. of water per hour from and at 212 degs. F. in temperature. The heating surface of each is 3010 sq. ft., with 76 sq. ft. of grate area. The steam generators are of the water-tube type, each containing 420 tubes, 2½ ins. in diameter and 11 B. W. G. thick. About 500 sq. ft. of the heating surface of each boiler represents superheating. There is no economizer, but a coil of tubing is placed in the path of the

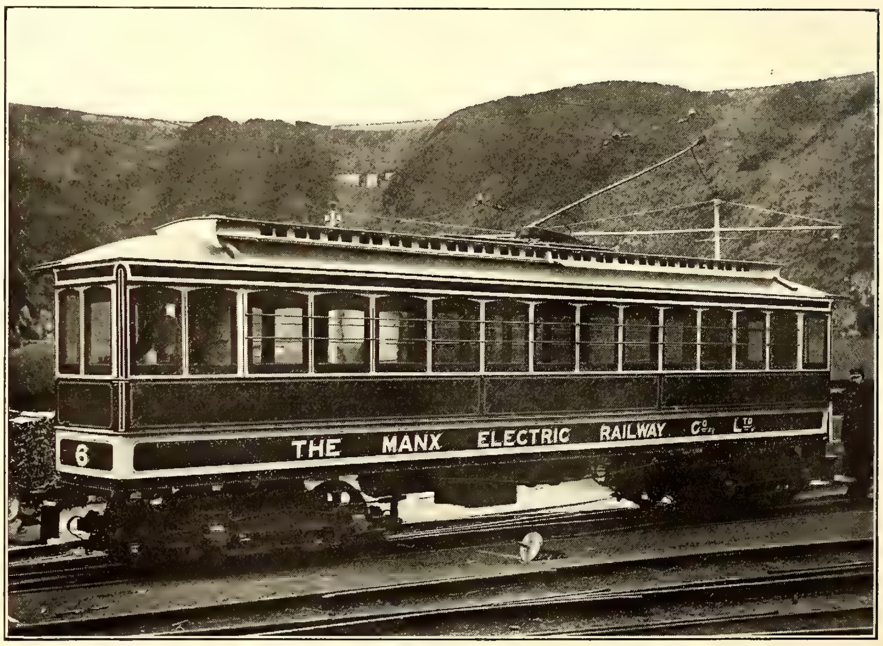


FIG. 19.—MOTOR CAR FOR MANX ELECTRIC RAILWAY

gases, directly over the tubes, and the boiler feed passes through this coil. The waste gases pass directly into a mild steel stack (each boiler has its own stack), 44 ins. in diameter and 75 ft. high. These stacks are made up in three sections,

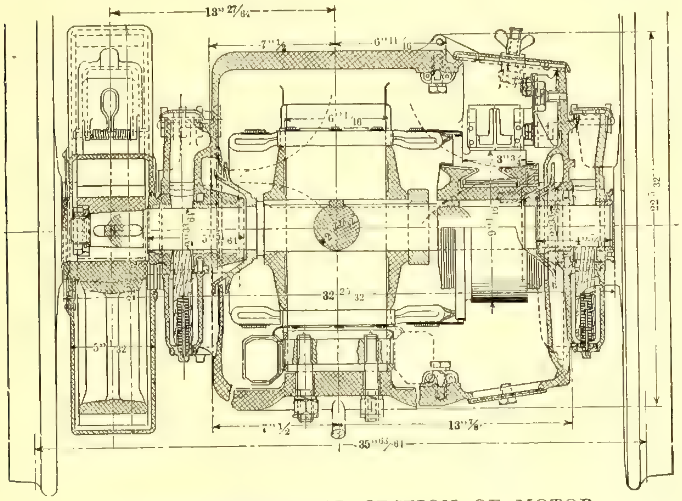


FIG. 20.—LONGITUDINAL SECTION OF MOTOR

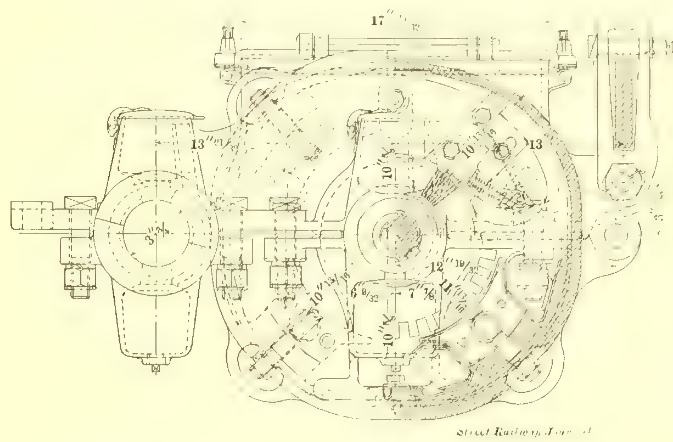


FIG. 21.—CROSS SECTION OF RAILWAY MOTOR

each 25 ft. long, the bottom section being constructed of plate ¼ in. thick, the center section 3-16 in. thick, and the top section ⅛ in. thick. The stack is stayed by steel wire guy ropes.

Each boiler consists of one central shell, bored to receive the tubes, which are so formed that both ends are expanded into the shell. Inside the shell there are a series of baffle plates, arranged to separate the water from the steam. On the top of the upper row of tubes there is a feed-water coil, one end connected to the water in the inner shell, and the other end connected to feed pumps. The whole rests on a cast-iron foundation plate, and is surrounded by a wrought-iron casing or jacket, lined throughout with patent fire-clay slabs, except the furnace, which is lined with fire-brick.

The central shell is 11-16 ins. thick, 42 ins. diameter and 2 ft. 9 ins. high, composed of Siemens-Martin steel, welding quality, 60,000 lbs. tensile strength. The vertical seams of shell are welded, and the circumferential seams single riveted with ⅞-in. rivets. The wrought-iron bearer for the grate bars is fastened with ⅞-in. tap bolts. The central shell is securely fastened to the cast-iron base plate by four cast-iron sections around the bottom.

The heads in the central shell are ¾ in. thick, and of the same quality steel as the shell, pressed to radii equal to their respective diameters and single-riveted with ⅞-in. rivets. There are four baffle or separating plates of ¼-in. steel. The central shell has one manhole, 11 ins. x 15 ins., in the top head, and another of the same size in the shell below the grate bars.

The upper rows of tubes are arranged so as to form a superheater.

The jacket or casing is in four courses, with a canopy or bonnet on top. The lower course round furnace is ¼ in. thick, in four sections with four firing and ashpit doors. The dead plate which supports the firebrick and grate bars is of cast-iron, made in eight sections and bolted to the lower course. The furnace is lined with firebrick from the dead plate to the top of the lower course with 1-in. air space. The upper course is 2-16 in. thick in eight sections each, with 2-in. flange all around, lined with fire-clay slabs 3 ins. thick. There are cleaning doors in each course.

The main steam pipe, 6 ins. diameter, is secured to the shell by a flange with a special casting to receive two safety valves. There are two 3½-in. spring safety valves, Hopkinson make, designed to blow off at 165 lbs. Light iron gangways with hand rails encircle the boilers, so as to provide access to cleaning doors, etc. The diameter of the outside furnace casing is 12 ft., and that of the upper casing 11 ft. 6 ins. The height of the boiler to the top of the canopy is 23 ft. 1 in.

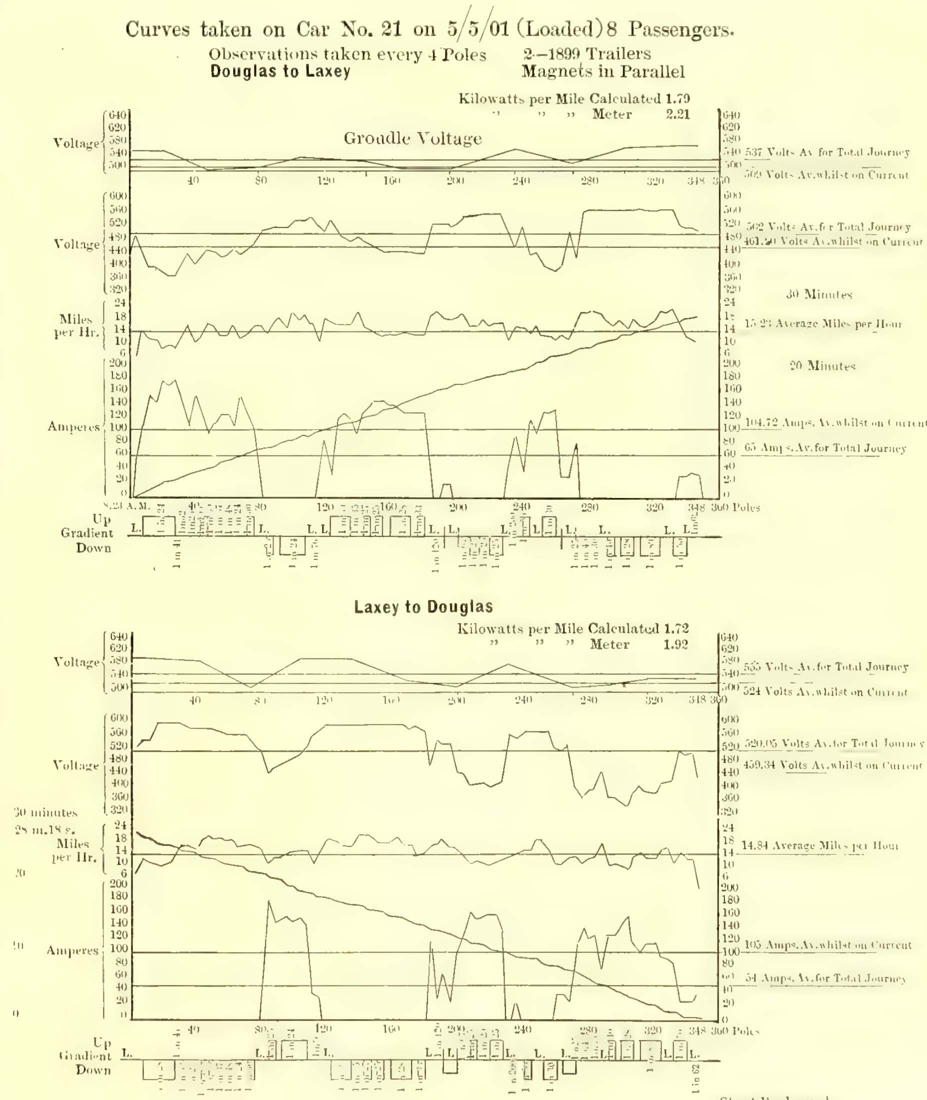


FIG. 22.—RECORD OF TEST RUN

The new generating sets, two in number, consist of high-speed engines direct coupled to high-tension alternators; they take the place of the Galloway sets originally installed. Figs. 3 and 4 show one of these sets.

The engines, supplied by Bellis & Morcom, are of the triple-expansion, vertical, high-speed enclosed type, designed to give the most economical results when working condensing, but capable of giving their full rated output when exhausting to the atmosphere, so that they will still continue to work satisfactorily should the condensing plant fail. The cylinders measure 12 ins., 17 ins. and 26 ins. in diameter by 13-in. stroke, and the normal speed is 375 r. p. m., with 155 lbs. steam pressure at the throttle. The shaft and the crank pins are all 5 ins. in diameter, and the total length of the bearings is 50 ins. The bearings are of gunmetal, lined with white metal. The fly-wheel is located next to the generator, and weighs 10,000 lbs. The speed is controlled by a centrifugal governor, which separates a throttle valve as well as the expansion gear. There is a steam separator attached to the engine bed. The cranks run in a bath of oil and water.

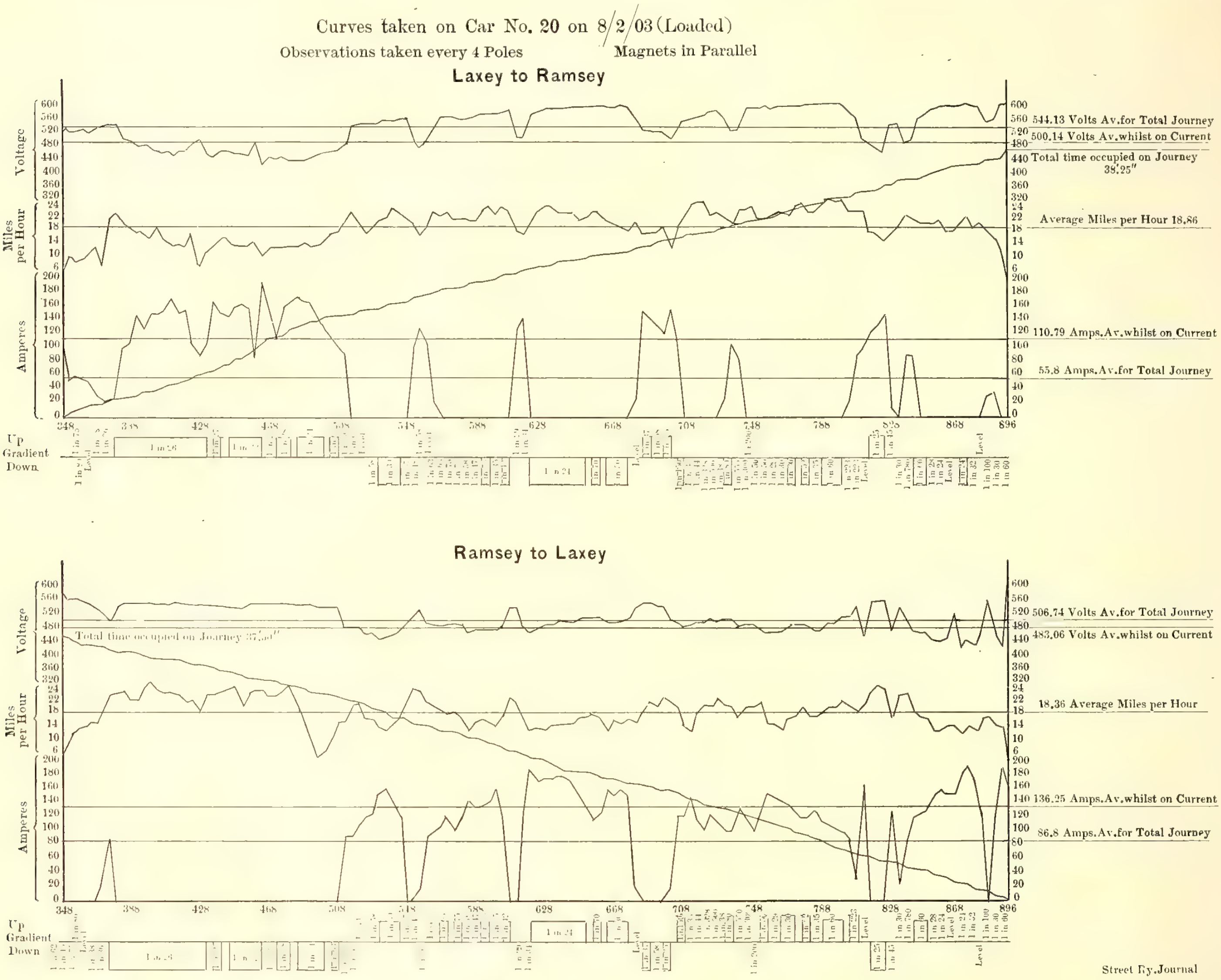


FIG. 23.—RECORD OF TEST RUN

The generators were supplied by Witting & Eborall, who were the contractors for the electrical plant, and are of the three-phase revolving field type, with iron-clad armatures. The rated capacity is 300 kw at 7000 volts and 25 cycles, when running at 375 r. p. m., built by the Electricité et Hydraulique Company, of Charleroi, Belgium. A section of these machines, giving dimensions, is shown in Fig. 5. The frames stand upon heavy sole plates, mounted directly upon the foundations, and have no connection with the bases of the engines. The outer bearing is self-aligning and self-oiling by means of ring lubricators.

Each alternator is provided with a shunt-wound exciter, direct coupled to the shaft, each such machine being capable of providing sufficient current for the excitation of both generators simultaneously.

The steam consumption of these sets is guaranteed not to exceed the amounts given below when running condensing at 375 r. p. m. and 155 lbs. steam pressure at the throttle, using technically dry steam:

Full load, 18.5 lbs. per ehp-hour.
Three-quarters load, 19.2 lbs. per ehp-hour.
Half load, 21.0 lbs. per ehp-hour.

The full-load capacity of each set is 300 kw, with 20 per cent overload for two hours. Fig. 6 shows the two sets erected at Laxey.

The rotary converter and static transformer were likewise supplied by Witting & Eborall, as was also the switch gear. The rotary and transformers were made by Kolben & Company, of Prague. There are two static transformers supplying one rotary; the former are of the three-phase core type, the rated output of each being 75 kw. At present they are air cooled, but arrangements are being made for them to be oil cooled. With the secondary windings on a non-inductive load, the rated efficiency, after a full-load run of 6 hours, is as follows;

Full load, 97 per centt.
Three-quarter load, 96.8 per cent.
Half load, 96 per cent.

The rotary is of the three-phase, six-pole type, and runs at a speed of 500 r. p. m. Fig. 7 gives overall dimensions. The guaranteed efficiency after a 6-hour run at full load is:

	Power factor 1 Per cent	Power factor 0.9 Per cent
Full load	94	94
Three-quarter load	92½	92
Half load	89½	89

The rotary can be operated either as a shunt machine or as a compound machine. In the former case hand regulation of the fields is employed in conjunction with the reactance coils which have been provided.

This rotary is precisely similar in every respect to the others distributed among the various other stations along the line. The machines are designed to be started up from the continuous-current side, the necessary current being obtained from the battery sub-station at Groudle.

The field magnet rings are of cast-iron with steel pole pieces bolted to the yoke ring, thus enabling a pole piece with its windings to be removed without disturbing the yoke ring. Damping coils are provided to prevent hunting. The armatures are drum wound, built upon a rigid cast-iron spider keyed to the shaft. Figs. 8 and 9 give different views of the two machines installed at Ballaglass station.

The addition of the above new plant at Laxey has necessitated the erection of a new switchboard for its proper control and operation. This switchboard is situated above the old low-tension board, and is provided with a gallery and flight of stairs leading down to the floor of the engine room. The gallery is about 8 ft. above the level of the floor.

The board itself consists of panels of white marble. Starting from the left-hand end the order of arrangement is as follows: Rotary converter panel (direct-current side), exciter panel, synchronizing panel, two alternator panels, one transformer

FIG. 25.—LIVE STOCK MOTOR CAR

panel and four feeder panels, two for Groudle, one for Snaefell and one for Ballaglass.

The switchboard is mounted in a metal frame provided with lugs for making connection to earth.

Each high-tension generator panel contains:

One indicating watt meter.
One ammeter.
One volt meter.
One three-phase watt-hour meter.
One triple-pole, high-tension quick break switch.

The exciting-current panel contains:

One direct-current ammeter.
One switch with discharge resistance and pilot lamp.
One field regulating resistance.
One change-over switch, to enable either of the two exciters to be used for either or both alternator fields.

The exciter panels are fitted up with ammeter, double-pole switch, double-pole fuse and full regulating resistance. The synchronizing panel contains two voltmeters, one multiway voltmeter switch, and an Everett & Edgecumbe rotary synchronizer. Each of the high-tension feeder panels is provided

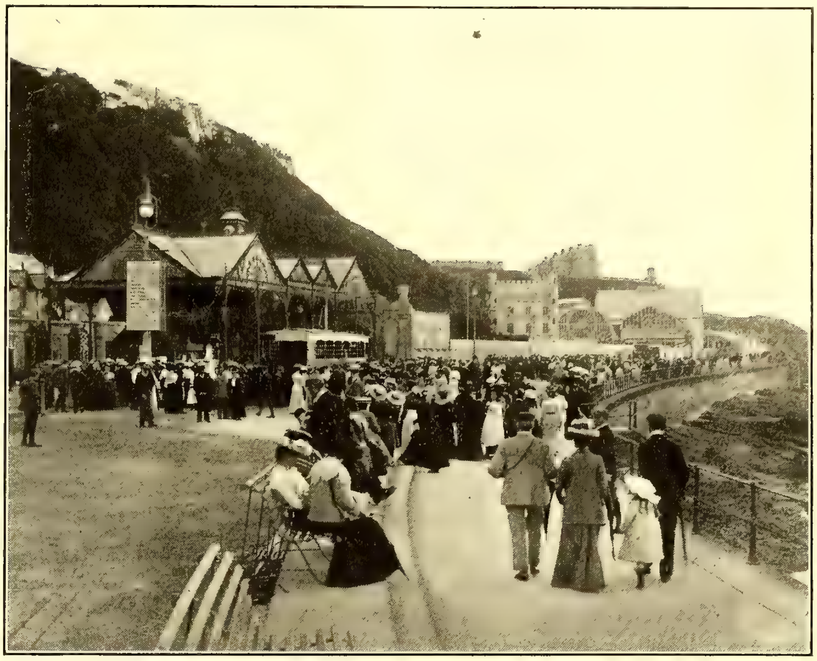


FIG 24.—DERBY CASTLE TERMINUS

with an ammeter, a high-tension triple pole quick-break switch and a lightning arrester. The high-tension transformer panel contains an indicating ammeter, and one automatic maximum current oil-circuit breaker.

On the rotary converter panel (direct-current side) there is mounted:

One I. T. E. laminated type circuit breaker.
One ammeter.
One paralleling voltmeter with zero in center of scale.
Two single-pole, quick break switches, kicking coil and lightning arrester.
One starting rheostat.
One equalizing switch.

For the field circuit there is an ammeter with the zero in the center of scale, a field regulating switch and field resistance. There is also a switch for changing over between shunt and compound running.

Fig. 10 shows diagrammatically the connections of the switchboard in the Laxey generating station. Fig. 11 shows a front view of the board.

The same type of switchboard has been used in the sub-stations as in the main power house. The only practical differences lies in the number of panels used, and, of course, no generator panels are required.

At the Ballaglass sub-station, where there are two rotary converters, two distinct and separate switchboards are employed, one for each machine, situated on opposite sides of the engine room. One of the switchboards is shown in Fig. 12. The two boards are absolutely identical in every respect. Each consists of four panels supported in an iron frame. The panels are arranged in the following order:

Feeder panel.
High-tension transformer panel.
Synchronizing panel.
Rotary converter panel.

Both boards are situated on a level with the floor, and not

over the old low board as in the case both at Laxey and Douglas. The switchboard at Groudle, where there are also two rotaries, is not split up as at Ballaglass. The board comprises four feeder panels, two high-tension transformer panels, a synchronizing panel, and two rotary converter panels (direct current).

Diagrams of this and the remaining sub-station switchboards are given in Fig. 13.

Each of the high-tension lines is controlled by a three-pole oil switch, manufactured by the British Thomson-Houston Company. All these, together with the other high-tension apparatus, are situated in a special annex, which has been added to the engine and dynamo room in order to accommodate them. The two transformers and the reactance coils are also situated in the annex. The high and low-tension parts of the boards are absolutely separated, there being no high-tension apparatus or conductors either on the back or front of the operating panels. All the high-tension apparatus is arranged in compartments built into the walls of the annex.

The three-pole oil switches are worked by levers and links from the operating panels, and the voltmeters and ammeters are supplied by step-down transformers at low pressure.

No high-pressure fuses are provided; instead the three-pole switches are fitted with a circuit-breaking attachment worked by means of the low-tension relay mounted upon the corresponding operating panel, and supplied by a small series transformer. The switch can be arranged to open at any predetermined value of current, and is guaranteed to open a circuit at 10,000 volts on the severest short circuit that can take place.

On account of the character of these oil switches, which are also provided for use in connection with the high-tension side of the sub-station transformers, no switch gear has been provided between the secondaries of the transformers and the slip rings, which are thus directly connected. Synchronizing is done on the high-tension side in the usual way, thus saving considerable expense in cable and securing greater freedom from breakdown.

Any panel can be readily isolated, while the remainder of the board and the bus-bars are alive. Suitable section switches at all necessary points are provided for these purposes. An Everett-Edgecumbe rotary synchronizer is supplied in addition to the usual phase lamps. Fig. 14 gives a section through one of the alternator panels.

The switch gear at Douglas, Groudle and Ballaglass is in every way similar to that at Laxey, with the omission of the generator switch gear.

Fig. 15 is a photograph of a portion of the high-tension switch gear in the special annex at Laxey. Owing to the small space available the view obtained is somewhat foreshortened, but it shows the general idea of isolating each of the high-tension three-pole oil switches in separate brick cells.

FIG. 27. GROUDLE GLEN STATION

Fig. 16 gives a typical view of the overhead construction.

Fig. 17 shows the switchboard at Douglas, which, like the one at Laxey, is erected over the old low-tension board, and is reached by a stairway.

The arrangement of the high-tension feeders running from the Laxey power station to the other stations is as follows: There are four sets of feeders running from the central station, one going to Snaefell, a distance of 3 miles; one to Ballaglass, a distance of 5½ miles, and one to Grudle (4 miles), and thence to Douglas, 2 miles further on. The Snaefell and Ballaglass feeders each provide an area of .1086 sq. in. per phase. Between Laxey and Groudle there are two three-core cables, .04 sq. in. section, while the two extending from Groudle to Douglas are .02 sq. in. section.

The high-tension three-phase cables, before being laid, were subjected to test pressures of 20,000 volts alternating between conductors, and 12,000 volts alternating between any conductor and the lead sheathing. The low-tension single cables were required to stand 2000 volts alternating between the conductors

and the lead sheathing of earth. The test pressures were applied for a period of 15 minutes, after the cables had been immersed in water for a period of 24 hours. After being laid in the ground the cables were tested with 70 per cent of the above pressures.

PIPING, VALVES, FEED PUMPS AND CONDENSING PLANT

All of the piping, valves, feed pumps and condensing plant were supplied by Babcock & Wilcox. The steam pipes are solid drawn with mild steel flanges. The pipe flanges are constructed of wrought-iron, attached to the pipes by riveting; in the case of the 7-in. and 8-in. diameter pipes the rivets being driven by hydraulic pressure. In the case of the 6-in., 4½-in., 2-in. and 1½-in. diameter pipes the flanges are fixed by fine screwed threads, the end of the pipe being afterwards expanded in. The copper piping is solid-drawn 15 B. W. G. thick, with heavy gunmetal flanges brazed on. The valves are of Glenfield & Kennedy's make, with cast-iron bodies and gunmetal working parts.

The steam pipes are covered with the Mica Boiler Covering Company's "mica" mats, the valves and fittings being covered with "mica" cement. All exposed cast-iron pipes are treated with one coat of Dr. Angus Smith's composition.

The feed pumps, two in number, are of the Weir standard construction, and were supplied by that firm. The cylinders measure 6 ins. and 8 ins., by 15-in. stroke, the pump being designed to deliver 2000 gals. of water per hour against a boiler pressure of 160 lbs. per square inch. Each pump is fitted with a relief valve and counter. The exhaust from these pumps is led through a coil of solid-drawn copper pipe, 2 ins. in diameter and 15 B. W. G. thick, located in the feed tank.

The condensing plant was supplied by Mirrlees & Watson, and consists of a surface condenser, a twin Edwards air pump, and a motor-driven circulating pump. The condenser has a cooling surface of 1800 sq. ft., and is designed to deal with 18,000 lbs. of steam per hour. The tubes are held in place in the brass tube plates by means of screwed ferrules with internal flanges, to prevent creeping. They are ¾ in. outside diameter, and are tinned inside and out.

The air pump cylinder measures 13 ins. diameter and 8-in. stroke, and the normal speed is 150 r. p. m. It is driven by an

FIG. 28.—LAXEY STATION

inverted vertical cross-compound steam engine, having cylinders 4 ins. and 8½ ins. in diameter. The crank pin end of the connecting rod is made of solid gunmetal, lined with babbitt. The valve plates and valves are of gunmetal throughout, the valves themselves being of the Kingborn type.

The circulating water is handled by a centrifugal pump, and is designed to deal with 19,000 lbs. of steam per hour. The pump casing is of cast-iron, with Delta metal blades. The shaft is of similar material with solid gunmetal glands fitted with self-oiling arrangements. The motor driving this pump is of the semi-enclosed multipolar continuous-current type, designed to operate at an average pressure of 525 volts. The circulating water is taken from the turbine race through a cast-iron grating, and is returned to the race at a lower point after passing through the condenser. Fig. 18 shows the general lay out of the condensing plant.

The discharge from the condenser is 4-in. diameter cast-iron piping, ⅜ in. thick, and is taken to the river. The blow-off piping is 3 ins. diameter. The blow-off trench, cable trench and hot-well discharge trench are all covered with wrought-iron

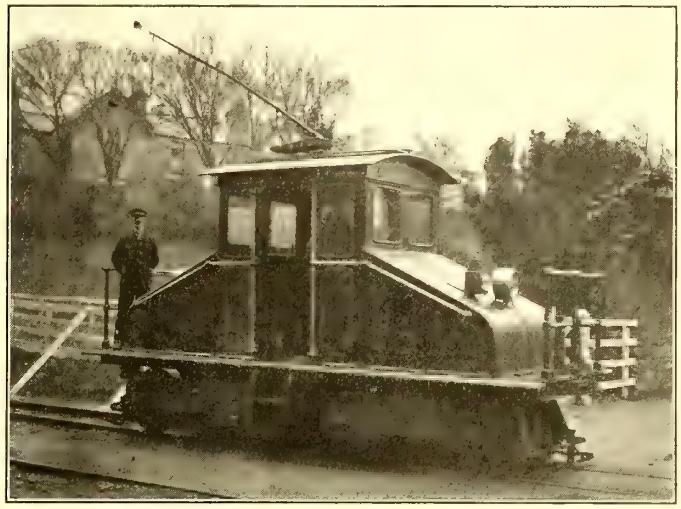


FIG. 26.—LOCOMOTIVE FOR MANX RAILWAY

chequered plating, 5-16 in. thick, with heavy cast-iron curb. These are 5¾-in. Geipel steam traps, with three-way cocks, so that they can be by-passed to the atmosphere when required.

ROLLING STOCK

The new single-deck open trailer cars, manufactured by Milnes & Company, are mounted upon double trucks, and have a seating capacity of forty-four passengers. The chief overall dimensions are:

Length of car over end framing, 28 ft. 6 ins.
Width over pillars, 6 ft.
Width inside pillars, 5 ft. 4 ins.
Width over steps, 6 ft. 9 ins.
Gage, 3 ft.

The side and end sills are of channel steel, 4½ ins. x 2 ins., with intermediate cross sills of pitch pine. The diagonal bracking between end sills and bolster is of oak. The under-frame bolster is of oak, firmly connected to the side sills, and oak blocks are provided to take the top center plates. The underframe is trussed underneath by 1-in. diameter truss rods.

The floor is of Norway pine, with hard-wood wearing strips fitted between the transverse seats. The pillars are of American white ash, secured to the side sills by wrought-iron knees. The end framing contains two fixed windows on either side, with a sliding light in the center. One oil lamp is fitted at each end of the car, at diagonally opposite corners. There are eleven seats, each holding four, arranged transversely; the backs of the seats are reversible.

Running boards are arranged on either side of the car, with treads and risers of pitch pine, supported from side bars by hangers of angle-steel. These boards are fitted with a strip of non-slipping tread iron.

Fig. 19 shows one of the motor cars. They are painted in red and white colors, and the whole effect is most handsome and attractive.

The existing cars, thirteen in number, have been supplied with new equal wheel bogies by the Brush Electrical Engineering Company. The cars to which they have been fitted are of three types, the principal dimensions of which are given in the table below:

	1893 Type ft. in.	1894 Type ft. in.	1898 Type ft. in.
Overall length of underframe	34 9	34 8	35 5
Distance between truck centers	23 8	23 8	23 8
Width of underframe over sills	5 8	5 8½	5 4½
Width of underframe between sills	5 4	5 4½	5 ½
Height of underside of sills from rail	....	....	2 5
Height of underside of floor from rail	....	....	2 8⅛
Radius of quadrants to center	2 2¼	2 2¼	2 1½
Overall width of car body	6 6	....	....
Number of passengers	38	38	56

FIG. 29.—DERBY CASTLE TERMINUS—DOUGLAS

The trucks are of the non-tilting, equalizing bar, swing-bolster type. The weight is doubly cushioned by two elliptical springs and spiral springs over each side box, and each truck is designed to take two d. c. railway motors, type T 11a, supplied by Witting Bros., manufactured by the Société Electricité et Hydraulique, of Charleroi. The swinging bolster is supported by four links, and rests on four conical coil springs, each having a movement of about 3 ins., so as to ensure a soft riding car body.

The wheels are of chilled iron, 30 ins. in diameter. The axles are of open-hearth steel, 3¾ ins. in diameter, and are required to be capable of being bent double, when cold, without flaw or fracture, and to resist a tensile stress of 65,000 lbs., with an elongation of 25 per cent on 8 ins.

The wheel seats on the axles are rough turned and white leaded before forcing the wheels on.

The motor cars have been fitted with Christensen air brakes, supplied by R. W. Blackwell & Company, Ltd. None of the trailer cars have as yet been fitted with air brakes, but the railway company has this matter under consideration. The existing arrangements, however, provide for the immediate and automatic setting of the trailer brakes, in the event of the coupling breaking. The same result would, of course, be obtained with air brakes on the trailer.

POWER MOTORS

The car motors, which have been supplied by Witting & Eborall, and are capable of exerting a minimum tractive effort of 520 lbs. at a speed of 15 m. p. h., and a minimum of 780 lbs. at 13 m. p. h., with wheels 30 ins. in diameter. They open from below. Figs. 20 and 21 show drawings of these motors.

The field coils are wound on formers, arranged so as to be readily removable and properly insulated with asbestos and rendered fireproof, and covered with varnished cloth and tape. Any coils likely to be subjected to the action of oil from the bearing are encased with lead. All connections taken through the motor case are brought through holes rendered watertight by means of rubber bushings. The armature is of the slotted drum type.

The controllers are of the ordinary standard series parallel type, with magnetic blow-outs and reversing and emergency stop connections. The reversing cylinder has five positions. The last position on either side is for the emergency brake, the motors being short circuited through a resistance and connected as generators.

The whole electric installation was designed by and carried out under the supervision of Messrs. Kincaid, Waller, Manville & Dawson.

The curves (Figs. 22 and 23), which accompany this article, show the power consumption on various portions of the line. During the year 1903 the aggregate number of passengers carried was 542,000, of which 230,000, or 42½ per cent, were conveyed during the month of August. Thirty thousand people made the journey to the top of Snaefell. Fig. 24 shows a crowd of holiday makers waiting to get on the cars at the Derby Castle terminus, Douglas, and gives a very good optical demonstration of the popularity of the line.

Fig. 25 gives an excellent view of the motor cattle truck, mentioned earlier in this description, and Fig. 26 shows (unfortunately, somewhat indistinctly) the electric locomotive which is used for hauling ballast cars and similar work. This locomotive was entirely constructed under W. Edmondson, the company's engineer, by the engineering staff in the workshops of the company. As all classes of merchandise and live stock are conveyed throughout the year, the locomotive and the cattle truck are kept pretty busy.

The time available was very short, for it was absolutely imperative that the work of reconstruction should in no way interfere with the running of the cars during the summer season. One of the conditions imposed upon the tenderers for the work was that sufficient progress should be made to enable the new units to be used for operating the summer traffic. In view of the amount of work to be done, the difficulties of transporting the machinery over hilly roads, and the very few appliances available in such an out of the way corner of the Kingdom, this condition was not easy of fulfilment, and the way in which the work was carried through reflects great credit upon all concerned. Tenders were invited at the beginning of February of last year, and within fourteen days from that time the contracts had been awarded. The generating units at Laxey commenced running on July 1, though the sub-station rotaries were not in running order till about three weeks later, owing to unavidable delays. Taking all the circumstances into consideration, we think that this very nearly constitutes a record for the rapid execution of the work.

FIG. 30.—DERBY CASTLE TERMINUS—DOUGLAS

Figs. 27, 28 and 16 show respectively the stations, booking offices, waiting rooms, etc., at Groudle, Laxey and Dhoon Glen. Figs. 29 and 30 give two views of the terminus at Douglas.

THE TRAMWAY SYSTEM OF BATH, ENGLAND

The ancient city of Bath, in Somerset, whose popularity as a health and residential resort is due to its far-famed medicinal waters and its baths, and also to the natural beauty of its surroundings, has just added a system of electric tramways to its other attractions. The population of the town is about 50,000.

The central portion of the city lies low, and the immediate outskirts are situated on rising ground, trending toward the surrounding hills. Walking is, therefore, a very tedious matter, and the electric cars now running have already proved a great boon. The new Bath system extends to within about 4 miles of the Bristol system, so that the interconnection of the two in the near future is quite probable.

The Bath Electric Tramways, Ltd., originated the project, and Geo. Hopkins & Son, of London, W. C.; Harper Bros. & Company, of London, E. C., and R. D. McCarter, of London, acted as engineers. The main contract for the tramways was awarded to Charles Chadwell, of London, S. W., and the track, together with the overhead equipment and the feeder cables, were laid and fitted by him. The British Westinghouse Electric & Manufacturing Company received the contracts for the erection and equipment of the generating station, a car house for forty cars, office buildings and the electrical equipment of the rolling stock.

VIEW IN BATH, SHOWING TYPE OF CARS AND POLES USED

LINES

The length of the lines now in operation comprises nearly 16 miles of standard gage single track, the total length of the routes being 12⅛ miles. The system consists of four routes, radiating from Southgate Street in the center of the city, two of them with short spurs, and one with an elongated loop. The extra mile authorized will go to form two loops in the city itself. The two longer of the four routes traverse the northern and southern districts respectively. The former runs due north to the church by Walcot Cemetery (this church forming the upper end of the loop referred to), and then follows the London Road northeast to Bathford. The southern line runs along Wells Road, and terminates opposite the Convalescent Home at Combe Down. The two other routes go to Weston and Tiverton, a short branch from the latter traversing the Oldfield Park district.

POWER STATION

The power plant is located on the River Avon, from which a good supply of water is obtained for feed and condensing purposes. Being very irregular in shape, much care was necessary to utilize the site to the best advantage. Much of it is made ground, in consequence of which the engine foundations had to be carried down nearly 30 ft., while the old river wall was found to be insecure and had to be rebuilt. The buildings consist of a boiler house, engine house and car house. The boiler house is 93 ft. long and 49 ft. wide, the engine and generator house being the same length, but 2 ft. wider. The car house is about 130 ft. long and 82 ft. wide. Over the street end of the car house are rooms for offices, etc., while at the rear end is a large basement, used as a repair shop. Eight tracks run the full length of the shed, an inspection and repair pit, 30 ft. long, being built in each track. The walls of the building are of brick. The engine room walls inside are of glazed brick to a height of 10 ft., and the roof trusses and the purlins for slating are entirely of steel. The engine foundations extend some 25 ft. to 30 ft. below the floor of the engine room, the floor being of concrete, finished with cement.

The steam plant comprises three Babcock & Wilcox tubular boilers, with a total heating surface of 9420 sq. ft., and each boiler is normally capable of evaporating 11,000 lbs. of water per hour, with a maximum of 13,000 lbs. per hour, the working steam pressure being 160 lbs. per square inch. Each boiler is fitted with a superheater having 339 sq. ft. of heating surface, sufficient to allow the steam produced by the boiler to receive a superheat of from 100 degs. to 120 degs. F. The economizer is of the Claycross type.

The feed water can be taken either from the River Avon or from the town mains. There are two feed pumps, one steam and one electrically driven. The former was built by J. P. Hall & Son, and is of the vertical slow-speed type. The latter is a Blake & Knowles three-throw pump, and is driven by a direct-current motor. The Hall pump is capable of delivering from 30 gals. to 45 gals. of water per minute, with a steam pressure of 150 lbs. per square inch and 100 degs. F. superheat against the boiler-working pressure of 160 lbs. The Blake &

Knowles pump has cylinders 5 ins. in diameter with 6-in. stroke, and can drive 2700 gals. of water per hour against the boiler

CARS PASSING THE BATH CITY MARKETS

pressure when running at 40 r. p. m. There are also two Blake & Knowles make-up pumps, each having a capacity of 300 gals. per hour.

The two Wheeler surface condensers have a combined cooling surface of 2820 sq. ft., and are capable of dealing with 28,000 lbs. of exhaust steam per hour, at normal load, and 35,000 lbs. for 1 hour as a maximum.

A Holly steam loop and gravity system is installed for taking care of the high-pressure drains. The water softener and purifier were furnished by Masson, Scott & Company. The former has a capacity of 300 gals. of water per hour, and the purifier a capacity of 1250 gals. per hour.

The main steam piping is 12 ins. in diameter, and the branches 6 ins., with 3-in. pipes to the pumps. The system is fitted with Hopkinson valves, and was supplied and fixed by the Sir Hiram Maxim Electrical & Engineering Company. The Holden & Brooke grease extractor is capable of dealing with 1500 gals. of condensed water per hour, and is fitted in the main exhaust pipe. The latter then passes on to the surface condensers.

Coal is conveyed from the railway trucks to the storage bins by "screw" conveyors, made by the Conveyor & Elevator Company, of Accrington. The bins have a capacity of 50 tons. A spiral coal conveyor brings the coal from the storage to the front of each boiler fire grate.

A Stothert & Pitt 15-ton electric crane, with a 50-ft. span, traverses the entire length of the engine room. The longitudinal travel is 175 ft. per minute, the cross-traverse 100 ft. per minute, and the hoist 6½ ft. per minute with full load, the total lift being 26 ft. The traveling, hoisting and traversing motors are 10 hp, 8 hp and 5 hp respectively.

The three Yates & Thom horizontal, tandem, single-crank, compound condensing engines have cylinders 15 ins. x 30 ins. in diameter and 36-in. stroke, and Corliss valves. They are of 320 hp each, and are capable of driving the 200-kw generators continuously at full load with 160 lbs. of steam, at 25 per cent overload for half an hour, and at 50 per cent overload momentarily. The engines give this output under both condensing and non-condensing conditions. Under condensing conditions and with the steam at 100 degs. F. superheat, the steam consumption at full, three-quarters and half-load does not exceed 15¼ lbs., 15¾ lbs. and 17 lbs. per hp-hour respectively.

The three 200-kw direct-current traction generators develop 500 volts to 550 volts. The armatures, which are pressed on to the engine shafts, are of the slotted drum type, with two circuit windings so arranged that the circuit will not become unbalanced by a displacement of 1-16 in. from the geometric center of the fields. The windings are arranged to give 500 volts at no load, and to over-compound to 550 volts, with a full load of 365 amps. The generators are capable of standing an overload of 25 per cent for half an hour, and one of 50 per cent for short periods. The 75-kw lighting and auxiliary traction set comprises a Westinghouse high-speed vertical, enclosed, two-cylinder, single-acting, compound engine, and a Westinghouse direct-

CAR HOUSE OF BATH TRAMWAYS

current railway generator. The high and low-pressure cylinders of the engine are 11 ins. and 19 ins. in diameter, respectively, and the stroke 11 ins. The generator has four poles, and gives about 150 amps. at from 500 volts to 550 volts, the set running at 300 r. p. m. The armature of the generator is pressed direct on to the extended crank shaft of the engine. The machine is compounded so as to give 550 volts with a full load of 136 amps. The machine will also carry a 25 per cent overload for half an hour, and a 50 per cent overload for a few minutes.

The two 15-kw boosters are four-pole machines, running at 575 r. p. m., the motor volts being 500 and the booster volts 50.

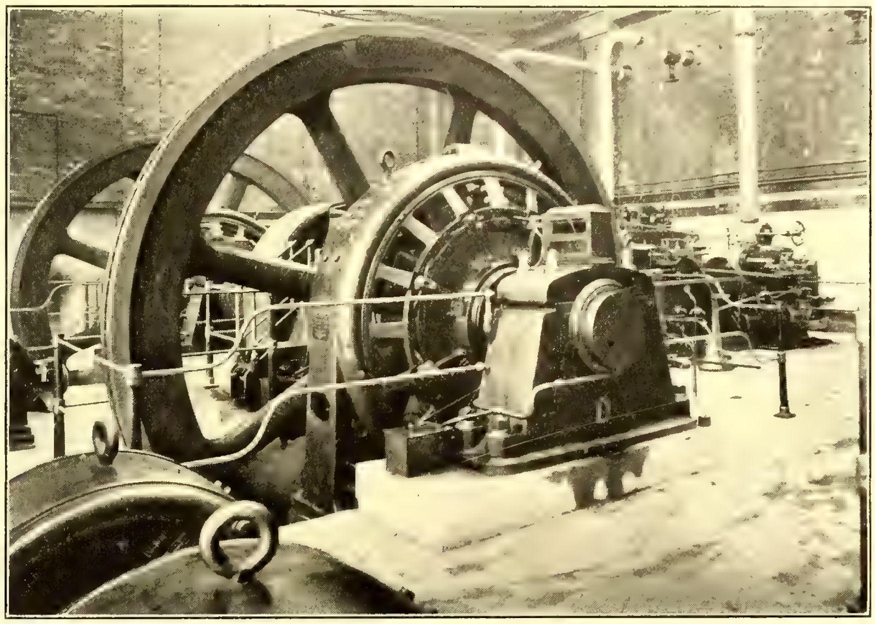
The main switchboard has thirteen white marble panels, 2 ins. thick, and is set in an angle-iron frame.

Some 900 ft. of double track are laid on 8-in. x 4-in. longitudinal sleepers in front of the hospital in Lower Boro Walls. The rails are cross-bonded about every 100 ft., the bonds being "Crown" 0000 B. & S. gage, with 7/8-in. nipples. These were supplied by the American Steel & Wire Company. The points are 8 ft. 6 ins. and 12 ft. long, and are chiefly of Hadfield's manganese steel, but some were supplied by the Lorain Steel Company. The crossings were supplied by, and the special track work done, partly by Hadfields and partly by the Lorain Steel Company. Wood paving is laid between the tracks in the center of the city, and granite sets and macadam with granite paving on the outlying portions.

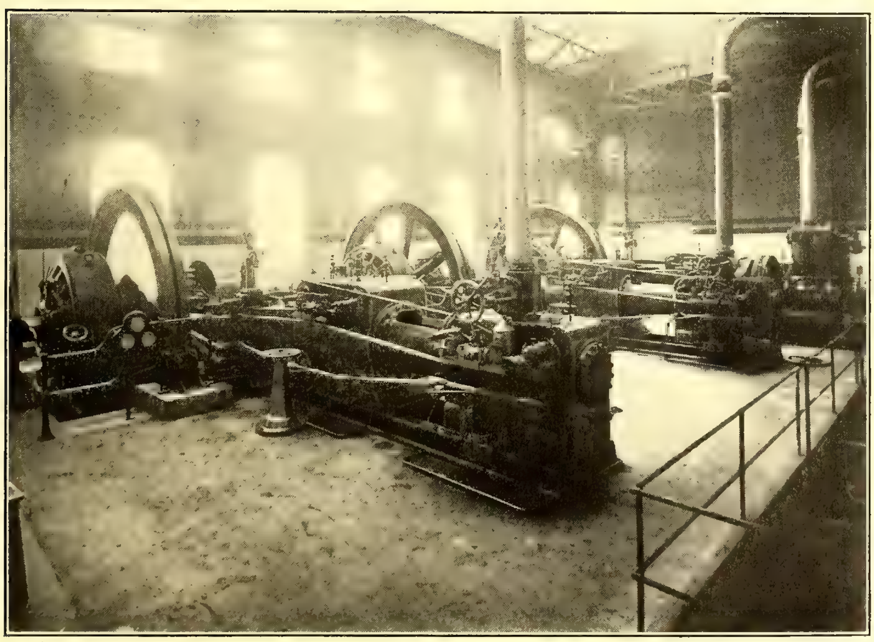
OVERHEAD CONSTRUCTION

The overhead line is supported mostly on brackets (varying from 6 ft. to 22 ft. in length) on side poles; but in some parts of the city span wires with supporting rosettes are stretched from the fronts of the houses. The poles are in three pieces. The panels are divided as follows:

One each for the three large traction generators, one for the lighting set, one station-load panel, one Board of Trade panel, one each for the two booster sets, one for the station lighting panel, one for the yard and car house lighting, two for positive feeders, one for the negative main,



DIRECT-CONNECTED GENERATING SET, 200-KW CAPACITY



INTERIOR OF ENGINE ROOM OF BATH TRAMWAYS

TRACK AND FEEDER CABLES

The thickness of the concrete bedding for the track is 6 ins. The rails are in 45-ft. lengths, and weigh 95 lbs. per yard, the width and depth of the groove being 1 1/8 ins. and 1 in., respectively. The fish-plates are 24 ins. long, and weigh 44 lbs. per pair, and the cup oval bolts measure 3 1/2 ins. x 1 in., and stand 24 ft. high over all. There is no center-pole construction. The trolley wire is of hard-drawn copper 00 B. & S. gage. The guard wires are of galvanized steel in strands, and are earthed through the poles, every third one of which (in the guard-wire sections) is bonded to the rails.

The distributing system comprises some 7 3/4 miles of paper-insulated and lead-covered cables, furnished by the British Insulated & Helsby Cables, Ltd. There are 810 ft. of .2-sq. in., 141 ft. .25-sq. in. and 20,100 ft. of .3-sq. in. section. The return cables have a section of .6 sq. in., and comprise a length of 1 mile.

ROLLING STOCK

Of the thirty cars now running twenty-six are double-deckers and four single-deck combination cars. There is also one watering car. The double-deckers are 27 ft. long over collision fenders, and the single-deckers 28 ft. The trucks are of Milnes S. B. 60, four-wheel type, the wheel base being 6 ft. The wheels and axles were supplied by the British Griffin Company. The trolleys have swivel heads with graphite brushes. Each car is fitted with two 49-B 30-hp motors, No. 90 controllers and magnetic brakes, in addition to hand brakes.

In the rooms of the Rapid Transit Commission in New York there is on exhibition an elaborate model of a New York underground railroad station, brilliant with small electric bulbs. Looking through this the spectator will get a view back into a section of tunnel, equipped with tracks, signal appliances and lights, and with tiny electric trains at intervals. They will be exhibited at the St. Louis Exposition. In a big show case are various minerals and curios found below the surface of the city of New York by the subway builders, including cannon balls dug up in Elm Street, ancient coins found all along the line, and even a human skeleton.

THE FUSED STEEL-TIRED WHEEL

BY KNOX TAYLOR

The fused steel-tired wheel is typically an American production, and with the extension of high-speed interurban electric railways, is coming into quite general use for this class of service. In its manufacture a steel tire of the open-hearth, hammered, hot-rolled type is selected, such as that made by the Standard or Latrobe Steel Companies, of America, and Krupp, of Essen. The tire is heated to a mild heat, and placed in the wheel mould. Then, under proper conditions, the cast-iron to form the center of the wheel is poured into the mould at a high temperature. The casting forming the center of the wheel can be of either spoke or plate type, as may be preferred. When the center is cast against the tire in the manufacture of fused wheels, experience shows that the union between the cast-iron and the steel is an actual fusion or weld. This can be proved by breaking a wheel through the rim, when the appearance of the fracture will be similar to that shown in Fig. 1.

The fact that an actual fuse takes place can also be proved by taking a wheel and turning it down on a lathe through the point of the union between the cast-iron and the steel. If this is done, the chips which come off the wheel in the lathe will break in the cast-iron, a slight distance from the weld, showing that the weld is stronger than the cast-iron. In fact, in steam railroad service the tires of fused steel-tired engine truck, tender and car wheels have been worn down into the cast-iron so that the thickness of the steel at points in the tire was practically that of a sheet of paper, yet the tire did not loosen. Although this practice is not to be recommended it indicates the closeness and the strength of the union between the two metals.

The fused steel-tired wheel, of course, can only be re-tired by the manufacturer, who remelts the center and pours it into a new tire, and for this purpose the old wheel has only scrap value. On the other hand, the fused steel-tired wheel has certain advantages over the built-up steel-tired wheel, that is, a wheel fitted with a tire which is held to the center by some mechanical fastening, such as bolts, retaining rings, etc. The tire in the fused wheel is integral with the center, and there is no costly machine fitting of tire rings and bolts. A saving is thus effected in the manufacture of the wheel, and later, as

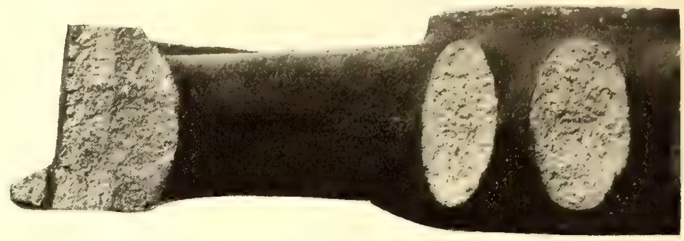
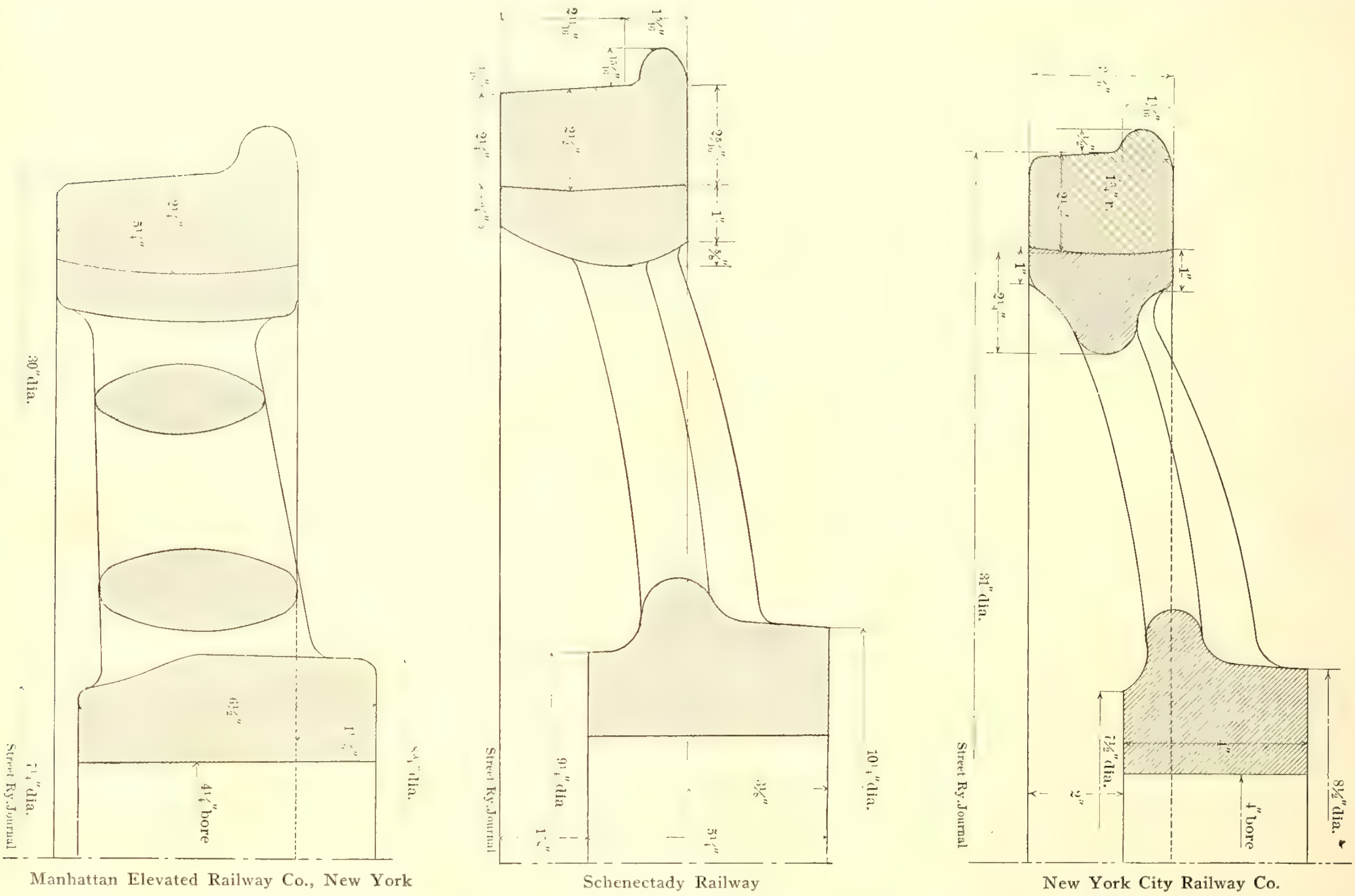


FIG. 1.—FUSED WHEEL BROKEN TO SHOW APPEARANCE OF FRACTURES IN TIRE AND SPOKES

well, in the equipment and labor necessary for repairs. The fused wheel is, therefore, stronger as the tire has added to its own strength the strength of the cast-iron which is underneath and a part of it. A tire held on in this manner cannot move around circumferentially or slip off, or expand away from the center when the tire is heated through brake-shoe action. More of the tire can, therefore, be put into wear than in any other type of steel-tired wheel.



FIGS. 2, 3 AND 4, SHOWING TYPICAL SECTIONS OF FUSED STEEL-TIRED WHEELS

A steel-tired wheel has a rim which can be made as thick as needed for any reduction in diameter in service that can be gotten conveniently out of a single wheel. It is perfectly feasible, so far as the manufacture of the wheel is concerned, to make it for a reduction in diameter of 4 ins. or more. Hence, the reduction in diameter, the greatest factor in the life of this type of wheel, is limited only by the equipment in which the wheel is mounted, and because of the thicker rims steel-tired wheels are considerably heavier than chilled iron wheels of about the same diameter.

The life of the steel-tired wheel is, roughly speaking, several

times greater than that of a chilled iron wheel, depending upon the proper mounting oi the wheels, weight of the load, degree of speed developed, and upon local conditions, such as curvature of the track, and whether the track is clean or gritty, etc.

The fused steel-tired wheels are already extensively used on interurban service with the exposed T-rail track, and there is a tendency also to introduce them in strictly city service. In city service, while the speeds are not as great, the tread and flange are often restricted to comparatively small dimensions, which is as hard on the wheels as high speed. The wheels in city service, before the introduction of electricity, served only to carry and to stop the car, whereas, now, with electricity, the wheels are the medium through which the car is started as well as still carried and stopped. In addition to this new duty loads are heavier and speeds higher. It is not strange, in view of all this, that the possibilities of the iron wheel for many classes of service have passed through a repetition of what took place years ago when the steam roads changed from the chilled-iron wheel to the steel-tired wheel for use in most of their engine, passenger, sleeping and dining-car service.

The fused steel-tired wheel gives many advantages, which may briefly be summed up as follows: It is stronger and more secure, for it is not likely to fly to pieces, no matter how high the speed, heavy the load, rough the track and cold the weather.

It gives almost entire freedom from the spots in ordinary service, for even in severe service the steel is not likely to develop slide flats.

There is freedom from broken flanges in ordinary service, for even in severe service the steel flange is so strong that frequently the wheel is run entirely on the flange, without any damage to it, over tracks that were designed for a lower flange. It will also be found that there is no chipping on the front edge of the tread.

It insures longer life in the rest of the equipment, which is not racked by the jolting of flat wheels.

There is less noise, for with the steel-tired wheel the ringing sound that is heard with the chilled-iron wheel is muffled to such an extent that its absence is at once a noticeable feature of the equipment.

Greater traction is obtained, as the coefficient of friction between steel and steel is greater than between chilled cast-iron and steel. This means less power required to start and stop the car, and makes it possible to have a cleaner rail, as less sand is needed, and, consequently, there is less wear upon the rails, and ultimately less wear upon the wheels. In the city service a big factor in the wear is the dirt upon the rail.

The mileage that can be obtained from steel-tired wheels in interurban or city service is less than that which can be obtained in steam car service, where the wheels are not used as driving wheels, and where the stops are less frequent and the curvature in the tracks less.

The short life of the early steel-tired wheels used on city railroads in America was due largely to the softness of the material of which they were composed and partly to defective design. As regards the former, the standard practice is now to use the best hot-rolled hard steel, and in design it has been found that it is more easy to secure a satisfactory and long-lived flange section in a steel-tired than in a chilled-iron wheel. The reason for this is that with chilled-iron wheels it is necessary, to secure good results in casting, to have a special shape of fillet, whereas the flange of a steel-tired wheel can be turned to conform more closely with the contour of the rail.

Some typical sections of fused steel wheels, as manufactured by the Taylor Iron & Steel Company, of High Bridge, N. J., are shown in Figs. 2, 3 and 4, which represent three different classes of service. The first is the standard trailer wheel of the Manhattan Elevated Railway, which is 30 ins. in diameter and weighs 650 lbs. Fig. 3 illustrates the type of interurban fused steel wheel, as employed by the Schenectady Railway Company, with a weight of 688 lbs., and Fig. 4 is a lighter wheel for city service, in use in New York, weighing 475 lbs. The New York City Railway Company is equipping half of the cars on one of its important electric lines with this wheel, an innovation full of significance.

CAST-WELDED JOINTS

BY ALBERT B. HERRICK

The history of the cast-welded joint cannot be written without at least an allusion to the numerous discouragements and persistent efforts to perfect the joint made by both Falk and Hoffman, but the results of the experiments have been successful, and the joint is now applied to a great number of miles of railway in the United States. Engineers now thoroughly understand, as they did not five years ago, what is necessary in order that the weld formed at the joints of the rail will form a molecular integral connection between the casting and the rail itself. It has been found that the perfection of this weld does not so much depend on the composition of the cast metal, which is usually pig-iron, but in bringing the rail surface to a temperature so that it will amalgamate with the cast-iron surrounding it.

This temperature is attained in several ways. The usual method is to use a sufficient mass of metal around the joint so that the actual thermal units are sufficient to raise the temperature of the rail to the required point. Where a sand mould is used around the joint the sand chills the outside iron, and rapidly reduces the total heat in the cast joint, so the weight of the metal cast around the joint has to be increased until sufficient molten metal has been poured into the joint to effect the amalgamation required.

An expedient to reduce the mass of metal required, devised by Mr. Hoffman, is to put an iron sheath instead of a sand mould around the joint. This sheath, supported by the rail and against the joint, and the space between the sheath and the joint, is poured full of metal. This reduces the conduction of heat units from the mass of molten metal and allows an integral weld to be made with less weight of metal per joint.

Another expedient, devised by the Grand Rapids Railway Company, is to allow the metal to overflow the mould on the other side from the pouring side. In this way the temperature of the joint can be brought up to the required degree with a small mass of metal. The overflow is afterwards broken off and remelted again for other joints. This weld is made an inch or so below the head of the rail, a method which has the advantage of not bringing the head of the rail in such close contact with the molten metal and thus run the risk of annealing it.

The application of Dr. Goldschmidt's method of welding and producing what is known as the thermit joint has been successfully applied in Germany to the welding of rails, and it is to be hoped that we shall soon see applications of it in America. In this joint the mass of metal required is very much smaller, and the apparatus to produce the joint is not as cumbersome, nor does it seem that the opening of the pavement has to be as extensive as in the case of the cast weld.

It has been often assumed that all rails could be cast-welded, and this erroneous impression has caused a number of failures. Some rails have a composition which will anneal at the temperature attained with the welded joint and others will not. It seems to be a fact that those rails which are high in manganese and low in phosphorous are self-hardening, that is, they will harden again on cooling, but that a low-carbon rail will anneal under the heat of cast welding. This will cause a soft joint, which will soon be pounded to a flat joint by the passing over it of the wheels. For this reason, before deciding to lay cast-welded joints, it is desirable first to test the rail for its self-hardening qualities to determine whether it is of proper composition.

The cast-weld has been generally admitted, since 1898, to form an electrical connection between the rail ends, which, as a rule, is lower in resistance than an equal length of rail, provided the weight of the metal around the joint is two and one-quarter times that of the weight of rail per yard. But it should be remembered that the resistance will increase toward the end of a pour if the temperature of the metal is not maintained. Cast-welding the rail-joints of a track will not insure the permanency of its alignment, unless the rails are held in the pavement and concrete, so that no longitudinal motion of the rails can take place. In laying roadbed designed for cast-welding, therefore, it is essential that the grouting and concrete against the rail be satisfactorily applied, and well tamped immediately under the foot and around the web of the rail. It has also been found that in mixing this concrete a cement, high in lime, will produce a greater coherence between concrete and rail than ordinary cement will give. Experience has also shown that the best results in cast-welding have been obtained when the pavement has been laid complete except at the joints before welding, and then completed after welding. If the joints are cast on open track and the paving then laid, the difference in temperature between morning, noon and night is sufficient to warp the track, so that it is difficult, if not impossible, then to align it without cutting the rails.

Welding up special work, and welding the main track with the special work, are directions along which developments should be made in order that the electrical and mechanical continuity of the rail shall be insured.

Jumpers are often used to bond cast-welded track, but, as a rule, they are not put in with sufficient capacity. I have often found that the drop across special work was equivalent to 3000 ft. or 4000 ft. of adjacent welded track.

Breakage is largely a question of sub-ballast and pavement condition. It is largest in asphalt pavement and lowest with granite paving or toothing block set in concrete. In about 40 miles of the former class of pavement I have found 0.8 per cent breakages. I believe that the reason for breakages in asphalt is that the dark surface of the asphalt absorbs heat readily, which, in turn, is transmitted to the rail. The stress under which this rail is subjected on this type of pavement is also much larger than with the less absorbent granite block or brick. Wood pavement is hardly a pavement in which a cast-weld can be successfully applied, as there is no foundation to which to secure the rail to prevent longitudinal expansion, due to temperature changes. I have found that the number of broken cast-welded rail-joints averages about 2 per cent of the total. The points at which the welds are found most liable to break are at the end of tangents and at top of the grades. It may seem surprising, though, that I have found 8 miles of exposed track, laid with 40-lb. rail on ties, cast-welded with slip joints about every 1000 ft., where the breakage has not been over 4 per cent. This track has now been down three years.

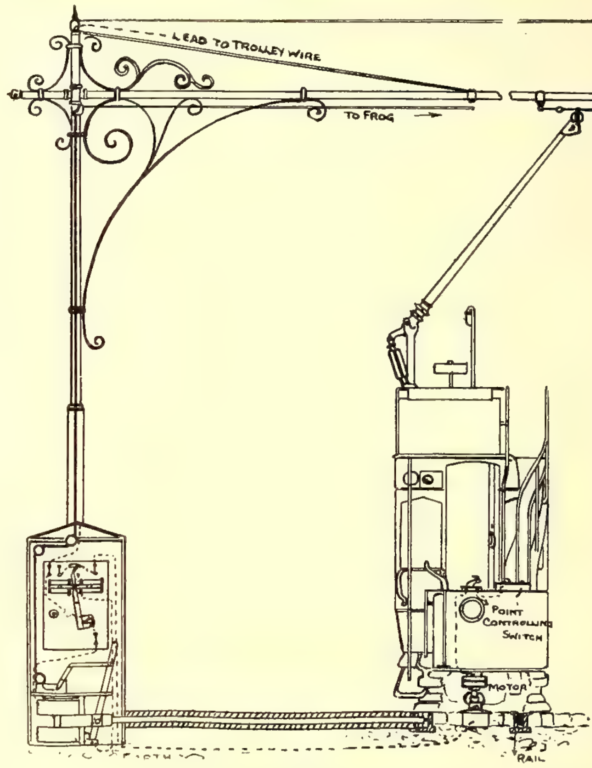
For the purpose of prolonging the life of a light rail in a paved street, cast-welding is certainly an electrical improvement, but to weld the joints for the purpose of improving the wearing qualities of the track is of doubtful mechanical and commercial value.

The Metropolitan West Side Elevated Railway Company, of Chicago, of which E. T. Munger is master mechanic, has adopted the plan of giving a bonus each month to the shop foreman who makes the best record during the previous month. In awarding this bonus, the amount of oil and various other supplies, and freedom from accidents to equipment due to neglect, are all taken into account. The competition between foremen to make the best record naturally results in considerable improvement, as the desire to make the best record is an even greater incentive than the bonus.

AUTOMATIC RAILWAY SWITCH

An automatic device for mechanically connecting and electrically operating the switches of electric railways on the overhead system is being manufactured by S. Dixon & Son, Ltd., of Leeds, England. The working parts of this apparatus are very simple and not at all liable to get out of order, being enclosed in a strong iron box of about the same dimensions as the ordinary street feeder box. This device has been in service on the Leeds City Tramways for over eighteen months, and is reported to be giving very satisfactory results.

The car is fitted up as follows: Two suitable water-tight controlling switches are fixed so as to be accessible easily to the motorman, one being placed at each end of the car, and a lead wire is taken from the main car circuit to one of the terminals of each switch. From the other terminals the circuit



DETAILS OF AUTOMATIC RAILWAY SWITCH

is continued through suitable fuses to one common permanent resistance, and then to a phosphor bronze slipper, or skate, suspended between the two motors in the center of the truck. This slipper is made adjustable from the inside of the car, and is raised normally 1½ ins. above the rail tread, and clears the crown of the paved track by ¾ in.

The iron street box used contains a powerful solenoid wound to suit the line voltage, having a core of suitable size and stroke to pull over both the track switch point and that of the overhead wire. The core is connected to the switch tongue by a suitable rod pivoted to it, and also to a lever projecting upward, so that when desirable, the points may be thrown over by hand. A suitable chain connected to this lever is carried to the overhead point, and adjusted so that the necessary movement is obtained at each, when the lever is thrown over either by hand or by the magnet.

The working of this magnet is controlled by an electrically-operated switch mounted in the same street box. The switch consists of two solenoids mounted with their axes in line, and having an iron core inserted in the central hole, which is slightly shorter than this hole, and is, therefore, sucked into one or the other according as the current energizes. To the center of this core, and mid-way between the two magnets, is pivoted a lever, forming the moving portion of the switch, and having insulated contacts upon it, so that when the iron core is

attracted into one of the solenoids the switch is closed, and when attracted into the other the switch opens. The closing of this switch completes a circuit from the overhead line, through the large magnet to the rails, causing the core to be attracted and the track switch and overhead points pulled over. On the switch being opened, the core is released and the points resume their original positions by the tension of a powerful spring.

The current for working the solenoids of this switch is derived from the line as follows: At a position about 30 ft. short of the switching point an iron contact-plate, embedded in a granite insulating box, is fixed in the center of the track. The surface of this contact plate projects about ¾ in. above the road level, and is tapered off on all sides, so as to offer no obstruction to wagon traffic. This contact-plate is connected electrically to the "closing solenoid" of the main switch, above described, while from a similar plate, fixed some short distance past the points on the branch line, another wire is brought to the "opening" solenoid of the switch, thus cutting the current off and allowing the points to resume their normal position.

If the motorman desires to pass the junction without leaving the main line, he simply keeps his car switch on the "off" position, and the points above and below remain unaffected. Should he wish to turn into a branch line he must, on approaching the first contact stud, turn his switch to the "on" position. Current then flows from the line down the trolley, through the motorman's switch, safety fuse, permanent resistance to the slipper, through the iron contact-plate to the "closing" solenoid of the main switch, thus closing this switch, and the large magnet becoming energized pulls over the track and overhead switches.

The car having passed the switches comes to the second contact-plate placed on the branch track. As the motorman's switch is still closed, a similar current flows through this plate to the "opening" solenoid, cutting the current off the large magnet, thus allowing the switches to resume their normal position. Provision is also made for mechanically releasing the main switch referred to from the outside of the street box by inserting a specially constructed key, which displaces the pivoted lever of the switch when it has been operated by a main route car.

Should a main route motorman inadvertently operate the points, he can, upon discovering his mistake, immediately put his car-point switch to the "off" position, reverse the motor controller, and back out; then the conductor can release, by the key referred to, the main switch in the street box, which will, of course, release the points.

VERTICAL MOTOR-GENERATOR SETS

A short time ago the Lend-Gastein (Austria) branch of the Neuhausen Aluminum Industrie Gesellschaft was equipped completely with electrical apparatus furnished by the Oerlikon Company, of Oerlikon, near Zurich, Switzerland. The most interesting feature of this installation is the use of vertical motor-generator sets, of which there are six in all. This type was chosen owing to the satisfactory service given by the vertical generators used in connection with the turbines in this plant. It was found that the vertical arrangement permitted the machinery to be handled with greater ease, and that the carbon and copper dust from the brushes fell directly downward and could not get into the armature windings.

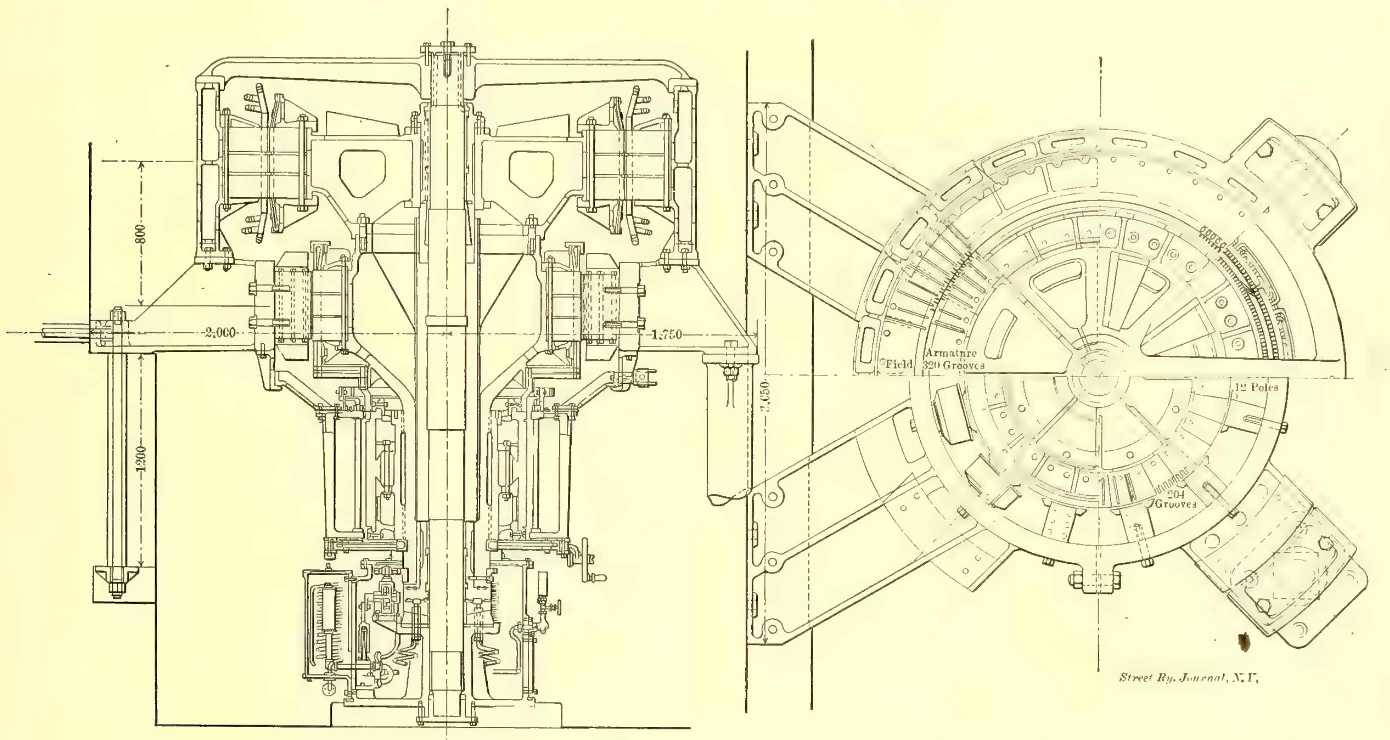


FIG. 1.—DETAILS OF VERTICAL MOTOR GENERATOR SET

The motors of each set are of the synchronous type, built to give 1000 hp at 10,000 volts, 45 cycles, 340 r. p. m. The 160-volt direct-current generators are each of 560-kw capacity.

The generator field is made of cast-iron. The motor armature is placed directly above the field of the generator, and is enclosed by an iron frame, cast in one piece.

The rotors of both machines are screwed to each other and revolve around the stationary shaft, which is lubricated from the oil-cup shown at the top of the shaft, in Fig. 2. The total weight of the rotors is about 14 tons. This weight is taken up by a spur foundation, located beneath the commutator of the generator. The stationary cast-steel spur plate is frustum-shaped, and rests in a cast-iron pan. The shell of the lower foundation, which is built in the commutator, has a flange at its bottom resting on the spur plate. Both the spur plate and flange have a circular groove for taking up the oil after it has been pumped through the machinery, under a pressure of 10 atmospheres. The entire supporting foundation, including the pumping machinery, is built in a cast-iron housing completely filled with oil, so that lubrication is ensured even if the pump fails.

The oil is kept cool by a spiral copper pipe, which conveys cold water through it.

The generators have twelve poles each and are shunt wound. The armature core is cooled by two ventilating slits. It contains 204 open slots for the windings, each slot containing four insulated copper wires. The connection between the armature winding and the commutator is made according to a new system devised by the Oerlikon Company, consisting in the use of copper forks, each of which combines two commutator laminations, separated from each other by twice the polar division, with the corresponding armature winding. The commutator consists of 408 segments of hard-drawn copper, insulated from each other by mica plates. All insulating rings in the interior of the commutator are also of mica. The twelve poles which carry the shunt windings are built of soft sheet-iron, and are

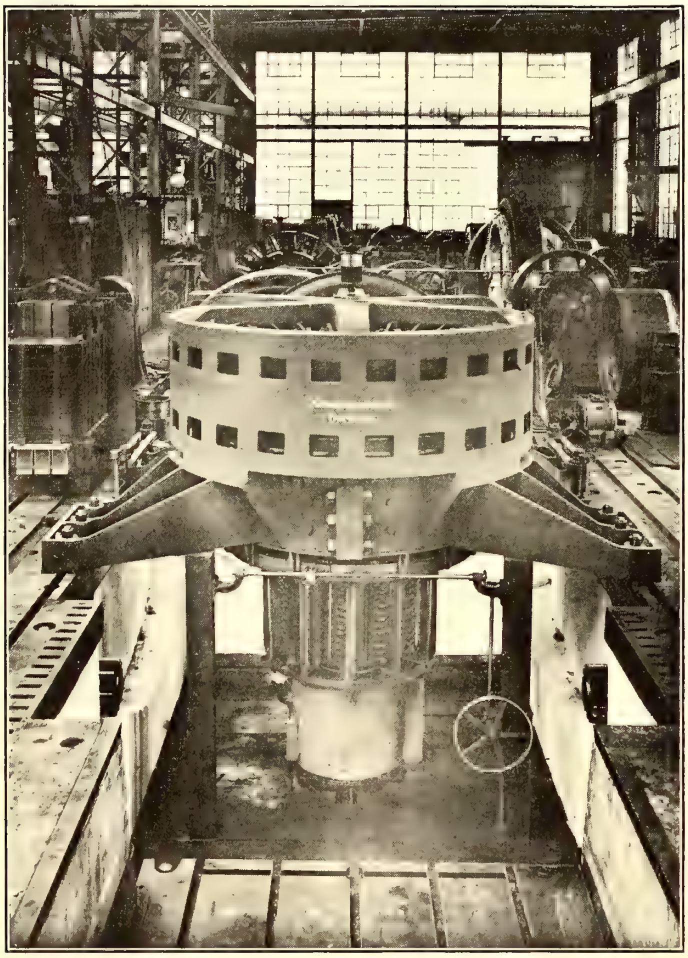


FIG. 2.—VERTICAL MOTOR GENERATOR SET, WITH FRAME

screwed to the field frame. Corresponding to the twelve poles the brush holder has twelve brushes, each of which is furnished with eleven carbon tips. These brushes are arranged so that all of them can be raised simultaneously when it is necessary to clean or true the commutator.

The motor has sixteen poles. The high-tension winding is laid in 192 slots, each containing eighteen series wires, insulated from each other by mica sheets. The rotor of the motor has a short-circuited winding.

ELECTRIC HAULAGE ON THE TELTOW CANAL

Some interesting experiments with electric boats and electric locomotives for hauling canal boats have been carried out recently on the Teltow Canal, Germany, under the joint auspices of the Teltow Canal Building Management and the Siemens-Schuckert Company. The locomotive and boat used for these tests are shown in the accompanying illustrations.

The boat is furnished with a 220-cell accumulator battery, but also has a 40-ft. trolley pole for taking current from one of the overhead wires placed along the canal bank. The second overhead wire is used for the return current. The locomotive is also arranged to send its return current through the second

ELECTRIC TUGBOAT ON THE TELTOW CANAL

overhead wire, as ground return would cause serious disturbances at the nearby Potsdam magnetic observatory.

The locomotive has a framed truss over which the hauling

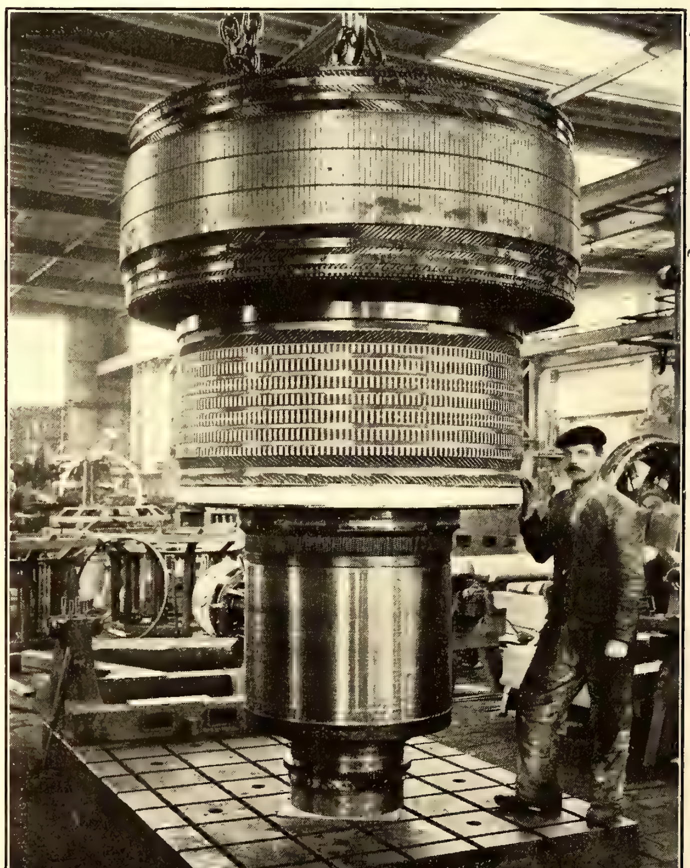


FIG. 3.—VERTICAL MOTOR GENERATOR SET, WITHOUT FRAME

rope passes. This truss is movable and may be raised so high that the rope will not interfere with any boats that may be lying along the canal bank. The locomotive is also furnished with a rope drum, on which the hauling rope is wound or unwound by

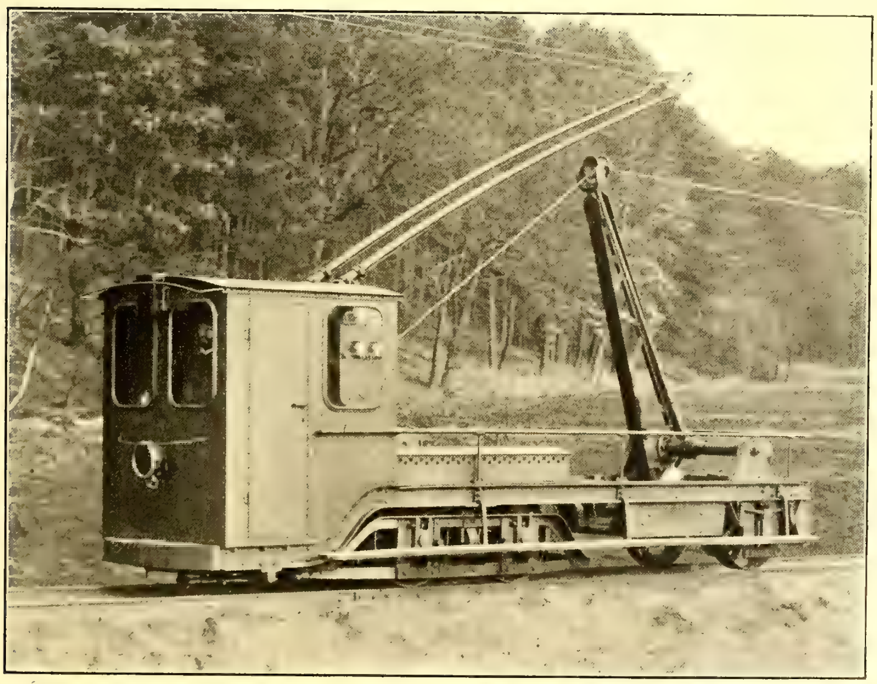
an electric motor. Besides this motor there are two others, one for raising and lowering the truss and the second for running the locomotive. All of the controlling apparatus is mounted in the motorman's cab.

At a recent test this locomotive hauled four scows, weighing 1450 metric tonnes (2205 lbs. per tonne), at 2.7 miles (4.35 km) an hour. The tractive effort at starting was 2205 lbs. (2000 kg) and during the trip averaged 1102.5 lbs. (1000 kg). The power required was 19.075 kw. During the second trip the total weight hauled was 1250 tonnes, the tractive effort 1984.5 lbs. (900 kg), the speed 2.6 miles (4.3 km) an hour, and the total power 16.275 kw. At a third trial the weight hauled was 1000 tonnes, the tractive effort 2095 lbs. (950 kg), and the power required 19.635 kw.

VIEW ALONG THE TELTOW CANAL

The tugboat is about 60 ft. long and 12.5 ft. wide. It is fitted with three screws, each operated by a 20-hp motor, running at 600 r. p. m. The speed of the screws, however, may be varied within wide limits. The motors are operated at 500 volts to 600 volts when using the overhead current, and at 400 volts to 450 volts when the accumulator battery is employed. The speed is not regulated by using resistances but by cutting motors in or out of the circuit and making different parallel and series connections. Under test it was found that the power required to operate the boat when running at 7.8 miles (12.5 km) per hour without load is 34 kw. On another occasion, when handling a load of 454 tonnes at 3.2 miles (5.2 km) per hour, the power required was 43 kw.

It will be seen from these figures that the efficiency of the boat is lower than that of the locomotive. The main reason for this difference is that the screws are too small to secure the best results. However, as the boats will only be used for short distances the problem of economic electric canal transportation is not seriously affected by this fact. The tests made thus far have proven very satisfactory. It is apparent from the foregoing that this subject is being seriously considered in Germany, and it is to be hoped that further reports will be forthcoming at an early date.



ELECTRIC LOCOMOTIVE USED ON THE TELTOW CANAL

AIR BRAKE FOR ELECTRIC RAILWAYS

The accompanying illustrations and description relate to a new air brake placed on the market recently by the Philadelphia Air Brake Company, of Philadelphia, Pa. While, in general, this apparatus involves no radical departure from standard practice, it possesses a number of special features tending toward lower first cost and economy in operation. The particular improvements which extensive tests have shown to be most advantageous are the duplex jam cylinder and the automatic cut-off, both of which will be described in detail hereafter.

Fig. 1 shows the complete motor and air compressor, consisting of a series-wound multipolar motor connected to a steel crank shaft by high-speed worm and gear. The gear is placed in the center of the crank shaft, operating two single-acting plunger pistons through connecting rods. This arrangement naturally gives the best transmission results, as the source of power is in the center of the work. It also greatly simplifies the scheme for oiling, as the moving parts all work in the same compartment, which is kept partially filled with oil and is completely enclosed.

The suction and discharge valves are arranged in the cylinder heads, so as to be easily accessible for inspection and grinding. The four valves (two suction and two discharge) are exactly alike and interchangeable.

The use of worm and gear running in oil reduces to a minimum the noise made by the compressor. The bearings are extra long, and fitted with oil-carrying rings. The pinion end of the armature shaft is fitted with two bearings, one either side of the worm, thus eliminating any chance of a bent armature shaft as well as doubling the bearing surface of the shaft. The motor and pump may be placed inside the car under one of the seats, or suspended underneath the car. In the latter case a dust-proof box is provided. This box is arranged so that the entire motor may be removed together with the bottom of the box by the removal of four bolts, or any part of the motor can be inspected through doors in the sides.

Fig. 2 shows the top field and armature of the motor removed.

Close inspection of this illustration will show the ease with which the several parts may be removed for renewal or repairs.

The automatic cut-off with cover removed is shown in Fig. 3. The cut-off is so designed that it stops the compressor motor

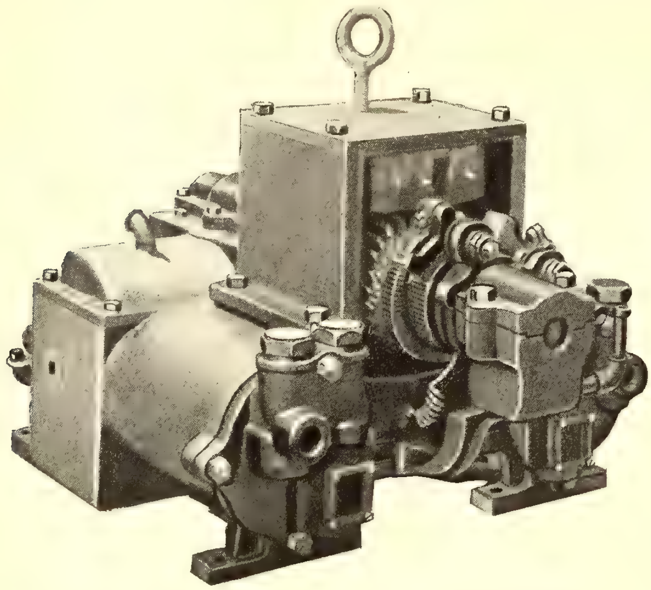


FIG. 1.—COMPLETE MOTOR AND AIR COMPRESSOR

when the pressure in the main reservoir reaches the maximum for which it is set and starts the motor when the minimum pressure is reached. The cut-off is very simple in design, having but two moving parts, that is, the diaphragm, operating the magnet contact, and the magnet armature, operating the motor current to the compressor. As the armature is drawn up the magnet contact is broken and the armature is held up by a pawl. The magnet is only in circuit during a portion of the upward travel of the armature, and for so short a period of time that the coil is never in service long enough to burn out or even warm. As the pressure against the diaphragm decreases to the minimum the pawl holding the armature drops by gravity to the first position, closing again the motor switch and starting the compressor.

As the cut-off works by gravity the closing of the motor switch is positive under any conditions, and is not dependent upon magnet or spring. In case of any accident to the cut-off

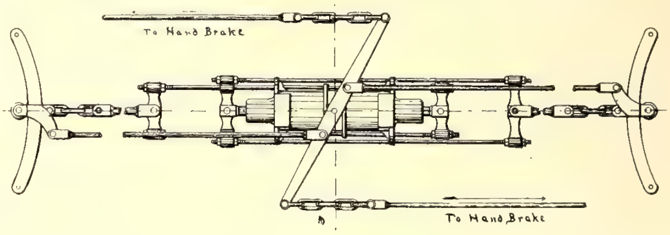


FIG. 3.—DUPLEX JAM CYLINDER, SHOWING HAND BRAKE CONNECTIONS

the compressor is left running and the air brake can be operated by use of the hand switch on the platform.

The duplex jam cylinder is shown in Figs. 4 and 5. By the use of this double cylinder, one end is connected to each end of the car. All the equalizing between the two trucks is accomplished by the use of compressed air, instead of a complicated system of levers, as in present practice. The cylinder is placed exactly in the center of the car, allowing a straight pull to each

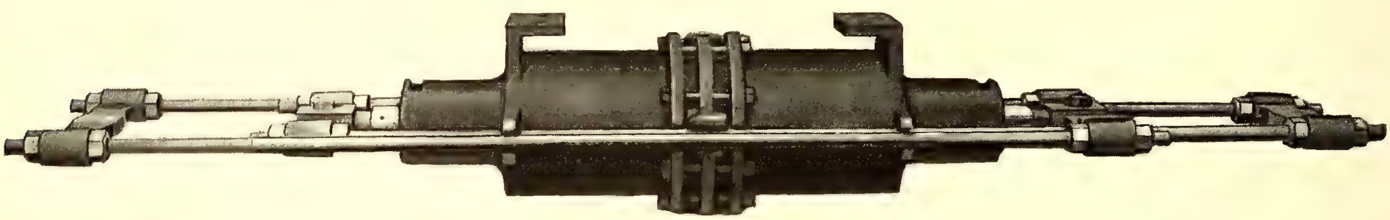


FIG. 4.—DUPLEX JAM CYLINDER

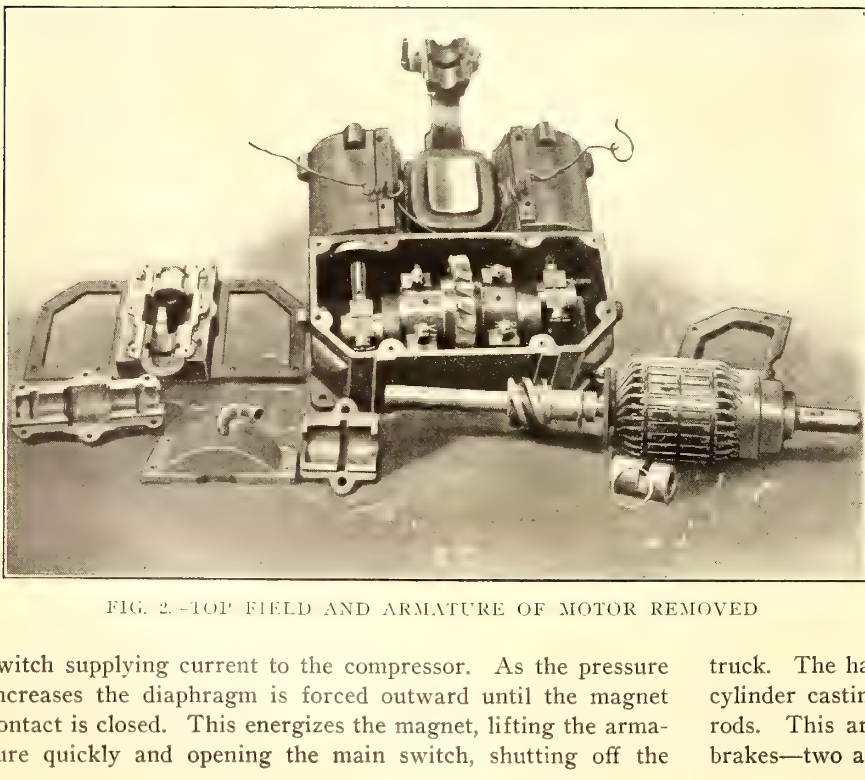


FIG. 2.—TOP FIELD AND ARMATURE OF MOTOR REMOVED

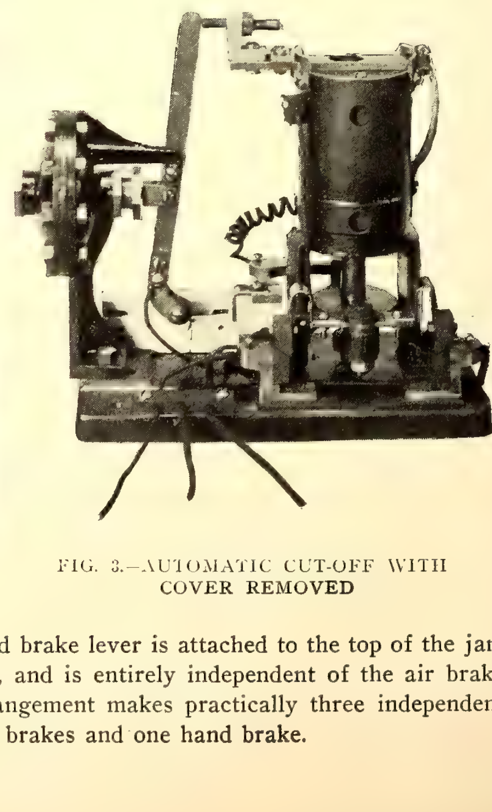


FIG. 3.—AUTOMATIC CUT-OFF WITH COVER REMOVED

switch supplying current to the compressor. As the pressure increases the diaphragm is forced outward until the magnet contact is closed. This energizes the magnet, lifting the armature quickly and opening the main switch, shutting off the truck. The hand brake lever is attached to the top of the jam cylinder casting, and is entirely independent of the air brake rods. This arrangement makes practically three independent brakes—two air brakes and one hand brake.

PNEUMATIC STATION INDICATOR FOR SUBWAY AND ELEVATED SYSTEMS

The accompanying illustrations show a novel and ingenious type of pneumatic station indicator now being tested on one of the cars of the Interborough Rapid Transit Company, of New York, and invented by Ernest K. Adams, of this city. In the engravings, Fig. 1 is a cross-section of the car with the

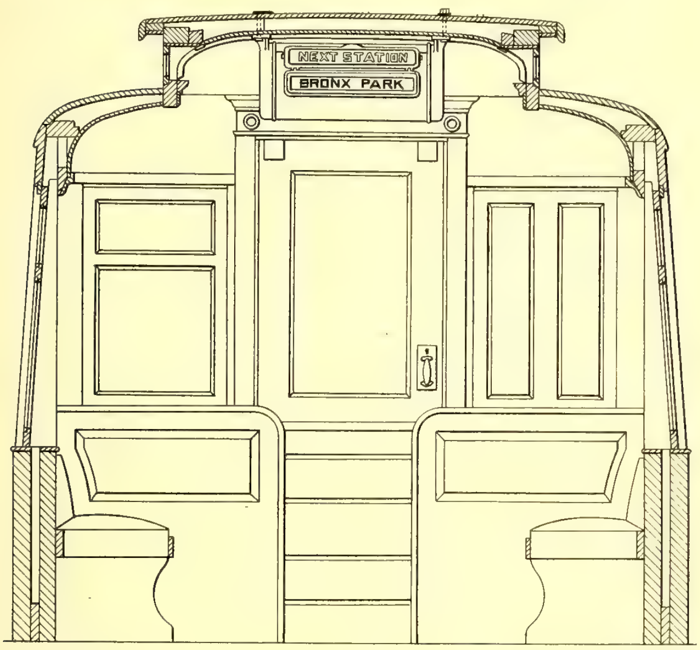


FIG. 1.—CROSS SECTION OF CAR, WITH PNEUMATIC STATION INDICATOR

indicator mounted therein, and Fig. 2 a longitudinal section of the same. The system primarily consists in placing a double indicator in the center of the roof of the car, where it can readily be observed from nearly every seat within. The indicator is operated by compressed air from the platforms of the car by means of a lever. A movement to the right of this lever causes the printed strip within the indicator to travel suitably

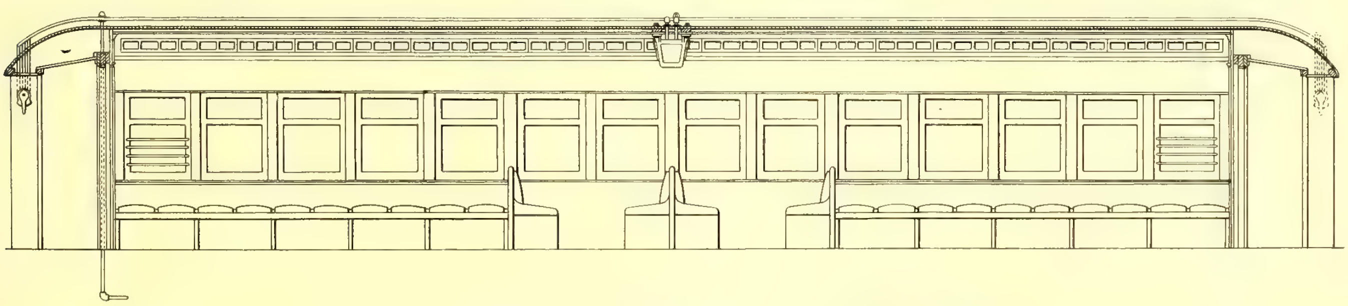


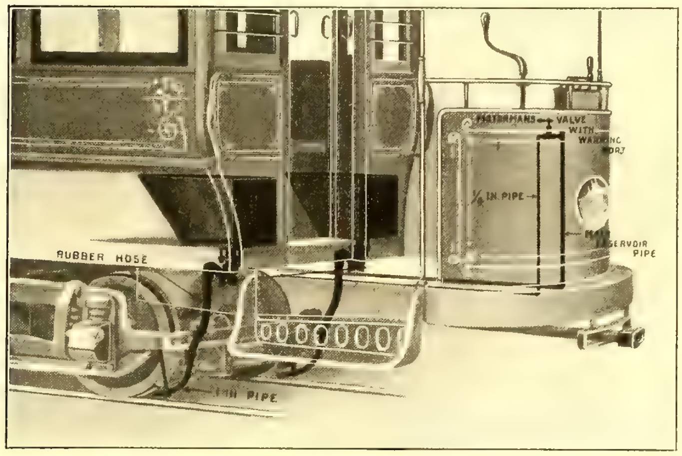
FIG. 2.—LONGITUDINAL SECTION OF CAR WITH INDICATOR

for an uptown trip, and conversely when the lever is thrown to the left to move correspondingly with a down-town run. The air for the system is supplied by a small automatic compressor, which is located under the car. In certain cases the compressed air may be obtained directly from the reservoir that supplies the brake system. To advance the indicator one station, about 1 cu. ft. of air, at 50 lbs. pressure per square inch, is required. The lever of the controller for this operation need be held at on side but for several seconds. When the equipment is employed on a route with branch lines, and it is occasionally necessary to pass over a number of station names on the printed strip, a movement of a controller lever suffices to quickly accomplish the function. Two stamped metal flaps, having the words "Next Station" raised thereon, are hinged to the sides of the indicator, and when for any reason it is not desired to operate the indicator system, these flaps may be made to cover the station names appearing at the indicator openings. In Fig. 2 the air conduits for the equipment have been carried along the roof of the car, and the indicator secured to it; but, of course, if preferred, the air conduits may be run within the car, and the indicator supported by brackets from the sides of the car.

The application of compressed air to station indicators is claimed to be more flexible and safer than electricity, particularly if the 500-volt current in the car is employed for the purpose. If desired, however, the indicator can be run by an electric motor. The indicator may be also mechanically operated.

PNEUMATIC SANDER

The accompanying illustration shows one of the several sanding devices made by the American Locomotive Sander Company, of Philadelphia and Chicago, for electric cars using air



ARRANGEMENT OF PNEUMATIC SANDER ON CAR

brakes. The device shown is extremely simple in its application to old equipments, and it is claimed that it will effect quite a large saving in sand over other methods. It consists essentially of two traps placed underneath the sand-box. From each trap a rubber hose connects with a 1-in. iron pipe. This latter pipe is fastened securely to the truck, the rubber hose allowing the car to swing around curves without interfering with any of the rigid connections.

The air supply is taken from the main reservoir from which it passes through the motorman's valve with warning port to the traps. The sand is then lifted from the traps and blown between the tread of the wheel and the rail. The operating valve in the cab is fitted with a warning port, and is so constructed that when the sander is in operation the warning port keeps up a continuous whistle. Should, however, the motorman wish to stop the whistle and still desire to keep the sander in operation he can do so by simply pressing on the valve placed in the end of the operating valve handle.

This sander is arranged to operate with fairly coarse sand,

but the best results will be obtained, of course, from sand that has been screened and dried. The manufacturer of this device recommends that the sand be screened through a sieve of No. 14 wire and four-mesh per inch.

It has been demonstrated that, compared with gravity sanding arrangements, pneumatic sanders effect a great saving in the amount of sand used, besides being more reliable. The manufacturer of this pneumatic sander claims that it easily effects a saving as high as 70 per cent. The fact that the sand is blown directly under the tread of the wheel makes it possible to start a car on slippery rails without any trouble, and when used in conjunction with the brake it can be brought to a standstill very quickly, thus avoiding costly accidents.

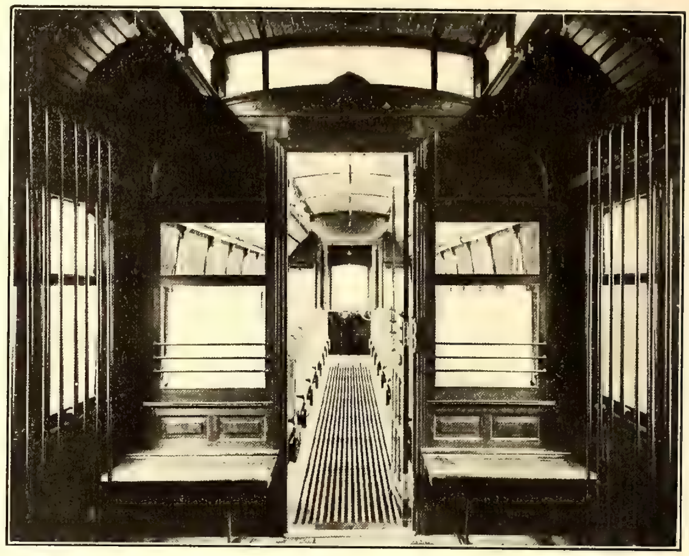
CARS FOR NEW LINES AT TRINIDAD, COL.

The American Car Company, of St. Louis, has furnished five semi-convertible cars of the Brill patented type to the Trinidad Electric Railroad, of Trinidad, Col. Three of the cars have bodies 20 ft. 8 ins. long, and are mounted on 21-E trucks. The other cars have baggage compartments, are 34 ft. over the bodies, and are mounted on the American Car Company's M. C. B. trucks, 14-B-1. The shorter cars are for use at Trinidad, and the larger cars are intended for interurban service between Trinidad, Sopris and Starkville, these three towns forming the vertices of a triangle, the distance between each point being about 5 miles. Trinidad is one of the most important mining centers of the State, and is in the vicinity of the celebrated Raton coal fields; it is also the junction of three important steam lines. The country traversed by the interurban line is thickly populated, and both systems, which have just been opened, will meet, doubtless, with success.

COMBINATION CAR FOR TRINIDAD ELECTRIC RAILROAD

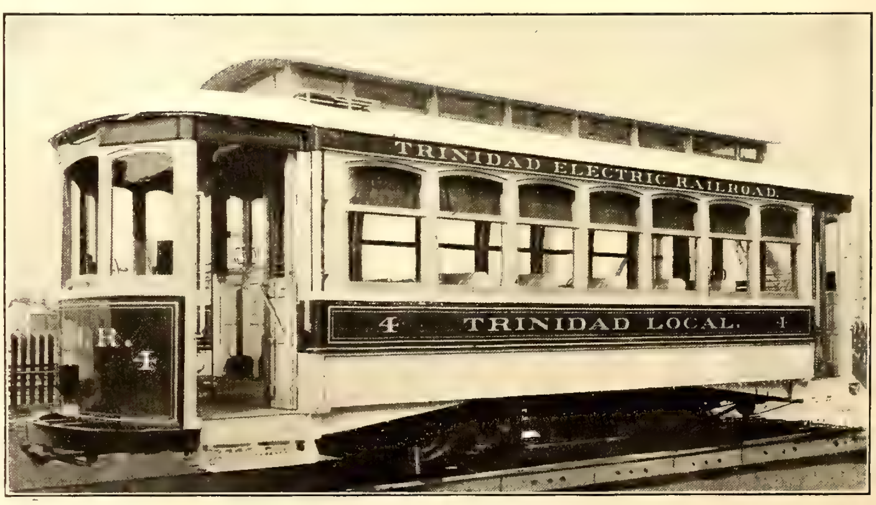
The dimensions of the shorter cars are as follows: Length over end panels, 20 ft. 8 ins., and over crown pieces, 29 ft. 8 ins.; from panels over crown pieces, 4 ft. 6 ins.; width over sills, including panels, 8 ft. 1 in.; width over posts at belt, 8 ft. $3\frac{1}{2}$ ins.; from center to center of side posts, 2 ft. 8 ins.; thickness of corner posts, $3\frac{3}{4}$ ins., and side posts, $3\frac{1}{4}$ ins.; sweep of posts, $1\frac{3}{4}$ ins. The side sills are 4 ins. x $6\frac{3}{4}$ ins., with 12-in. x $\frac{3}{8}$-in. plates on the insides; size of end sills, $5\frac{1}{4}$ ins. x $6\frac{3}{4}$ ins.; width of aisle, 23 ins. The distance from rail-head to platform-step tread is $14\frac{7}{8}$ ins.; from step to platform, $12\frac{3}{4}$ ins. The seats are 36 ins. long and accommodate twenty-eight passengers. The wheel base of the trucks is 7 ft. 6 ins.; diameter of wheels, 33 ins.

The combination passenger and baggage cars are 34 ft. over end panels, and 43 ft. over crown pieces; from end panels over crown pieces, 4 ft. 6 ins.; width over sills, including sheathing, 8 ft. 4 ins.; distance between center posts, 2 ft. 8 ins.; size of side sills, $44\frac{1}{2}$ ins. x $7\frac{3}{4}$ ins., and end sills, $5\frac{1}{4}$ ins. x $7\frac{3}{4}$ ins.; sill plates on the inside of side sills are 12 ins. x $\frac{3}{8}$ in. The side posts are $3\frac{1}{4}$ ins. thick, and the corner posts $3\frac{3}{4}$ ins. The cars are seated for thirty-six passengers, and the baggage compartments are furnished with folding seats for smokers. The seats are of the walk-over type, and are 36 ins. long, leaving the aisle $23\frac{1}{2}$ ins. wide. The illustration of the larger car illustrates the open appearance when the windows are raised into the roof pockets. The height of the step from the rail-head is $13\frac{5}{8}$ ins., and the distance of steps 11 ins. The trucks have a wheel base of 6 ft., and have 33-in. wheels. All the cars are handsomely finished in cherry with ceilings of birch. They are equipped with sand-boxes, angle-iron bumpers, "Dedenda" gongs and radial draw-bars of Brill manufacture.


INTERIOR OF TRINIDAD COMBINATION CAR

NEW CARS FOR MONTREAL

The Montreal Street Railway has appropriated $300,000 to be utilized in the construction of fifty new cars, to be built at the company's own shops. The new cars will be of the semi-convertible type, 40 ft. over all, and 30-ft. body. The doors will be at the side of the cars, making them of the accelerator type. Then, again, the platforms on the new cars will be 5 ft. wide instead of 3 ft. 8 ins., as at present.



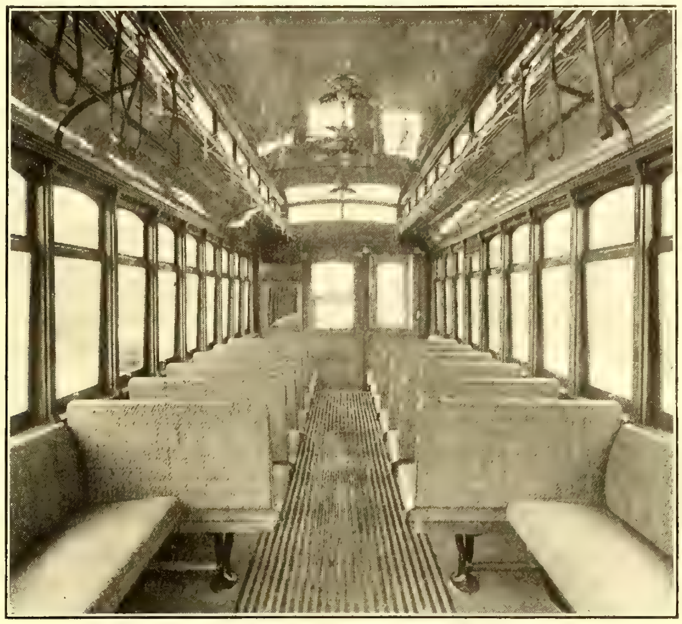
LOCAL CAR FOR TRINIDAD ELECTRIC RAILROAD

NEW CARS FOR DETROIT

The J. G. Brill Company has completed lately for the Detroit United Railway Company an order for fifty cars like the one shown in the accompanying illustrations. The cars are for use on the city and suburban lines of Detroit, and include features which particularly adapt them to the conditions met with in that city.

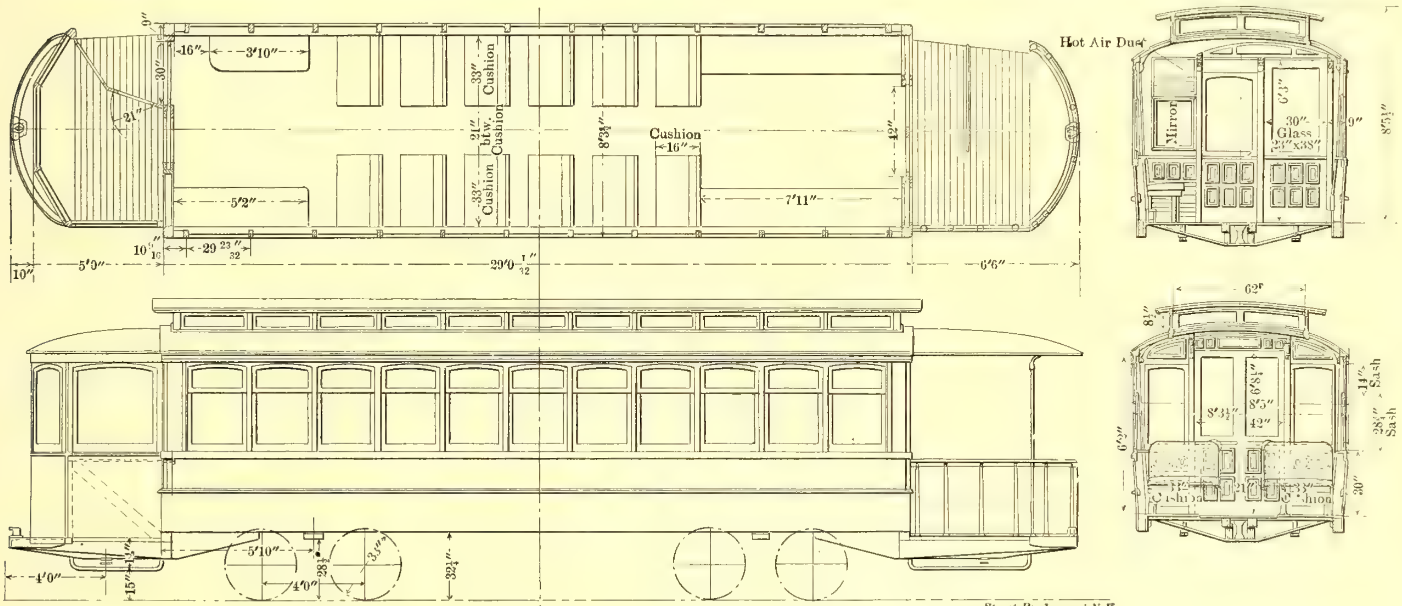
The seating arrangement was planned carefully to utilize the floor space so that forty-three passengers may be seated, only one less than with the usual cross-seat arrangement of the entire car, and providing standing room for a larger number of passengers. The clear space from the rear door to the cross-seats is a trifle over 8 ft., and between the longitudinal seats 4 ft. 6 ins. This ample space, together with the fact that the rear platform is of the Detroit type and is divided by a railing which prevents obstruction, enables passengers to move freely in and out, minimizing the length of stops, thus adapting the car to short headway and to service on busy lines. The forward end of the car is provided with a single sliding door in the right-hand corner, of the Brownell semi-accelerator type, of which the builders are licensees. This arrangement permits the use of a diagonal partition with swinging door and extending from the inner door post of the car end to the vestibule corner post. The motorman has a commodious vestibule, or cab, and is free entirely from distraction by passengers. The heater is placed in the corner of the vestibule at the paneled side.

The interiors are handsomely finished in quartered oak, with stationary. The seats, which are placed transversely to the car are 33 ins. long and have stationary backs. The aisle is



INTERIOR OF DETROIT CAR

21 ins. wide. The door at the forward end has a 30-in. opening, and the mutually-operating double doors at the rear end have a 42-in. opening. The width of the monitor deck, measured be-



CONSTRUCTION DETAILS OF DETROIT CAR

bird's-eye maple ceilings, simply decorated. The lower sashes are arranged to drop into wall window pockets; the pocket openings are closed with hinged covers. The upper sashes are tween the vertical faces of the ventilator posts, is 5 ft. 2 ins. The cars have a double flooring, with the interspace filled with mineral wool, which serves the double service of deadening the sound of the trucks and keeping out the cold.

DETROIT CAR FOR URBAN AND SUBURBAN SERVICE

The length of the cars over end panels is 29 ft., and over vestibule sheathing, 41 ft. 1 in.; width over side sills, including panels, 8 ft. 1 in., and over posts, including drip rail, 8 ft. 5 ins. The side sills are of long-leaf yellow pine, 4 ins. x 7¾ ins., with 12-in. x ⅜-in. steel plates on the inside. The end sills, of white oak, are 5¼ ins. x 6⅞ ins., and the center cross joists, 4½ ins. x 5½ ins.; thickness of corner posts, 3¾ ins., and of side posts, 2¼ ins.; sweep, 1¾ ins. The trucks are Brill No. 27-F, with 33-in. wheels and 4½-in. axles. Two 55-hp motors are used per car, both being on the rear truck.

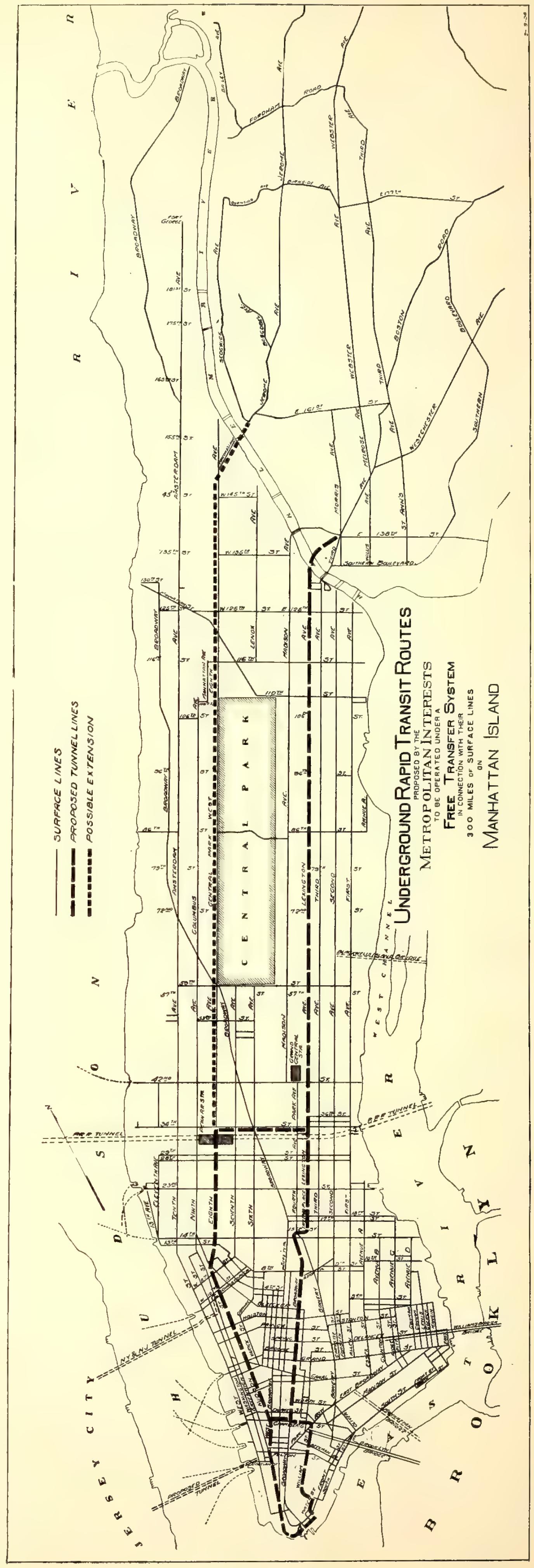
TRANSIT PROPOSALS TO NEW YORK COMMISSION

The session of the Rapid Transit Commission of New York, held on Friday, Feb. 26, was especially significant, because of the important proposals that were made for the extension and improvement of the city's transportation facilities. Three distinct and separate projects were outlined—the plan of the New York City Railway Company to build, at a cost of $40,000,000, a subway down Lexington Avenue, Broadway and William Street to the Battery, and returning under Eighth Avenue and Thirty-Fourth Street to a junction with the main line; Chief Engineer Parsons' plan for extending the Brooklyn branch of the subway from Flatbush and Atlantic Avenues, Brooklyn, through to the Willink entrance of Prospect Park, to facilitate the running of subway trains from The Bronx to the beaches without change of cars; Mayor McClellan's plan for a Williamsburg Bridge terminal at the Bowery and Delancey Street, to be built within eighteen months.

Of these plans the most important undoubtedly is that of the New York City Railway Company. The company proposes, if terms not too onerous can be secured, to build an underground road from the Battery, on the West Side, to Thirty-Second Street, and eventually, perhaps, beyond the Harlem; and, on the East Side, under Lexington Avenue north from Fifteenth Street and south from Fifteenth Street under Broadway, with connecting links under Thirty-Fourth and Chambers Streets, and an extension from Chambers Street under William Street to the Battery. There would thus be provided a belt line enclosing a large section of the lower part of the city, with east, central and west continuations where they are greatly needed. The chief attractions of this scheme are its provision of free transfers over the company's surface system. The plans have been submitted to a committee composed of President Orr, Controller Grout and Charles Stewart Smith, with instructions that a public hearing be ordered.

Mr. Parsons' plan, as previously outlined, provides for the extension of the Interborough Rapid Transit Company's line from the intersection of Atlantic and Flatbush Avenues, Brooklyn, the original Brooklyn terminus, under Flatbush Avenue to the Prospect Park Plaza. Mr. Parsons in his report, however, suggested that instead of ending there the Brooklyn tunnel should be extended to the Willink entrance of Prospect Park and beyond to Malbone Street, where connection could be made with the Brighton Beach and Coney Island railroad lines, providing an unbroken line of communication from the northern end of The Bronx to the seashore. The plan was referred to the committee previously delegated to consider the New York City Company's offer.

Mayor McClellan announced that trolley cars would be in operation across the Williamsburg Bridge before long.



MEETING OF THE EXECUTIVE COMMITTEE OF THE AMERICAN STREET RAILWAY ASSOCIATION

A meeting of the executive committee of the American Street Railway Association was held at the Waldorf-Astoria, New York, on Feb. 29 and March 1. There was a large attendance, the following members of the executive committee being present: Messrs. Ely, Foster, Grant, Shaw, Penington, Hutchins, Rogers and Smith.

One of the principal subjects discussed was, of course, that of the next meeting place of the Association, which, at the last meeting, was left open, subject to appointment by the executive committee. A number of cities were considered, and considerable progress was made in selecting a meeting place. No absolute decision was reached, however, at the meeting in New York. The decision of the committee in this respect and also as to the date of the meeting and the programme will be announced in these pages as soon as it is made public.

LONDON LETTER.

(From Our Regular Correspondent.)

One of the most novel schemes in the history of light railway enterprise in England is proposed to be carried out in the Forest of Dean, namely, construction of a three-rail track of line, 12 miles long, from Cinderford to Lydney on the Severn. The track constituting the middle and outer rails—a narrow-gage one—is to be used for passenger traffic and the two outside rails as a broad-gage line for mineral traffic. Owing to the high gradients from Cinderford to the Severn, no motive power, it is estimated by the engineers, will be needed to draw the trains, while it is proposed that the power necessary to make the return journey to Cinderford be obtained by utilizing the force of the tides of the Severn for the generation of electricity. The scheme has excited a good deal of interest in the Forest of Dean, and at a public meeting recently held it was decided to support it.

A storm of indignation has been raised in the district by the proposal of the London County Council to continue the present Hampstead Road tramway service which terminates at Euston Road along Tottenham Court Road as far as Oxford Street. The argument put forward by the tradesmen of the thoroughfare is that the tramway is unnecessary, that it would lead to "nowhere," and that at present the "tube" and omnibuses are sufficient for the needs of the locality. Statutory consent to the tramway has been given the London County Council by the St. Pancras Borough Council. When, however, the bill comes before Parliament it will be strongly opposed by the Holborn Borough Council, which declares that that portion of Tottenham Court Road which forms the boundary of their district is not sufficiently wide to admit of a double line of trams, and so, in spite of all efforts, London continues to be about the worst city in the world as far as electric transportation is concerned.

At a recent meeting of the Leicester Tramways Committee it was decided that Mr. T. Robert Smith, A. M., Inst. E. E., should be appointed resident electrical engineer to the new undertaking. The salary will be £250 a year, rising to £350.

The Walthamstow Urban Council has just placed the contracts for the construction of an electric tramway system, which, when completed, will connect the growing towns of Walthamstow, Tottenham and Leyton, besides establishing direct communication between Northeast London and Epping Forest. The contracts have been given two British firms—W. T. Henley's Telegraph Works Company, of Greenwich, for permanent way and overhead equipment; and F. Suter & Company, of London, for the dynamos, gas plant, etc.—the total of the two contracts being £96,611.

The proposal to connect Dundee more directly with the Highlands than by way of Perth has been more than once seriously considered, but has never got any further. It has now been brought up in view of the scheme for forming a water power electricity generating station in the Highlands. If this proposal is carried out an effort will likely be made to find a market for the current in Perth and Dundee. In that case it can either be brought to Dundee via Perth or direct from Stanley. It is considered that an electric railway could be worked along the route of the cable, and thus accomplish a project which has long been considered a very desirable part of the city's railway system.

The East London & Lower Thames Electric Power Company is promoting a bill of far-reaching importance. The bill, which provides for incorporation, will also empower the erection of generating stations and works, and the supply of electricity in an extensive area in the counties of London and Essex, including the metropolitan boroughs of Hackney, Bethnal Green, Stepney, Poplar, Deptford, Woolwich, Greenwich and Bermondsey; Ilford, Woodford, Wanstead, Leyton, Barking, Romford, East Ham and West Ham. The proposed capital of the company is £2,000,000, with borrowing powers.

The electrical "tubing" of London, which proceeds apace, is making an inevitable impression upon the suburban fares of the existing trunk lines. The District was the first to lead the way, other companies have followed, and now the Great Northern announces a general reduction of its ordinary suburban fares after Feb. 1. It is also inaugurating third-class season tickets between stations in the suburban districts and King's Cross and the City, with facilities for passengers to use the intervening Metropolitan stations without extra charge.

An important railway scheme will be promoted in this session of Parliament. The North Yorkshire Dales Railway Bill seeks power for the construction of a greater length of heavy electric railway, as distinguished from light railways or tramroads, than has ever been authorized in one scheme by the Legislature. The proposed line is to run from Hellifield to Scorton, and, according to the proposals, its ability to serve the Northern dales will be enhanced by the fact that junctions are proposed with the steam lines of the leading railway companies now running through the district. The railway will be no less than 51¼ miles in length and almost entirely double track, and will be provided with all the usual equipment in the way of stations, signaling, etc. The estimated cost of construction, including land, stations, bridges, earthworks, etc., but apart from electrical equipment, is £886,581, and the capital of the company to be incorporated by the bill is £960,000, besides borrowing powers to the amount of £450,000. The promoters of the scheme are Messrs. T. J. Harrison, J. W. Lodge, A. Lupton,, J. C. Winn and M. D. Wyvill.

The growth of tramways in the United Kingdom is shown by the following figures taken from the blue-book on the subject published recently:

	1878	1903.
Miles of lines open	269	1,772
Passengers carried	146,001,223	1,681,948,655
Capital expended	£4,207,350	£41,656,597

Under the draft provisional order which has been deposited at the Scottish office by the Glasgow & Southwestern Railway Company, power is sought to construct about 6 furlongs of new lines, and to widen about 4½ miles of their existing lines. Power is also sought to enable the company to "at any time work by electrical power the traffic on their railways or any part thereof, or any railways in connection therewith, now worked or used by them, or any railways hereafter to be constructed."

The London County Council has had under consideration for some time the tenders for the supply of four 300-kw. three-phase generators for its new Greenwich power house, to be coupled to the Musgrave engines recently ordered. It has now decided to give this contract to the Electric Construction Company, Limited, of London and Wolverhampton, for the sum of £29,600, though there were lower bidders. The design submitted by this firm is for a complete fly-wheel alternator, built up with steel plates, and is very suitable for high speeds, while the construction proposed is the safest known for withstanding centrifugal strains.

Mr. Henry W. Clothier, whose association with H. T. switchgear designs is well known, has resigned as manager of the estimating department of Ferranti, Limited, to take up the development of the business of Walker & Hodgetts, Limited, of Salford. Mr. Clothier joined Messrs. Ferranti, Limited, in 1894, and has the record of having designed the first oil-break switch put to commercial use in England. He was chief assistant to Mr. Ferranti in the design of switchgears, etc., to the end of 1890, when he was offered an appointment as commercial manager for the switch department. At the commencement of 1903 the management of Messrs. Ferranti, Limited, was reorganized, and he was appointed to the position he has recently given up. Walker & Hodgetts were initiated in the year 1898, and became a limited liability company in 1900. They are known as makers of C. C. dynamos and motors, their clientage hitherto being chiefly colliery companies, theaters, and other users of lighting and power installattions. They have made a specialty of electric haulage and mining machinery. Mr. Hodgetts will in future manage the works and attend to the design of motors and dynamos, in which class of work he has specialized for a number of years. It is now the intention of Walker & Hodgetts to promote the interest of the existing motor and dynamo section, and to inaugurate a special department for the manufacture of switchgears for use in central stations, collieries, etc.

London County Council will ask Parliament this session to sanction tramway extensions costing £1,729,845, including £657,300 for the widening of streets. The Highways Committee has recommended the Council to give statutory notice of an intention to compulsorily acquire the London Southern Tramways system. Some delay has been caused by the indecision of the Lambeth Borough Council. The Finance Committee, reporting upon the financial aspects of the purchase, state that the total capital outlay involved in this proposal is about £393,000 gross, or, after deducting the value of recoupment in connection with the street widenings, £385,000 net. These figures, however, include no part of the cost of the generating station for supplying electrical energy.

The Torquay Tramways Bill has passed the Standing Orders stage on the consent of the corporation being proved. The total length of tramways contemplated is just over 8 miles, at an estimated cost of £87,000. To start with, 5 miles of lines will be laid, viz., from Castle Circus to Tor railway station; from Castle Circus to the south pier, and from Castle Circus to St. Marychurch Townhall; and it is stipulated that these three lines shall be open for public traffic before the expiration of eighteen months from the passing of the Act, probably about next July.

A. C. S.

PARIS LETTER

(From Our Regular Correspondent.)

Affairs of the Metropolitan, as usual, continue to occupy a very great deal of public attention. At a recent sitting of the Municipal Commission appointed for watching the City interests in the Metropolitan schemes, and at which the State Council and the Prefect of Police of Paris were represented some few unimportant modifications were approved concerning the lines in operation and projected. The principal improvement is to give two entries and exits to all stations to be constructed and to transform several already finished, notably the Palais Royal Station, the most frequented of line No. 1.

Line No. 3 (Courcelles-Menilmontant) is completely finished beween the Avenue de Villiers and the Place Gambetta. The Metropolitan company, to whom the tunnel has been delivered, expects to inaugurate the line in July. The trains will consist of six cars, larger and better ventilated than existing cars on the lines now opened, and will be mounted on bogie trucks. The equipments will be furnished by the French Thomson-Houston Company, which has recently taken the order for 90 equipments. The six-car trains will each consist of 3 motor-cars and 3 trailers, and the equipments will be of the Type M, modified by having contractors and reversers mounted in the motorman's cabin instead of beneath the car; the cabin is constructed entirely of metal. At the present moment tests are being made with bogie trucks, of which the corners are rounded on account of sharp curves. The motor cars will measure about 11 meters in length over all.

The list of accidents on the Metropolitan is not yet closed. Small outbreaks of fire are pretty constant, but are immediately extinguished. The third rail, however, still gives trouble owing to defective insulation; no permanent insulators have yet been adopted to replace the defective ones, which have given rise to a number of short circuits and incipient outbreaks of fire.

The inquiry regarding the catastrophe of last August on the line No. 2 has just been closed, and responsibility is attached by the commission to the traction manager as well as the employees of the burned train.

In spite of the unfinished condition and the recent bad luck of the Metropolitan, it is growing in public favor, and its managers should feel encouraged in their progressive policy by the favorable figures reported. These latter have been remarkably good in January last, surpassing the then record (April, 1903) by frs. 34,840, and surpassing January, 1903, by frs. 419,000.

For the second 10 days in January, 1904, the company showed 3,202,724 passengers and frs. 556,382 receipts.

The corresponding figures for the Compagnie Generale des Omnibus show a decrease. On the other hand, the Compagnie Generale Parisienne des Tramways report an increase of frs. 18,000 for January, 1904, over January, 1903.

As regards now the departmental tramways and their operation in 1904, statistical data is available in the Journal Officiel, from which is abstracted the following: The tramway lines in the Seine Department, guaranteed by the State, show an increase in receipts equal to frs. 16 per share, a decrease in expenses of frs. 14 per share, giving a net profit equal to frs. 63 per share. As regards lines not guaranteed, the net product has increased by frs. 174 per share. The net increase per kilometer for tramways in this department is about frs. 163, and in other departments the average attains frs. 577 increase per kilometer.

The eastern suburbs of Paris have been deprived of their one means of transport and communication with Paris. This was due to the strike on the Est Parisien. Out of 1200 employees 1125 went on strike on Jan. 30. The strikers, as usual, prevented cars from running and the usual consequences of the strike occurred. The questions at issue concern the hours of work and have nothing to do with the wages. Formerly the cars ran 18 or 19 hours a day, and in consequence there was a day and night shift. A constant schedule was run. The company, in response to demands from the public, doubled the service at the rush hours morning and evening, and reduced the number of cars running in midday. This interfered with the usual habits of the men and broke their 9-hour day into two shifts, hence the reason for determining to go on strike.

The strike was referred to arbitration and a temporary peace was made. Higher wages were paid by the company for extra hours of service, and two monthly holidays were given instead of one. The company, moreover, agreed to introduce a system similar to the original arrangement. The strike caused immense inconvenience to the district served by this company, and even yet all questions are not settled, although service has been resumed in a general way.

IMPORTANT CHANGES IN AN INDIANA RAILWAY

The owners of the Fort Wayne Traction Company have voted to change the name of the company to the Fort Wayne & Wabash Traction Company, so as to include the interurbans running to Logansport and Lima, Ohio, which the company has recently acquired. George F. McCulloch, president of the Indiana Union Traction Company, has disposed of his interests in Fort Wayne and other northern Indiana lines, and the real heads of the traction lines in Fort Wayne and vicinity now are Messrs. Morgan, Jones, Taylor and Wanamaker, of Philadelphia; James Murdock, of Lafayette, and H. C. Paul and F. B. Flemming, of Fort Wayne. These capitalists own, besides the city lines in Fort Wayne, Wabash, Logansport and Lafayette, the Wabash & Logansport Interurban line, the Wabash River Traction line and the Rochester & Northern Traction line. The Fort Wayne & Wabash Traction Company will control all the large traction lines in Northern Indiana. Under the new arrangement lines will be extended and interurban service begun between Elkhart, St. Joseph, Fulton, Marshall and Kosciusko counties.

PROPOSED ELECTRIC RAILWAY BETWEEN PHILADELPHIA AND ATLANTIC CITY

The Delaware River & Atlantic Railroad Company, which was incorporated some years ago for the purpose of building an electric railway between Philadelphia and Atlantic City, has at last let the contract for building the road to the Delaware River & Atlantic Construction Company, and the work is to be completed by May 1, 1905. P. B. Shaw, owner of the controlling interest in a number of railway and lighting plants, is the president of the construction company, and Wilbur F. Sadler, Jr., of Trenton, N. J., is the general manager.

The railroad company has completed the purchase of a private right-of-way, 100 ft. wide, between the Delaware River, at Gloucester, and Florida and Atlantic Avenues, Atlantic City, and, according to present plans, four tracks will be laid, with 100-lb. rails. Owing to the abolition of all grade crossings, the amount of earth to be used in filling in will reach a total of more than 2,840,000 cubic yards, and there will be 60 bridges, costing over $500,000 for the structural work alone.

The main power house will be located at Gloucester City, on account of the low price of coal at tidewater, and the power will be distributed to half a dozen or more sub-stations along the 52 miles of road. The plans provide for turbine engines aggregating 25,000 hp, and there will be sufficient room to accommodate twice this amount of equipment. The method of feeding the current to the cars has not been definitely determined.

On the Philadelphia end of the line most elaborate preparations have been made for the handling of the passenger traffic. Some time ago the Delaware River & Atlantic Railroad Company purchased the land on Delaware Avenue, between Market and Chestnut Streets, adjoining the ferry houses of the Pennsylvania and Philadelphia & Reading Railway Companies. The Gloucester Ferry Company's six boats, franchises, stocks, bonds and real estate have also been purchased by the Delaware River & Atlantic Railroad Company. Additional ferry-boats of the double-deck type, patterned after the Pennsylvania Railroad Company's West Twenty-Third Street, New York, boats, will be purchased. The Ferry Company owns a terminal at South Street, Philadelphia, and an 850-foot frontage at Gloucester City.

The cars will be of the Pullman type, equipped with four 250-hp motors, and will be capable of attaining a maximum speed of 100 m. p. h. As there will be no grade in excess of 1 per cent, and no curve in excess of 1 degree, excepting at terminals, it will be possible to maintain a speed of about 75 m. p. h. It is stated by one of the officials that the time will be 1 hour from Philadelphia to Atlantic City, or vice-versa, including the ferry trip. The fare will be $1 instead of the $1.75 charged by the steam railroads; tickets will be unlimited, and cars or trains will be run every 15 minutes from 6 a. m. to 12 midnight, daily. The road will also haul freight, express and mail. All the principal trains, passenger and freight, will be run through the 52 miles without a stop.

The field for business is a peculiar one. The Philadelphia & Reading and Pennsylvania Railroads, according to their reports, carried 18,600,000 passengers between Camden and Atlantic City last year, and were even then unable to handle all the excursion business offered. There have been more than 300,000 visitors in Atlantic City on a single Sunday.

The Delaware River & Atlantic Railroad Company is understood to have expended about $3,000,000 in purchasing the ferry business, rights of way, etc., including the $104,000 paid to the State of New Jersey for the charter.

NEW REPAIR HOUSE

The Dittrick & Jordan Electric Company, of Cleveland, has been incorporated by the members of the firm of Dittrick & Jordan, that city, who for the past two years have been doing general electric railway repair work. Until a short time ago the company had been doing business on a small scale, but lately it has been found necessary considerably to increase the factory space and equipment to take care of the growing business. Mr. Dittrick, who is in active charge of the company's shop, was for a number of years in charge of electrical repair work at the shops of the Cleveland City Railway Company, where he gained a wide, practical knowledge of the requirements for high-class repair work. Mr. Jordan has had wide experience as an operating man, having formerly been division superintendent of the Detroit United Railway and later superintendent of the Cleveland, Painesville & Eastern Railway. The company's shop is well equipped, and it is the intention to carry a large stock of repair parts on hand for immediate shipment. The company was probably the first in the country to use micanite coils for armatures, and the success of this innovation is well known. In selling coils the company makes a practice of soaking them just before shipment. For facilitating prompt deliveries on Western work the company has established a branch shop at Leavenworth Kan., where a full line of coils will also be carried. The company numbers among its regular patrons some of the foremost interurban and city roads.

DISCLOSURES MADE AT THE TRIAL OF THE PHILADELPHIA ACCIDENT FAKIR

The trial in Philadelphia, a few days ago, of Frederick Seymour, alias Francis Irving and John Harte, whose arrest as the result of a bogus accident claim against the Philadelphia Rapid Transit Company was noted in the Street Railway Journal of Feb. 13, brought to light a swindling scheme said to involve sixteen persons, four of whom are physicians. Besides the alias Harte, Seymour appears to have been known at one time or another as J. J. Galbraith, J. Samuel Gordon, Edward Williams and Edward J. Tooney, and under all of these names, with the assistance of his accomplices, brought action for damages against public service companies in four different States. This he confessed when arraigned in court, but gave the name of only one of his confederates in crime. It is said that the other persons who operated with him are known to the Rapid Transit Company, and that they will be arrested very soon.

In the swindle against the Philadelphia Company Seymour was assisted by one Beatrice Graham, said to be a chorus girl playing in New York. The actress, who had been passing as Seymour's wife for three years, said she had been injured while a passenger on a trolley car in Philadelphia. Her claim against the company was for $5000. Seymour says that about a month ago he read an account of an accident at Ninth Street and Girard Avenue, Philadelphia, and that he then arranged with Miss Graham to say that she had been a passenger and had been injured. She went to bed at New York City and a claim for damages for personal injury was then presented. In court Seymour admitted that the woman was not in Philadelphia on the day of the accident. On Nov. 8, 1903, Seymour himself, under that name, was at the Bingham House, Philadelphia, and put in a claim for injuries said to have been received while attempting to board a Chestnut Street car at Twentieth Street. On Jan. 14, as J. Samuel Gordon, stopping at Green's, he attempted to board a car at Nineteenth and Chestnut Streets, and was thrown down. It is said that the conductor of this car recognized Gordon as Seymour and reported the case to the company.

Seymour, together with other members of the gang, so successfully worked a fake against the Public Service Corporation of New Jeresy that they secured $65 in payment of a claim against that company. Later, however, the discovery was made by the company that it had been swindled. An investigation followed, and Daniel, one of the members of the gang, confessed. It seems that this same Daniel, in January, collected $100 from the Brooklyn-New York Ferry Company for reputed injuries to his wife in a ferry-boat collision. It was also admitted by Seymour on the stand that he, under the name of J. J. Galbraith, presented a claim against the Fair Haven & Westville Company, of New Haven, Conn.

Judge Wiltbank, before whom Seymour was tried, sentenced the offender to two years in the Eastern Penitentiary.

PHYSICAL TESTS BY THE BROOKLYN COMPANY

The Brooklyn Rapid Transit Company is subjecting all its motormen to a rigid physical examination. About thirty men are being called daily by the company to pass muster before its physicians. A thorough test is made of the men's eyesight, while an examination is also made of the general physical condition. Every motorman is thoroughly examined before he is engaged by the company, but some of the men have now been in the service for over fifteen years. It is to insure itself that these men are equally as capable now as when first assigned to duty that the tests are being made. Last summer the company conducted a series of eyesight tests. Of a hundred men who were inspected at that time only one failed to pass. There are at present about 400 motormen on the elevated system and 1700 on the surface lines. In summer there are perhaps 2500 in all, as the company takes on several hundred extra men at that time.

CONTRACT FOR SECOND CRAWFORDSVILLE-INDIANAPOLIS LINE

A contract has just been signed by the Consolidated Traction Company, of Indianapolis, Ind., with Westinghouse, Church, Kerr & Company, to construct and install completely the electric and mechanical equipment for the Consolidated Company's road between Indianapolis and Crawfordsville. The engineering work is to begin as soon as the weather permits, and the work of building the power house at Crawfordsville is to begin about the middle of next month.

The traction company has been working for about eight months on the grading, culverts, bridges and fences along its way, and this work is practically completed. It has not yet been decided whether the overhead or the third-rail system will be adopted, but the conditions are almost ideal for the use of the third-rail system, as the way is practically a straight line from Indianapolis to Crawfordsville, with only slight grades at any points, with a private right-of-way the entire distance and with only sixty-two road crossings in its 43 miles, outside of this city's limits. The only railroad crossing is at New Ross.

The work of building the road will be pushed as rapidly as possible, and it is thought that it will be completed this year. The principal towns through which the road will pass are Clermont, Brownsburg, Pittsboro, Lizton, Raintown, Jamestown, New Ross and Limmsburg. The road will begin with an hourly passenger service, and it is the intention to pay considerable attention to the freight business.

THE NEW POWER PLANT OF THE EVERETT RAILWAY & ELECTRIC COMPANY

Material is being shipped to Lake Isabel, 32 miles east of Everett, Wash., for the early beginning of work on what is known as the May creek power plant, by the Everett Railway & Electric Company. The plant is designed to furnish 15,000 hp, to be carried to Everett for street railway, lighting and power purposes, and the plant will be unique in that the head of water will be the greatest in the United States.

The intake for the 32-in. steel pipe will be 30 ft. below the surface of Lake Isabel. The pipe will be carried 12,000 ft., with a fall in that distance of 2500 ft. The total distance will be shortened by 4000 ft. if the company determines to tunnel a granite hill lying between the lake and site for the power house.

Owing to the enormous pressure special steel pipe has been ordered. Toward the nozzle the pipe decreases in diameter to 20 in. The diameter of the nozzle itself will be about five-eighths of an inch. A wheel of the Pelton type will be used. Later, when additional power is needed, another stream and wheel will be installed. The pressure on the steel pipe is 1100 lbs. to the sq. in., and the speed of the water leaving the nozzle is 25,000 ft. per minute.

The cost of the plant will be about $600,000, and it will take the place of a fine steam plant built two years ago. The outlet of Lake Isabel will be dammed, thus storing enough water for a six months' run. This is in a precautionary measure. May Creek is not large, but is a tumbling mountain stream flowing into the lake, and is never dry.

The company is now building roads to the lake, which is a little more than a mile from the Great Northern tracks. The country is so rough that a roundabout route must be taken.

ST. LOUIS COMPANY'S LOAN

It is reported in financial circles that the loan desired by the St. Louis Transit Company has been secured. It is stated that this has been done by either selling or giving as collateral $8,000,000 of the $20,000,000 issue of improvement bonds authorized at the last meeting of the stockholders. These bonds have not been sold up to this time.

Murray Carleton, president of the company, said that the negotiations for securing the loan were progressing favorably, but had not yet been closed. The money is wanted to discharge obligations resulting from the large amount of work made necessary by the Fair, and to meet large payments which come due March 15.

A large force is at work building the World's Fair terminals, and General Manager du Pont says that the work will be pushed to an early completion. Some grading and excavation have been done, but now is the first time that a large force could be profitably employed. The ground has thawed enough to permit active work, and on some of the prepared ground tracks have already been laid. Mr. du Pont is confident that the terminals will furnish all the facilities required and that they will be in readiness for the first crowds.

THE CONNECTICUT RAILWAY AND LIGHTING COMPANY SECURES POWER FROM THE NEW MILFORD COMPANY

The Connecticut Railway & Lighting Company has entered into a 30-year contract with the New Milford Power Company for power for its trolley systems, electric light and power business in Waterbury and New Britain. This contract calls for a minimum payment to the New Milford Power Company, when the plants are completed, of $129,600 per year. These payments are to be graduated during the first eighteen months in the following manner: Minimum payment for the first six months to be not less than $37,240; for the second six months, $46,480; for the third six months, $55,720, and thereafter during the entire term of thirty years the sum of $129,600 per year.

The New Milford Company, operating under a special charter granted by the Legislature of Connecticut in 1893, has acquired and is the owner of the valuable water powers at Bulls Bridge, Gaylordsville and Boardman's Bridge, Conn., on the Housatonic River, and the lands necessary for its use along the river on both sides, for a distance of about 10 miles. It has constructed a dam of solid concrete masonry at Bull's Bridge, on rock foundation, and built a canal over 11,000 ft. in length, giving a fall from the terminus of the canal of 115 ft. A power house has been constructed entirely of masonry and steel, and there are six hydraulic machines and six generators installed and in operation. The capacity of the plant, as rated at the wheels, is 10,500 hp, which power is being delivered at Waterbury for the trolley systems.

This means that the plant already installed has capacity to supply the amount required for the third period or at the rate of $111,000 per year. Plans are now being matured to construct an auxiliary plant at Boardman's Bridge, and also to enlarge the present development by making use of part of the surplus water. The canal has been constructed with sufficient capacity to carry 50 per cent additional water.

SUPREME COURT DECIDES IN FAVOR OF JERSEY CITY

The Supreme Court has just given judgment on demurrer to Jersey City against the Jersey City & Bergen Railroad Company, the Consolidated Traction Company and the North Jersey Street Railway Company and the Bergen Company, lessee, being all the street railway companies using the streets of Jersey City. The suit of the city was to compel the Public Service Corporation, which controls the companies, to pay a license of $10 per car to the city. At the time of the granting of authority to use the streets, the city of Jersey City did so upon condition that the company pay an annual license fee of $10 per car. The companies accepted the condition and then an ordinance containing the license clause was passed, but as soon as the road had been installed the Supreme Court set aside the ordinance. The court holds that the company is bound by its contract with the city. The license fee of $10 per car has not been paid since 1868. The fees now amount to many thousands of dollars long past due, and the companies will be compelled to pay $10 upon each car annually in future.

ANNUAL REPORT OF LOUISVILLE COMPANY

The annual meeting of the Louisville Railway Company was held a few days ago. Directors were re-elected and the operating report for the year just ended was presented. This report shows as follows:

Gross earnings		$1,941,599
Operating expenses	$1,050,125	
Taxes for year	150,000	
Interest on debt and dividend on preferred stock	482,785	
Depreciation on equipment	50,000	
Set aside on account of judgment for back taxes	30,000	1,762,911
Net earnings		$178,688
From which deduct dividend on common stock of 5 per cent		175,000
Net balance		$3,688

For the purpose of comparison the summarized reports of 1903 and 1902 are appended:

	1903	1902
Gross earnings	$1,941,599	$1,771,887
Operating expenses	1,050,125	1,127,716
Net earnings	$891,474	$644,171
Fixed charges	712,786	333,880
Net income	$178,688	$310,291
Dividends	175,000	300,000
Surplus	$3,688	$10,291

PROPOSED NEW POWER STATION FOR NEW ORLEANS

The construction of a new power house station for the New Orleans (La.) Railways Company is proposed. The ultimate capacity of the proposed plant will be 20,000 hp. An equipment capable of developing 7000 hp is to be installed, in the first instance. Sanderson & Porter, 52 William Street, New York, are the consulting engineers for the New Orleans company.

DETAILS OF NEW YORK BRIDGE PLANS

With the approval of Mayor McClellan to the general features of the plan, Bridge Commissioner Best, on Saturday, Feb. 27, made public the details of the proposition framed by Chief Engineer O. F. Nicholls to connect the Brooklyn and Williamsburg Bridges. It involves the erection of an elevated road from Worth and Centre Streets, where the proposed Brooklyn Bridge terminal would end, to run to the Bowery and Delancey Street, at which point it would connect with the proposed elevated road terminal from the Williamsburg Bride. This connection, it is estimated, would cost $2,000,000 for the land, and about $1,000,000 for the construction of the elevated connection.

The proposed extension of the Williamsburg Bridge elevated structure will run over the widened Delancey Street to the Bowery, and there, by having the structure high enough to cross over the Third Avenue elevated tracks, the connection with the road running from the Brooklyn Bridge could be effected. It is proposed to have a large station at the Bowery and running two blocks west toward Mott Street.

The Williamsburg Bridge extension is figured to cost about $8,000,000, including the widening of the street, to which the city will take title May 1. The Brooklyn Bridge terminal, proposed to relieve the bridge crush, will cost $6,000,000, including the terminal building from the bridge to Duane Street, with a three-story office building on top, bringing the total height to a level with the Hall of Records. The switch yards would run to Worth Street, where the connecting railroad would meet it.

MEXICO CITY SYSTEM TO BE EXTENDED

The Mexico Electric Tramways, Limited (known as the Wernher-Beit system), proposes to considerably extend its lines in Mexico City, which are now including those running in the suburbs, some 120 miles in length. The company has filed an application with the Department of Public Communications for authorization to build a line from Nino Perdico, on the south, to Los Angeles on the north side, thus forming a complete circuit across the city.

REORGANIZATION TALK IN CHICAGO

In connection with the retirement of R. R. Govin from the receivership of the Chicago Union Traction Company, Mr. Govin announced that persons controlling the Chicago Union Traction Company, who also have large stock interests in the North Chicago and West Chicago Street Railroad Companies, had concluded to take steps to bring about the reorganization of the Chicago Union Traction system. As many of those interested are desirous that Mr. Govin should represent them, and as his duties and obligations as receiver might hamper him, it seemed wise to him that he should ask the court to relieve him from the position as receiver. Mr. Govin says that any scheme of reorganization, in a measure, rests upon the litigation now in the courts The hearing of the ninety-nine-year case is now being held.

MORE NEW CARS FOR KANSAS CITY

The Metropolitan Street Railway Company, of Kansas City, Mo., has ordered thirty-five more new cars of the St. Louis Car Company. These cars are to be similar to the standard cars of that company, described in the STREET RAILWAY JOURNAL of June 27, 1903, except that they will be mounted on St. Louis No. 47 short wheel-base trucks, instead of the Brill trucks mentioned in that article.

THE McGUIRE-CUMMINGS MANUFACTURING COMPANY

The McGuire-Cummings Manufacturing Company, of Chicago, has recently been organized to take over the business of the McGuire Manufacturing Company. This reorganization is practically a consolidation of the McGuire Manufacturing Company and the Globe Iron Works, both of Chicago. The Cummings mentioned in the new company's title is John J. Cummings, president of the Globe Iron Works.

The Globe Iron Works has a factory located on the north side, Chicago, where it makes a number of iron specialties. The consolidation will add to the manufacturing facilities of these companies.

PERSONAL MENTION

Mr. C. A. SEARS has resigned as electrician of the Puget Sound Electric Railway, of Tacoma, Wash., and Mr. R. J. McClellan has been appointed as his successor.

MR. JAMES A. GREER, for several years connected with the Weber Rail Joint Company, of New York, has recently been advanced to the position of assistant general manager of the company.

MR. A. C. HARRINGTON, formerly manager, purchasing agent and superintendent of the Erie Rapid Transit Street Railway Company, of Erie, Pa., has been appointed superintendent of the Columbus, London & Springfield Railway Company, of Columbus, Ohio.

MRS. W. F. KELLY, wife of W. F. Kelly, general manager of the Oakland Transit Consolidated Railway Company, and the San Francisco, Oakland & San Jose Railroad Company, died at her home in Oakland, Cal., on Feb. 14. Mr. Kelly, who is widely known throughout the country among street railway men and an eleven-year-old son survive her.

MR. CHARLES THRASHER, who has been elected vice-president and general manager of the New York & Long Island Traction Company, is an extremely young man for such an important position. He received his training on the Mandelbaum roads in Ohio, having been auditor of the Western Ohio Railway, and later of the Cincinnati, Dayton & Toledo Traction Company. He was sent to the Long Island road last year, and has been in charge of the operation of the road since that time.

THAT the late Senator Hanna was extremely popular with all the officials and department heads of the street railway companies with which he was connected is attested by the kindly resolution of sympathy drawn by the employees of the Cleveland Electric Railway, and the tribute made to the Senator's memory by Mr. George Mulhearn, for thirty-one years general superintendent of the Cleveland City Railway Company, of which Mr. Hanna was president. Mr. Mulhearn said: "I have lost my best friend. In all the years that I knew Mr. Hanna I never heard a harsh word pass his lips, nor an appeal for help refused. His men always turned to him in trouble, and he was never too busy to listen to their grievances and to right their wrongs. * * * He was one of the most consistent friends of labor in America, and workingmen were just beginning to realize it at the time of his death.

MR. CHARLES T. CHAPIN, for many years the president of the Rochester Car Wheel Works of Rochester, N. Y., which position he filled with conspicuous ability, has been elected vice-president of the National Car Wheel Company, which is a consolidation of four important plants, viz: The Rochester Car Wheel Company, Rochester, N. Y.; Keystone Car Wheel Company, Pittsburg, Pa.; Maher Wheel & Foundry Company, Cleveland, Ohio, and the Cayuta Wheel & Foundry Company, Cayuta, Pa. The list of officers for the new company are as follows: C. V. Slocum, president, Pittsburg, Pa.; Charles T. Chapin, vice-president, Rochester, N. Y.; C. A. Maher, secretary, Cleveland, Ohio, and William T. Goodnow, treasurer, Cayuta, Pa.

MR. C. D. BALDWIN has recently been appointed purchasing agent of the United Railroads, of San Francisco, to succeed Mr. A. K. Stevens, who has been made claim agent of the company. the former claim agent, Mr. E. E. Gates, having resigned to take up private law practice. Mr. Baldwin formerly was purchasing agent for the Jersey City, Hoboken & Paterson Railway Company, and more recently held a similar position with the Public Service Corporation, of New Jersey, at Newark, N. J. Another change in the personnel of the United Railroads is the appointment of Mr. H. H. Lynch, formerly superintendent of construction and road engineer, as consulting engineer of the company. Mr. Warren C. Lane has been made engineer of maintenance of way, assuming Mr. Lynch's duties, the title of superintendent of construction being abolished.

MR. GEORGE A. STANLEY, of Cleveland, who, as previously noted in the STREET RAILWAY JOURNAL, has been elected president of the New York & Long Island Traction Company, is prominently identified with the Andrews-Stanley interests, which control the Cleveland Electric Railway, the Utica & Mohawk Valley Railway and the New York & Long Island Traction Company. Mr. Stanley is purchasing agent for the Cleveland Electric Railway Company, and has had a wide experience in electric railroading. The New York & Long Island Traction Company has about 22 miles of road in operation, and has secured all the franchises necessary for building an 18-mile extension. Its lines will connect with the Kings County elevated line of the Brooklyn Rapid Transit Company at the city line in Brooklyn, and with the surface lines of the Brooklyn company at Jamaica, thus giving ready access to Brooklyn and New York.


G. A. STANLEY

MR. WILL H. BLOSS, heretofore chief engineer and roadmaster of the Indiana Union Traction Company, has resigned and accepted a position with the Paige Iron Works, of Chicago, which is the switch and crossing department of the Buda Foundry & Manufacturing Company. Mr. Bloss will represent the Paige Iron Works, traveling from the Chicago office, and will give especial attention to the increasing of the urban and interurban work of this company. His connection with the Indiana Union Traction Company covers a period of five years, starting in when the line was being built between Anderson and Indianapolis. Mr. Bloss will look after the outside matters heretofore cared for by Mr. E. S. Netherout, chief engineer of the Paige Iron Works. Mr. Netherout, who has been with the company for over twelve years, will spend most of his time directing the sales from the Chicago office and looking after the engineering of the company.

MR. W. A. McGUIRE, president and general manager of the McGuire Manufacturing Company, died in Chicago, Feb. 20. Mr. McGuire was one of the most prominent and successful manufacturers of street railway apparatus in this country, and was personally the patentee of a great many of the appliances which he manufactured. He was a resident of Chicago, but also had large manufacturing interests in England where the McGuire apparatus was almost, if not quite, as well known as in this country. Mr. McGuire was very successful in his enterprises and might have retired a number of years ago but for the great personal interest and pride which he took in the companies which bore his name. He had recently, however, decided to retire from active business, and only last week disposed of his interests in the McGuire Manufacturing Company to several gentlemen, prominent among whom is Mr. W. J. Cooke, who for a long time has been vice-president of the company, and who has always had charge of its selling interests.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Including all lines operated.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co.	1 m., Jan. '04	59,607	37,098	22,509	22,467	43
	1 " " '03	58,787	34,843	23,944	20,966	2,978
ALBANY, N. Y. United Traction Co.	3 m., Dec. '03	418,140	288,013	130,127	76,147	53,979
	3 " " '02	398,667	262,482	136,185	71,672	64,512
AURORA, ILL. Elgin, Aurora & Southern Traction Co.	1 m., Jan. '04	34,694	22,309	12,385	9,256	3,129
	1 " " '03	33,254	21,301	11,953	9,216	2,736
	7 " " '04	276,955	162,339	114,616	64,374	50,242
	7 " " '03	257,131	147,012	110,120	63,514	46,606
BALTIMORE, MD. United Railway & Electric Co.	12 m., Dec. '03	5,571,003	2,554,241	3,016,762	2,708,030	308,732
	12 " " '02	5,094,680	2,252,133	2,842,547	2,637,115	205,432
BINGHAMTON, N. Y. Binghamton Ry. Co.	1 m., Jan. '04	16,764	10,812	5,952	......	......
	1 " " '03	16,417	11,586	4,831	......	......
	7 " " '04	144,951	75,003	69,949	......	......
	7 " " '03	133,035	75,052	57,983	......	......
BUFFALO, N. Y. International Trac. Co.	1 m., Dec. '03	325,464	190,072	135,392	134,365	1,027
	1 " " '02	309,871	169,957	139,914	132,822	7,092
	6 " " '03	2,174,765	1,164,777	1,009,988	796,444	213,543
	6 " " '02	1,923,689	999,654	924,035	774,555	149,480
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., Jan. '04	18,987	10,812	8,175	......	......
	1 " " '03	12,035	6,571	5,465	......	......
Metropolitan West Side Elevated R. R. Co.	1 m., Jan. '04	174,240	......	......	......	......
	1 " " '03	174,795	......	......	......	......
South Side Elevated R. R. Co.	1 m., Jan. '04	135,781	......	......	......	......
	1 " " '03	134,287	......	......	......	......
CINCINNATI, O. Cincinnati, Newport & Covington Light & Traction Co.	1 m., Dec. '03	108,419	* 59,488	48,932	21,413	27,518
	1 " " '02	100,587	* 53,950	46,638	23,886	22,752
	12 " " '03	1,224,352	*700,962	523,390	252,760	270,630
	12 " " '02	1,103,995	*610,445	493,551	255,873	237,677
CLEVELAND, O. Cleveland & Southwestern Traction Co.	1 m., Jan. '04	27,852	22,557	5,294	......	......
	1 " " '03	26,949	19,615	7,334	......	......
Cleveland, Painesville & Eastern R. R. Co.	1 m., Jan. '04	11,740	9,024	2,716	......	......
	1 " " '03	12,158	7,971	4,187	......	......
DETROIT, MICH.	1 m., Jan. '04	311,440	226,103	85,337	88,067	† 2,730
	1 " " '03	321,145	195,938	125,207	81,156	44,051
FORT WORTH, TEX. Northern Texas Traction Co.	1 m., Jan. '04	37,880	25,468	12,412	9,583	2,828
	1 " " '03	29,950	16,313	13,637	8,933	4,704
	12 " Dec. '03	465,394	261,357	204,037	111,371	92,667
	12 " " 02	269,116	123,682	145,433	5,852	139,582
HANCOCK, MICH. Houghton County St. Ry. Co.	1 m., Dec. '03	13,756	12,008	1,748	2,697	†949
	1 " " '02	13,800	11,105	2,695	2,604	91
	12 " " '03	189,404	122,840	66,564	34,933	31,631
	12 " " '02	170,710	112,412	58,297	31,250	27,047
HARRISBURG, PA. Central Pennsylvania Traction Co.	1 m., Jan. '04	36,158	37,221	†1,063	......	......
	1 " " '03	38,352	26,414	11,938	......	......
HAZLETON, PA. Lehigh Traction Co.	1 m., Jan. '04	10,017	7,798	249	......	......
	1 " " '03	9,674	9,323	351	......	......
HOUSTON, TEX. Houston Electric Co.	1 m., Dec. '03	29,707	24,956	4,752	8,109	†3,358
	1 " " '02	30,418	24,973	5,444	6,250	† 806
	12 " " '03	416,124	272,564	143,559	84,657	58,903
	12 " " '02	360,018	210,772	149,246	......	......
JACKSONVILLE, FLA. Jacksonville Electric Co.	1 m., Dec. '03	21,424	15,606	5,818	3,170	2,648
	1 " " '02	18,115	12,650	5,466	2,917	2,549
	12 " " '03	248,650	165,942	82,707	36,403	46,304
LIMA, O. Western Ohio Traction Co.	1 m., Jan. '04	14,154	8,850	5,304	......	......
	7 " " '03	142,374	70,240	72,134	......	......
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Jan. '04	259,413	139,552	119,862	74,719	45,143
	1 " " '03	244,469	129,402	115,067	71,098	43,969
MINNEAPOLIS, MINN. Twin City Rapid Transit Co.	1 m., Jan. '04	331,412	156,502	175,911	70,019	104,891
	1 " " '03	311,838	148,575	163,263	60,900	102,862
MONTREAL, QUE. Montreal St. Ry. Co.	1 m., Jan. '04	183,708	131,487	52,221	16,482	35,739
	1 " " '03	172,143	110,611	61,532	18,516	45,016
	4 " " '04	769,136	486,837	282,299	68,848	213,451
	4 " " '03	703,788	424,576	279,213	65,990	213,222
MUNCIE, IND. Muncie, Hartford & Ft. Wayne Ry. Co.	1 m., Jan. '04	11,569	6,387	5,182	......	......
	2 " " '04	24,307	11,780	12,527	......	......
NEW YORK. Interborough Rapid Transit Co.	3 m., Dec. '03	3,743,308	1,396,395	2,346,913	1,596,579	750,334
	9 " " '03	10,124,323	4,006,105	6,118,218	2,949,617	3,168,601
New York City Ry. Co. *a*	6 m., Dec. '03	11,864,837	5,777,619	6,087,218	6,028,133	59,085
	6 " " '02	11,595,620	5,826,173	5,769,447	5,840,106	†70,659
PEEKSKILL, N. Y. Peekskill Lighting & R. R. Co.	1 m., Jan. '04	8,643	5,735	2,908	......	......
	1 " " '03	8,015	5,472	2,543	......	......
PHILADELPHIA, PA. American Railways	1 m., Jan. '04	99,624	......	......	......	......
	1 " " '03	89,978	......	......	......	......
	7 " " '04	852,220	......	......	......	......
	7 " " '03	729,905	......	......	......	......
ROCHESTER, N. Y. Rochester Ry. Co.	1 m., Jan. '04	113,454	70,865	42,589	26,125	16,464
	1 " " '03	101,912	54,520	47,392	25,586	21,806
ST. LOUIS, MO. St. Louis Transit Co.	1 m., Jan. '04	565,098	......	......	......	......
	1 " " '03	527,870	......	......	......	......
SAO PAULO, BRAZIL. Sao Paulo Tramway, Light & Power Co., Ltd.	1 m., Jan. '04	120,000	36,000	84,000	......	......
	1 " " '03	102,587	32,019	70,568	......	......
SYRACUSE, N. Y. Syracuse Rapid Transit Co.	1 m., Dec. '03	73,649	43,067	30,582	20,245	10,337
	1 " " '02	67,405	36,804	30,600	19,025	11,575
	6 " " '03	424,644	239,156	185,488	121,705	63,782
	6 " " '02	371,733	203,067	168,666	114,150	54,516
TERRE HAUTE, IND. Terre Haute Elec. Co.	1 m., Dec. '03	45,524	34,405	11,119	9,480	1,639
	1 " " '02	35,378	27,684	7,693	6,414	1,279
	12 " " '03	474,250	312,084	162,167	87,385	74,782
	12 " " '02	327,957	265,355	62,602	76,165	†13,563
TOLEDO, O. Toledo, Bowling Green & Southern Traction Co.	1 m., Jan. '04	19,747	15,379	4,368	......	......
	1 " " '03	20,791	13,845	6,946	......	......
Toledo Rys. & Lt. Co.	1 m., Jan. '04	137,517	73,806	63,711	41,312	22,399
	1 " " '03	125,494	62,396	63,097	39,458	23,639

INDIAN ...

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, MARCH 12, 1904. No. 11.

PUBLISHED EVERY SATURDAY BY THE
McGRAW PUBLISHING COMPANY

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.
BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION
In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues).............................. $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

The Ninety-Nine Year Case at Chicago

At last, after many years of negotiations and attempts at compromise, the famous case, involving the rights of the Chicago street railway companies on certain important streets, was last week heard in court in Chicago, able attorneys appearing to represent both the city and the companies, as noted elsewhere in this issue. This whole case hinges on whether, by an act of legislature, passed in 1865, the franchises, as well as the charters of the existing street railway companies in Chicago, were extended ninety-nine years. That this act of legislature extended the charters, and therefore the corporate life of certain of the Chicago street railway companies in existence at that time, is admitted by all parties to the controversy. The uncertainty lies in whether the act is to be interpreted as also extending the franchises of the companies at the same time and to the same extent as the charters were extended.

The contention of the city, as already outlined in these columns, is that the act was not so intended, and if it was so intended that part of it would be unconstitutional. The city's position is that the Ninety-Nine-Year Act extended the corporate life of the companies, and therefore authorized the city to grant them franchises during their corporate lives, but that the power of granting specific franchises was still left with the city. As to what the act really meant it is not for us to assume the role of a court of law and decide. Stripped of all confusing details, however, the question to be decided is as above outlined, and is comparatively simple. That the language of the act is somewhat ambiguous goes without saying. Otherwise there would be no controversy over it.

Trolleys

The standard American trolley wheel has come into such general use on this side of the Atlantic that considerable interest attaches to the new form with which the cars of the Key route in Oakland are equipped, and which was recently described in these columns. As cars were to be operated in multiple-unit trains, and as a third rail was out of the question, it is not strange that the builders of this road cast about for something which would be more satisfactory for multiple-unit operation than the regular trolley wheel, with its disadvantages in the way of possibilities of leaving the wire and damaging both overhead line and trolley pole. The trolley adopted at Oakland consists of a long cylinder with bearings at each end. It involves some slight changes in regular overhead line work, in order that the ends of the cylinder (the cylinder being, of course, at right angles to the trolley wire) may not hit the span wire. It will be interesting to learn the performance of this new trolley and the wear of trolleys and trolley wire as compared to the standard trolley wheel and wire. It will not be surprising if the trolley wire wear is much less than with the regular grooved trolley wheel. It is well known that the principal wear on a trolley wire is due to the flanges of the trolley wheel, reducing it to a V-shape. So convinced was the management of a large city system a few years ago that an unnecessary amount of trolley-wire wear is caused by this milling or grinding action of the trolley wheel flanges, that an appropriation of several thousand dollars was set aside to make a thorough test on one of the company's lines with trolleys without flanged wheels, either of the European bow form or some rolling contact form like that now used at Oakland, and on the Valtelina single-phase road in Europe. Owing to the death of the president of the company and a complete change in the management, the experiments were never carried out, and it has been left for later generations to determine whether, after all, the standard American trolley wheel gives the best results for the money expended.

Our own opinion is that the trolley wheel, when properly designed for the shape of the wire under which it is to run, has far greater capabilities that those with which it is usually credited. Abstractly considered, the area of contact between the wheel and wire is so small that great difficulty should be encountered in attempting to pass a heavy current from one to the other. Practically, however, no serious troubles have arisen from the frequent, though not continuous, conduction of several hundred amperes in interurban service through one trolley wheel to the motors.

The advent of the single-phase alternating-current motor, which will make it desirable to retain the overhead trolley wire

for heavy and high-speed work, where, otherwise, a third rail would have been used, makes a thorough investigation of the best form of trolley a matter of much importance just at the present time. The standard American trolley wheel has done such a service under all kinds of extremely trying conditions, and has proved itself so well adapted to the work that the burden of proof "lies with the other fellow." It does not necessarily follow, however, that the standard trolley wheel is the best thing that can be devised for taking current at high speed from an overhead trolley wire.

Improving the Service

Perhaps the prosperity of an electric railway company depends more upon the quality of its service than upon any other single factor. The roadbed, track, rolling stock and electrical equipment may be representative of the most expensive practice in the art, but these count for little in the public esteem if the service, as a whole, is not first-class. A surly conductor can do more harm in one day than several well-mannered men can do good, because the public lets good service go by as a matter of course, while it is quick to notice the slightest departure from the best. While the standards of service vary greatly between different cities, it is true in every case that we consider good service is made up of close and painstaking attention to details of operation by every employee of the company.

It is true that the people of every large city must do a certain amount of car riding, regardless of whether the service furnished is excellent or intolerable. It does not necessarily mean that a street railway company is going into bankruptcy if its service is inferior to the best, but it is indisputable that the dividend rate is directly affected by the character of the service, and from this standpoint alone it pays to give the public as much for its money as liberal practice will allow.

Nothing is lost in making the transportation system of a city intelligible to the stranger within its gates. In a great metropolis like New York, Chicago or Boston this is a difficult problem, but it is by no means beyond solution, and in a smaller city is much simpler. A good map of a city, with the different car lines plainly marked upon it, helps wonderfully when a stranger desires to get his bearings, and is practicable in many cases. To place such a map in a glass-fronted wooden case at railway stations, in hotels, clubs, restaurants, saloons and other public places would not be a matter of heavy expense, and whether one were in Boston or Cripple Creek it would be of inestimable value to the traveling public. Again, the careful and accurate articulation of street names by conductors is a point of great importance in maintaining good service, while the courteous answering of questions about the geography of the city is equally essential. In still smaller communities it is not unreasonable to expect a conductor whose car connects with, or runs to, railway stations, to be posted upon the time of through trains to neighboring cities, and if he cannot carry them in his head the company might provide him with a pocket guide or Pathfinder, with whose pages he is required to be familiar. In this connection it is well to emphasize the vital importance of making train connections on time, and of seeing to it that cars are at the station when through trains arrive. If a company cannot afford to meet trains with cars that have schedules designed to accommodate steam railway travelers it can, at least, provide some sort of waiting room or shelter, instead of leaving the stranger stranded at the entrance to the depot, with the clock marking 11:50 p. m., the thermometer clinging to the zero mark, and no time-table or bulletin to show at what time relief may be expected to heave in sight.

The importance of equipping cars with legible signs that stand out in bold letters or figures by day and night, cannot be easily overestimated in its effect upon the service. Colored lights are of little assistance to the stranger, but a plain, readable sign, which a person of average eyesight can take in at a glance, is one of the best appreciated adjuncts to street railway travel. There is little or no excuse for a company's leaving any car signless. Even if the cars run upon but one street, the name of that street and the destination of the cars should be shown.

It may seem that the foregoing comments are unduly critical, but it is only by unceasing vigilance in watching every detail of the service that high standards of operation can be reached and maintained. While it is true that the public often demands refinements of service that pass the limits of reason, it should be the aim of every street and interurban railway manager to give the very best which long and constant study makes possible.

Tests at the St. Louis World's Fair

From the plans that are now being made it looks as if one of the features of the Louisiana Purchase Exposition which will mark a distinct advance over previous Expositions, in an engineering way, will be the facilities for testing the efficiencies of the various pieces of apparatus on exhibition. This is in line with the announcements made by the promoters of this exposition at the outset that this exposition was to be pre-eminently an operating exposition. Special interest attaches to the electric railway tests which are to be carried on under the direction of a commission of well-known electric railway men, under the chairmanship of J. G. White. One testing track, 3000 ft. long, has been provided and another of half that length. As is eminently proper, electric railway exhibits, even if located in and near the Transportation Building, are to be under the chief of the electrical department, Professor W. E. Goldsborough, and not under a steam railroad department of transportation, as at previous expositions. The United States Bureau of Standards will occupy a laboratory in Electricity Building, and a corps of the bureau's experts, together with many of the instruments of the new national laboratory, will be available for testing during the exposition.

It goes without saying that in this year of the single-phase alternating-current railway motor an unusual interest will attach to both electric railway exhibits and tests, because we have the assurance that at least three of the new single-phase alternating-current types of railway motors will be on hand for exhibition and test.

More About the Track Association

A letter from Mr. Simmons, of Milwaukee, in our correspondence department in this issue outlines a plan for a proposed reorganization of the American Street Railway Association, which has received strong endorsement, and which will certainly be interesting. There are many arguments in favor of a step of this kind, not the least of which is that it will give co-ordination to the work of the different associations, and there will be no danger of any subject being carried on by two associations in divergent directions, or the omission from consideration of any important topic in railway work. These are important considerations, especially in view of the tendency toward standardization of different parts of the equipment and the obvious necessity of further advance in this direction. Another argument in favor of united work is that there should be a reduction in expense in administering the affairs of one large organization of this kind as compared with that of several

organizations. The subject is likely to come up at the next meeting of the American Street Railway Association, and before this time there will be plenty of opportunity to study the proposition thoroughly and determine whether anything can be definitely accomplished in this direction.

An Impending Deadlock

We have often had occasion to consider the effect of the ownership of electric lines by steam railway systems, but there is one phase of the matter which is now beginning to assume something of importance, and to which attention should be directed. We believe it is within bounds to say that upon the whole the electric roads operated by steam railroad companies are among the very best of the interurban class. Their managers bring to the work of construction and operation the best precedents of railroad practice, too often neglected by the independent roads, and the general results are worthy of high commendation. But for the full development of the usefulness of electric traction, so far as the public is concerned, and for the maintenance of earning capacity it is highly desirable that interurban lines, now generally run in a very heterogeneous fashion, should work in harmony and deal with through traffic of the less important kind at least. What is the use of having great electric railway networks, covering scores of hundreds of miles, if they cannot be fully utilized for want of proper management? The managers of interurban lines are rapidly finding out that through cars are a paying part of the equipment, and that it pays to use connections instead of disregarding them. Now, these connected systems, when properly operated, give to the public much better service than is generally given by the steam lines which cover more or less thoroughly the same territory, and are, therefore, competitors in the proper sense of the term. What shall be done about through connections in case the steam system acquires, by hook or by crook, one of the essential links in the electric interurban network?

This is a matter in which the public is vitally interested, since reasonable competition may properly be called one of the inalienable rights of the body politic, which sooner or later it will fight to maintain. There is no use shutting our eyes to this fact, which is becoming daily more evident. It is extremely nice to be on the inside of a successful combination for the suppression of competition, but it is deucedly unpleasant to be on the outside, and the outsiders being in a very large majority will, in the long run, win out. Now, it is perfectly clear that if a steam road gets a strategic point on an electric railway system it will use that point for the purpose of blocking any general traffic which would mean competition for long-distance traffic, and the problem of adjusting the triplicate relation between the steam road, the electric road and the public becomes a very difficult one. In the case of ordinary railroad systems, which were gradually built up from a tangle of warring lines, the situation was relatively simple. The public, after suffering past endurance, took things into its own hands, and when the several lines would not come to an amicable agreement for interchanging traffic, took steps to compel them. Now, in a railroad system which runs trains at relatively long intervals, it is a comparatively easy matter for a railroad commission, or its equivalent, to get at the equities of the case, and to enforce such regulations for the exchange of cars, or of track privileges, as may seem desirable for the protection of the public. But the coming of the electric railway has raised a totally new set of issues with respect to competition. In the good old days of rate wars and rebates, two competing lines had sooner or later to come to about the same tariff in order to live, and savage rate cutting hurt both parties grievously. Now, however, it has been pretty effectively demonstrated that for moderate distances and speeds the electric lines, if well administered, can live in peace and prosperity on a tariff that would very quickly put the steam line into the clutches of a receiver.

It has, therefore, become necessary for the railroads to do one of two things, adopt electric traction for so much of their service as is feasible, or to block, at all hazards, the competition of the electric roads. Most roads have, from sheer conservatism, adopted or attempted the latter course. But in spite of temporary and apparent success, a fight against improvements is always in the long run a losing one. The people have the last word, and will sooner or later realize that modern rapid transit must not be throttled for the sake of letting a few big railway systems pay dividends upon watered stock. The flank movement executed by the railroads in securing important links in the electric railway network is a very adroit one, and will certainly block the union of interurban lines for through business in numerous instances. As a matter of public policy this attack must be in some way met, but it is rather difficult to settle on a course of action which will be both effective and unobjectionable. The general interests of the community are served by an increase in the facilities for transportation, and the fact that such an increase will injure somebody's previous monopoly of them is not a thing that should be considered any more than the introduction of improved machinery should be hindered, because it destroys the monopoly secured by an earlier patent. But whatever steps are taken to prevent the crippling of the development of interurban roads must be taken cautiously and without prejudice or malice.

The ordinary process of enforcing common rights over tracks or a proper interchange of rolling stock, is peculiarly difficult to apply to electric roads, which run through the streets of towns and cities, operate no or few trains, and at times work the local traffic to its limit, shortening the headway of the cars until serious congestion ensues. With such conditions it is a difficult task to arrange for through traffic even under the guidance of harmonious co-operation. An attempt to enforce co-operation between owners whose interests are opposed must, in the nature of things, be vastly more difficult. There can be certainly no such easy remedy as in the case of ordinary railroads. Some States have provisions for a compulsory exchange of track privileges between electric roads, and while this may now and then work hardships, it can generally be carried out without serious inconvenience, the more rapidly because there is usually no real competition between the parties to the exchange. In case of electric roads acquired and operated by steam roads for the sake of averting competition, no such favorable situation can be expected, and the problem of devising means of escape from the difficulty is most formidable. If the prevention of the organization of through traffic were the only result of such ownership the situation would be annoying enough, but there is a tendency also to use the electric lines not to increase the total facilities for travel, but to replace the local trains, already in operation, so that the net result is a merely nominal increase in the rapid transit service. The natural and proper function of certain electric roads is to serve as feeders for trunk lines, and these cases take care of themselves, but the great electric networks which are now being built in all parts of the country, are a part of the growth of the community, and must not be suffered to fail of their purpose. Certain recent events indicate that the question is not one of academic interest only, but is worthy the most serious consideration of publicists.

POWER STATION, ROLLING STOCK AND DISPATCHING SYSTEM OF THE PACIFIC ELECTRIC RAILWAY COMPANY

The present main source of power supply of the Pacific Electric Railway Company is a steam station known as Station No. 1, located on Central Avenue, between Sixth and Seventh Streets, in Los Angeles. This is really two stations, as it combines a power plant, owned by the Los Angeles Railway Company, and erected over twelve years ago, and a new station, Fig. 1, begun by the Pacific Electric Railway Company in 1902, and not yet completed. Both plants are connected and operated together, and distribute their direct-current output in one network for all the city lines of both companies, so this description will include both.

A second steam station, combined with a motor-generator sub-station, is located at Pasadena, and is designated as No. 2 on the accompanying map, Fig. 2, which shows the present high-tension line and station of the company. A large water-power development is now being made on the Kern River by the Pacific Light & Power Company, a lighting company in which Mr. Huntington is largely interested, and, when completed, a portion of the power will be transmitted to one of the sub-stations of the Pacific Electric Railway Company, and be distributed over its 15,000-volt transmission lines. The transmission distance will be upwards of 130 miles, and it is planned to have 10,000 hp ready for delivery in a few weeks.

FIG. 1.—STATION NO. 1 OF PACIFIC ELECTRIC RAILWAY COMPANY, WITH STATION AND CAR HOUSE NO. 3 OF THE LOS ANGELES RAILWAY COMPANY

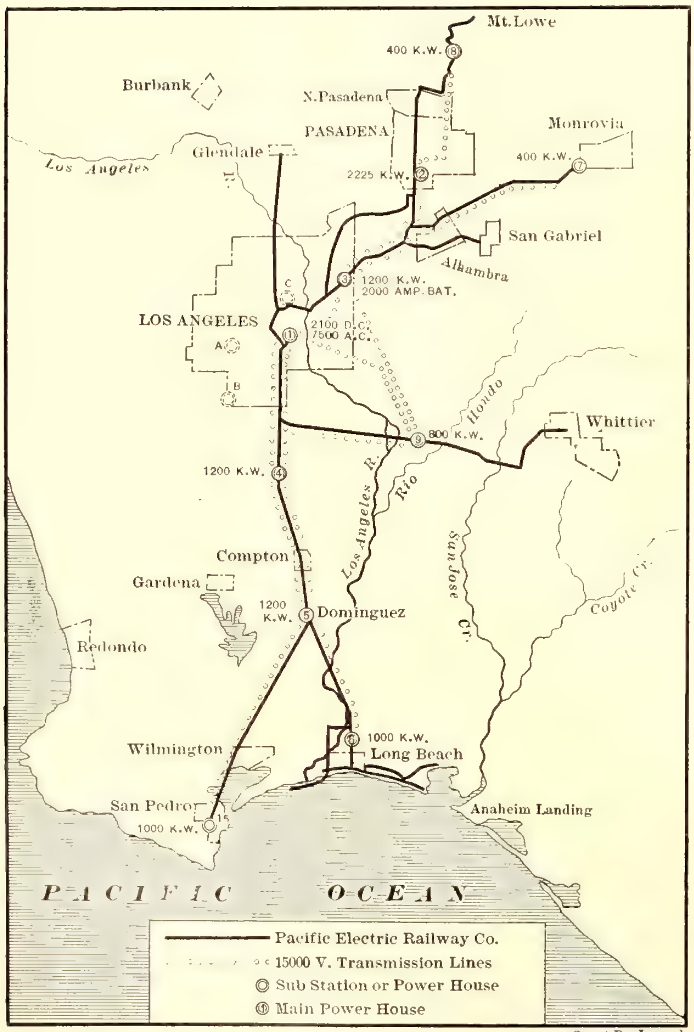


FIG. 2.—MAP SHOWING TRANSMISSION LINES OF THE PACIFIC ELECTRIC RAILWAY COMPANY, WITH LOCATION OF MAIN POWER STATION AND SUB-STATIONS

MAIN POWER STATION

The general arrangement of buildings and apparatus in Station No. 1 is indicated by the plan, Fig. 3. It is seen that the old power plant and the new one adjoin. The older equipment is all direct-current, and comprises two 800-kw Walker generators, direct-driven by Allis-Chalmers horizontal cross-compound engines; a 200-kw and a 300-kw generator, rope-driven by a 500-hp I. F. Thompson slide-valve Corliss engine; two 270-kw Thomson-Houston generators, rope-driven by a 750-hp Risdon-Corliss engine and a 200-kw Edison bipolar generator, belt-driven by a vertical cross-compound Ball engine. In the new plant are installed five direct-connected generating units and one direct-current and four three-phase alternating current, all of the engines being of the MacIntosh & Seymour horizontal cross-compound condensing type. The direct-current generator is a 1050-kw Westinghouse machine. The four alternators are 1500-kw, 50-cycle machines, generating at 2300 volts, two being of the Stanley type and two of the Bullock manufacture. Orders have been placed for the sixth unit, which will complete the present engine room equipment. This last unit will consist of a 1500-kw Bullock alternator, driven by a Nordberg full-stroke gear cross-compound condensing engine. Motor and engine-driven exciters are provided.

All the engines are run condensing, and the new ones are equipped with individual Wheeler surface condensers. One of the Allis engines in the old plant has a surface condenser, and the other old engines are equipped with jet condensers. The pumps are motor-driven, those in the new plant by 2200-volt induction motors. For cooling the condensing water an elaborate cooling tower and reservoir system has been installed. The water is stored in large concrete reservoirs back of the station, as shown in Fig. 3, the larger one having a capacity of 1,500,000 gals. Each reservoir is covered by a wooden cooling tower of the company's own construction, the water being conducted to the tops of the towers by means of wooden troughs. In the case of the new station the space between the roofs of the engine and boiler rooms is utilized for a main trough, into which the condenser pumps discharge. The arrangement of the cooling water system is indicated in Fig. 4.

The boiler equipment of the old plant comprises ten 250-hp

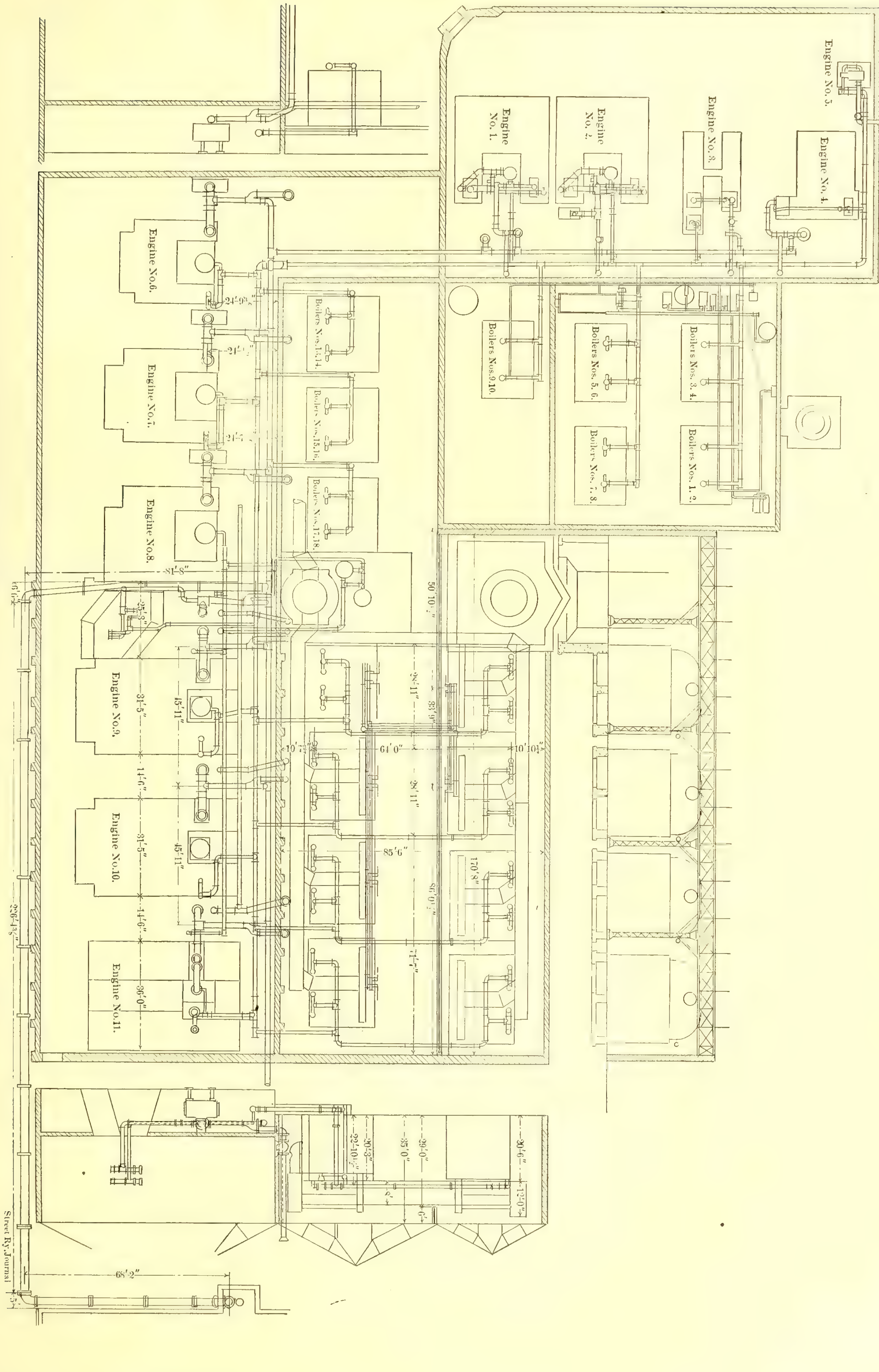
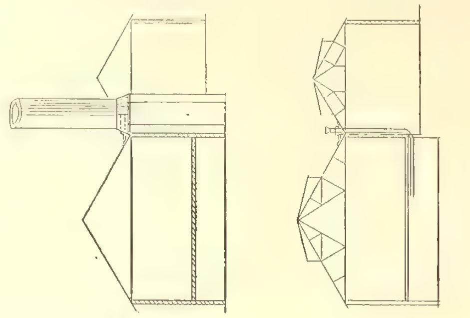


FIG. 3.—PLAN AND SECTIONS OF POWER STATION, SHOWING OLD AND NEW PARTS

Stirling boilers, mounted in batteries of two. In the new plant are installed fourteen 400-hp Babcock & Wilcox boilers, and in an addition are being placed ten 400-hp Edgemoor boilers, all arranged in batteries of two. The old boilers discharge their gases into a brick stack, and the new ones into a concrete stack. The latter is said to have been the first concrete stack of any size erected in this country. It was built of California cement, and is designed to provide draft for 6000 hp of boilers, and to withstand a wind pressure of 50 lbs. per square foot. Above the boiler room floor it is 159 ft. high, and above the base 175 ft. 6 ins. The stack rests on a foundation 35 ft. in diameter, and has an interior diameter of 11 ft. and an exterior diameter of 15 ft. 2 ins.



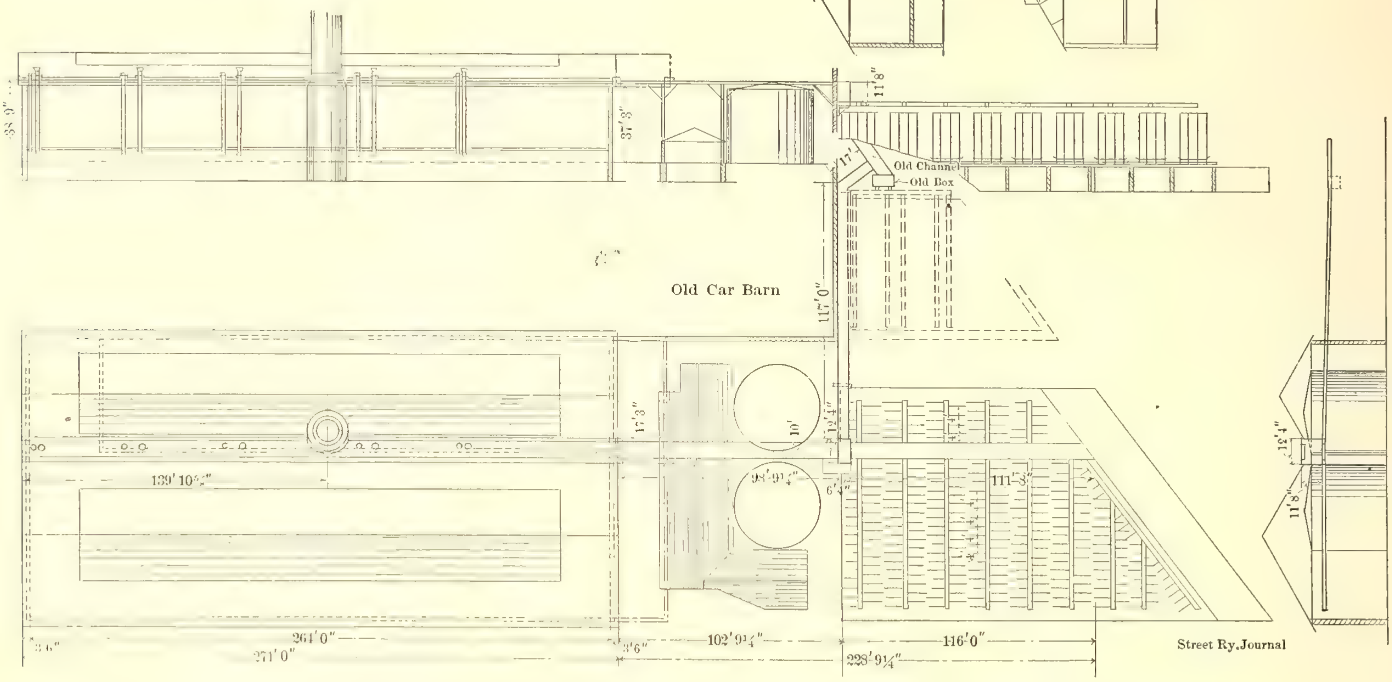


FIG. 4.—PLAN AND SECTION SHOWING GENERAL ARRANGEMENT OF WATER-COOLING SYSTEM

FUEL OIL SYSTEM

Crude oil is used exclusively for fuel in the power houses, and the daily consumption at present is about 950 barrels a day. During the holiday season over 1000 barrels were consumed daily. The consumption of oil at this station has shown an increase of 100 per cent for each of the last two years. In the Pasadena station about 130 barrels are consumed daily.

The oil is obtained from the wells located in Los Angeles and from the oil districts immediately surrounding the city. It is hauled to the station by standard tank-line cars on the steam roads and by wagon; but principally by means of oil-tank cars operated over the local electric railway lines. One of the oil cars used is shown in Fig. 5, as it is loading at the company's own wells in the western portion of the city. This car contains a fifty-barrel tank, and is a standard combination baggage and passenger car that was fitted over for the purpose. Oil tanks were formerly run through the streets without any covering, but as the people objected the tanks were placed in regular passenger car bodies, as shown. The windows are painted black, and the only thing which would indicate the purpose for which the car is employed is a capped pipe opening on each side of the roof, about midway of its length. As these are hardly noticeable, and as the car is labeled "Private Car," there are few citizens who know what it is used for, and so it goes through the streets without causing complaint. A similar car, with a forty-barrel tank, owned by the Los Angeles-Pacific Railroad Company, will also be used soon.

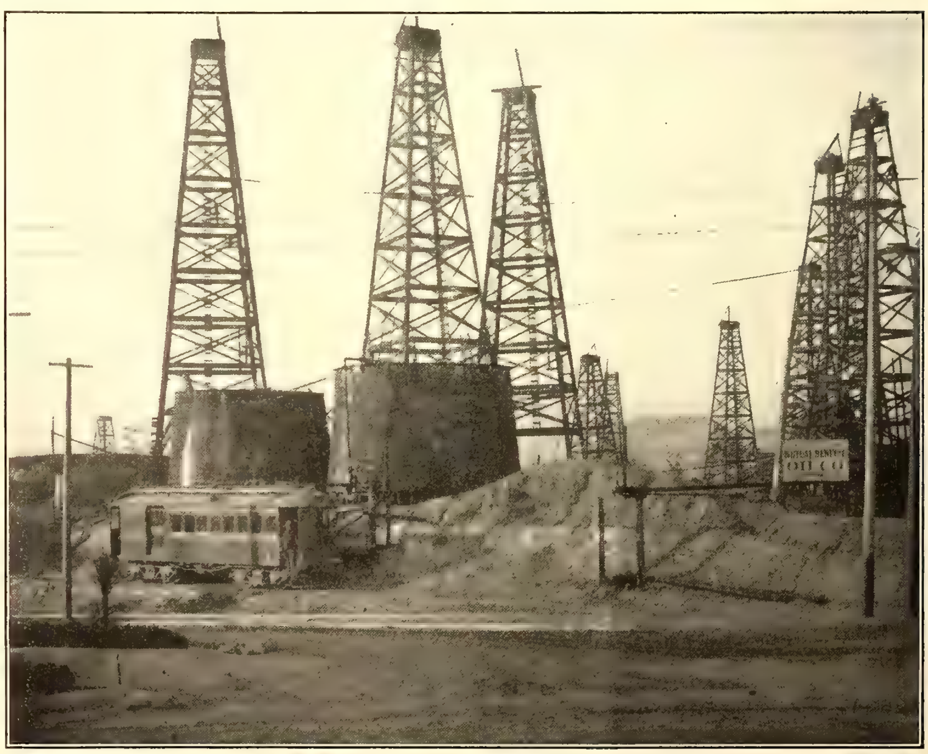


FIG. 5.—OIL-TANK CAR LOADING AT COMPANY'S OIL WELL IN WESTERN PART OF CITY

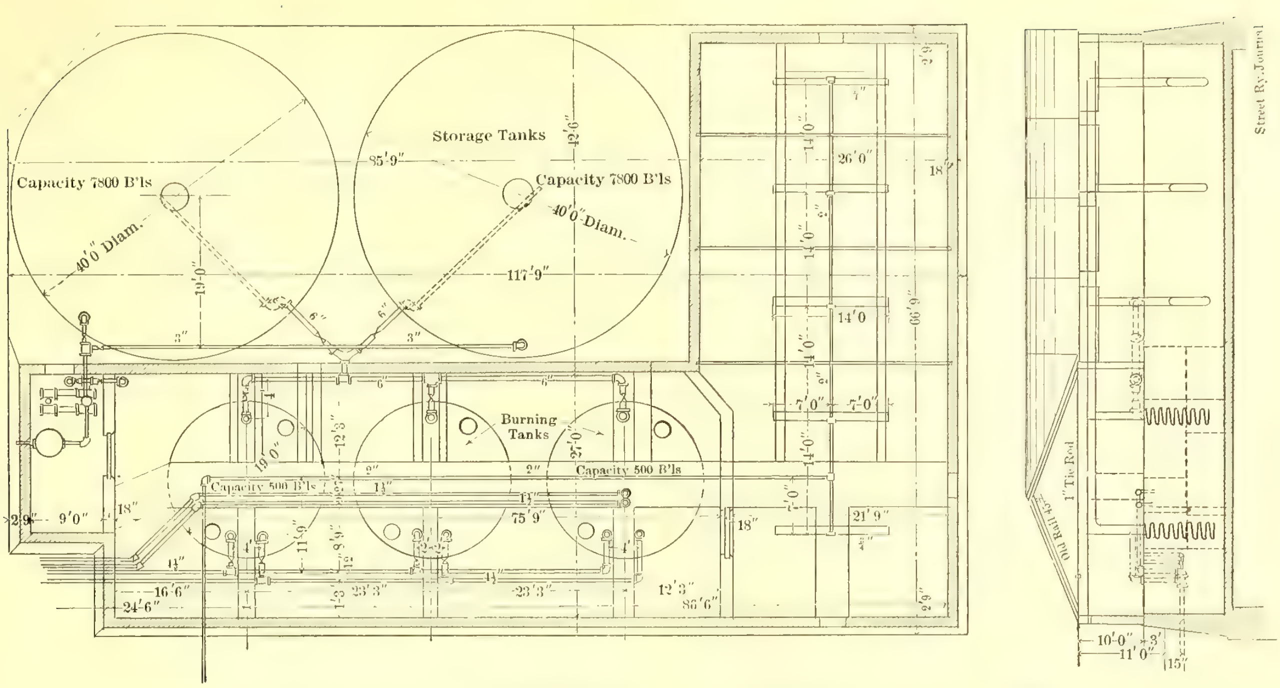


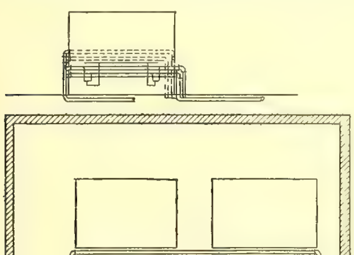
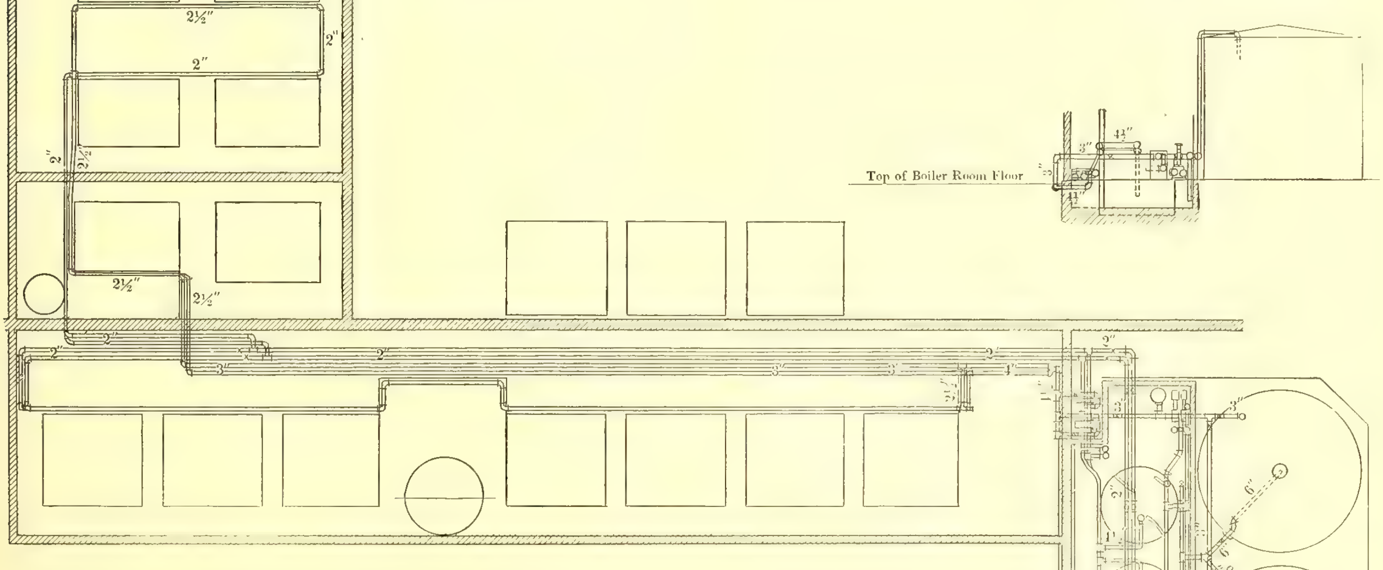
FIG. 6.—PLAN AND CROSS-SECTION OF OIL SYSTEM FOR OIL HOUSE

At the power house the cars are emptied by gravity into oil houses. When the oil is of a heavy grade and also in cold weather live steam at boiler pressure is run into the cars to hasten the flow. At present an oil house, that has been in service some time, is used, but a new house, back of the Pacific Electric boiler room, has been completed, and will shortly be put into service. The arrangement of the new house is shown in Fig. 6, while Fig. 7 gives the arrangement of the oil system for the boilers. The lower part of the house consists of a concrete tank, with walls 8 ft. high, the flow being on about the level of the condenser pit in the power house. This pit is divided by cross walls of concrete, in which the oil is allowed to settle, the lighter oil being run off into the last pit, from which it is pumped into the two storage tanks. Each of these tanks is 40 ft. in diameter, 35 ft. high and has a capacity of 7800 barrels. The oil flows by gravity from these storage tanks to the three burning tanks situated in the oil house. Each of the burning tanks holds about 600 barrels. They contain steam coils which heat the oil to about 124 degs., and it is then pumped to the boilers. Deflecting plates are located in the tanks so as to aid in circulating the oil.

A double-pipe system is used for distributing the oil to the boilers, the oil being kept in constant circulation under about 35 lbs. pressure. The fuel is supplied to the boilers through Hammel burners with steam at boiler pressure, 150 lbs.

ELECTRICAL FEATURES

The direct-current output of the station is distributed to the city feeder lines from a General Electric switchboard with thirty-two feeder panels, located in the old engine room. Many of the details of the ultimate equipment for this station have not been decided upon as yet, so only general mention can be made of them. The transformers are located in fireproof compartments under the south side of the engine room, and between

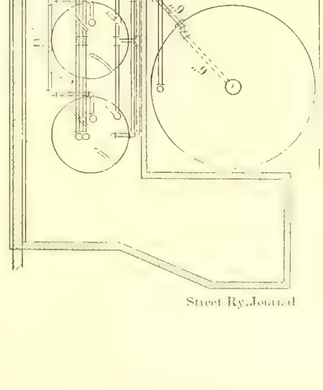


FIG. 7.—PLAN AND SECTION SHOWING GENERAL ARRANGEMENT OF OIL SYSTEM FOR BOILERS

these compartments will be placed the oil switches and operating gear. The transformers will raise the machine voltage of 2300 volts to 15,000 volts for transmission. The high-tension wires will be carried up the wall in fireproof conduits to the

FIG. 8.—WESTLAKE PARK SUB-STATION IN OIL DISTRICT; A TYPICAL SUB-STATION

high-tension gallery, which extends nearly the entire length of the south side of the engine room. This gallery is 15 ft. wide, and has a concrete floor. The high-tension switchboard consists of a partition wall erected along the center of the gallery, and constructed of concrete and expanded metal. The board

FIG. 10.—HIGH-TENSION GALLERY OF SUB-STATION, SHOWING HIGH-TENSION BUSSES, OIL SWITCHES AND HIGH-TENSION LINE SWITCHES

will be equipped in duplicate with high-tension busses and oil switches on each side. The control of all electrical apparatus will probably be done electropneumatically from a small operating board on the main floor. From this station 15,000-volt high-tension lines extend as indicated on the map, Fig. 2, to the different sub-stations of the system.

SUB-STATIONS

At this writing there are nine sub-stations on the Pacific Electric Railway Company's lines, which are operated from station No. 1, they being located as indicated on the map. Stations A, B and C belong to the Los Angeles Railway Company, but are fed from the same transmission system. A standard type of sub-station has been adopted, and with the exception of stations 3, 8 and 6, located respectively at Pasadena, Echo Mountain and Long Beach, the general design and equipment is the same, the difference being principally in capacity of apparatus installed. The accompanying illustrations are of the Westlake sub-station (marked "A" on the map) of the Los Angeles Railway Company. Fig. 8 shows the exterior of the station. In this case the station room proper and the battery room had to be separated on account of the oil well between, but usually the battery room is built directly in rear of the station. Fig. 9 is a general interior view of the station, and shows the arrangement of motor generator, switchboard, high-tension gallery, etc. The high-tension wires enter the station

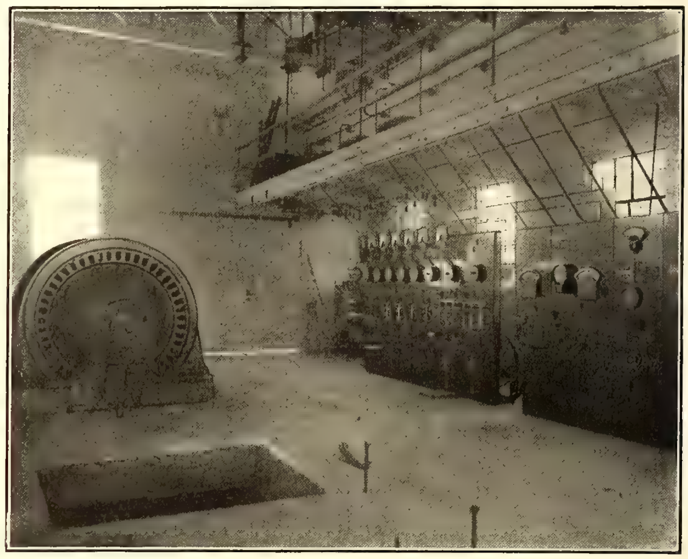


FIG. 9.—INTERIOR OF SUB-STATION, SHOWING MOTOR-GENERATOR, STATION SWITCHBOARD AND HIGH-TENSION GALLERY

through sewer-pipe openings under a separate roof, and are carried to the air switches shown in Fig. 10, and then to the high-tension busses, as shown. These busses are of solid copper with rubber insulation and braided covering, and are supported on porcelain insulators. The insulators are mounted on iron or locust pins, which are cemented into the concrete partition wall of the gallery. The high-tension oil switches are also mounted in this gallery, as shown. Everything is in duplicate, the other set of high-tension busses and switches being mounted on the rear of the partition wall. The transformers, which, in this case, are of the Stanley oil-insulated and water-cooled 150-kw type, are located on the station floor below the oil switches, the wires being carried through the floor of the gallery in porcelain bushings, as shown in Fig. 11, to emergency or selector switches. These switches have four copper blades, opening radially from the center. Two of the terminals are connected to the high-tension busses above, and the other two are connected to the transformer leads, so that the transformer may be cut in on either the front or rear bus. These switches are never opened under load. They serve as an additional safeguard when open for working on the transformers or oil switches.

The switchboard comprises six standard General Electric feeder panels, two generator panels, three panels for the storage battery and two for the alternating-current motors that drive

the generators. Each of these alternating-motor panels is equipped with a three-phase ammeter and indicating wattmeter, designed by R. S. Masson, consulting electrical engineer of the company, and built by the Wagner Manufacturing Company; a Weston field ammeter, two switch gear handles for operating the oil switches on the high-tension gallery, rheostat and exciter switch. On brackets are mounted a Lincoln synchronizer and a voltmeter. The engineers have adopted the policy of making everything as simple as possible and having everything standardized. With this object in view all superfluous apparatus has been done away with, including all fuses. As a special feature

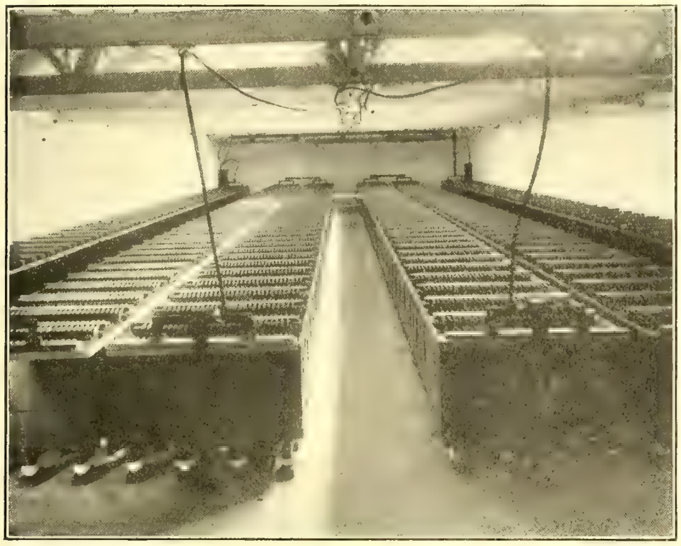


FIG. 12.—SUB-STATION STORAGE BATTERY OF 2000-AMPÈRE HOURS

the bus-bars on the rear of the feeder panels have been designed so that they can be easily enlarged or replaced. The bus-bars consist of circular-bar copper, 1 in. in diameter, covered with circular loom, and held in place by special copper plates. These plates are provided to accommodate one or two rods, and as more bus-bar capacity is needed more bars are added with the necessary plates to hold them in place. The bus-bar rods can

FIG. 13.—PASSENGER CAR OF "100" CLASS

be quickly detached from the feeder connections, and all that is then necessary to remove a panel is to unscrew a few nuts with a wrench. This construction permits the switchboard panels to be drilled and equipped in the shops, and then quickly mounted on any switchboard when they are needed. When additional feeder panels are required the bus-bar rods are simply extended. All wires in the sub-stations are run in iron conduits, and no wood is used in construction, everything being of steel, concrete, glass or porcelain.

The motor-generator set shown in Fig. 9 consists of a 425-kw, 50-cycle, 2200-volt Stanley synchronous motor, driving a 400-kw S. K. C. railway generator. The standard motor-generator sizes adopted for the sub-stations are 200 kw, 400 kw

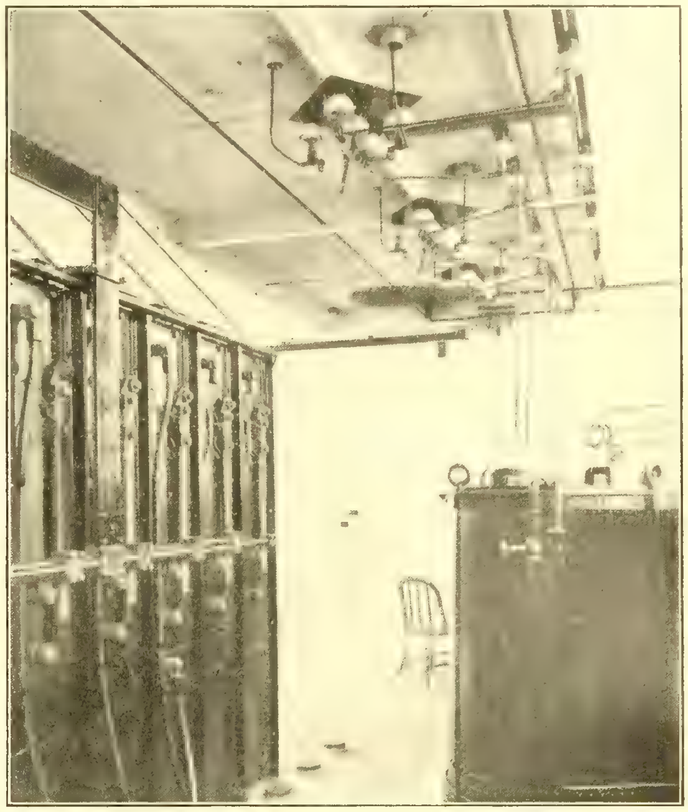


FIG. 11.—REAR OF SUB-STATION SWITCHBOARD, SHOWING FEEDER PANELS, WITH ROUND COPPER BUSSES, TRANSFORMERS AND SELECTOR SWITCHES ON CEILING OF HIGH-TENSION GALLERY

and 600 kw, and twenty-four sets of Westinghouse manufacture are now being installed.

Storage batteries have been installed at station 3 of the Pacific Electric Railway, and at stations A, B and C of the

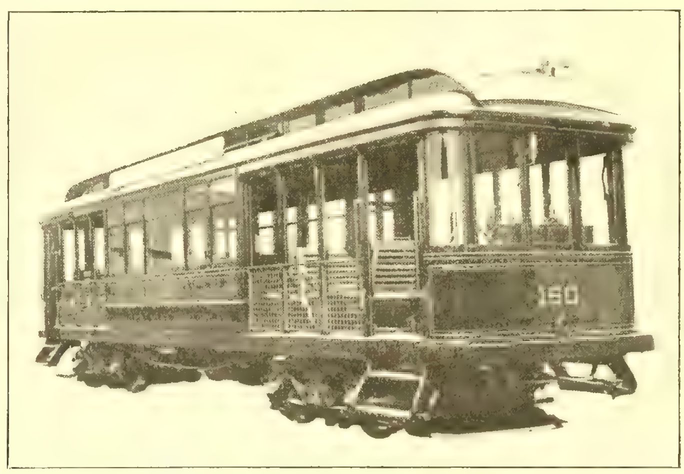


FIG. 14. PASSENGER CAR OF "150" CLASS

Los Angeles Railway. These are all of the chloride type with 264 cells, and are provided with differential boosters. Station A battery has 1000-amp. hours capacity, and the other three 2000-amp. hours. The battery at station 3 is illustrated in Fig. 12.

ROLLING STOCK

The company is engaged in standardizing its passenger cars to four or five types, each being fitted for a different service. Most of the cars are of recent manufacture, and those of older construction are being remodeled, as time and occasion permit, to conform to the standard of the newer types. The cars of

the "100" class, Fig. 13, are 42 ft. 2 ins. long, seat fifty-two people and weigh 35,400 lbs. They are mounted on the company's own trucks, and are equipped with two No. 38-B motors and K-11 controllers. The car bodies are of the Hammond manufacture. These cars are used on the Los Angeles-Pasadena lines, and also for local Pasadena service.

The "150" type of car, Fig. 14, are 39 ft. long, seat forty-four people, and weigh 40,300 lbs. The equipment consists of four 38-B motors and K-14 controllers. Five of these cars are used on the Rubio line for Mt. Lowe service, where grades of 8 per cent are encountered, so the gear ratio of the motors is low. Westinghouse magnetic traction brakes have recently been installed on these cars on account of the heavy grades. Other cars of the same type are used on the city lines in Los Angeles.

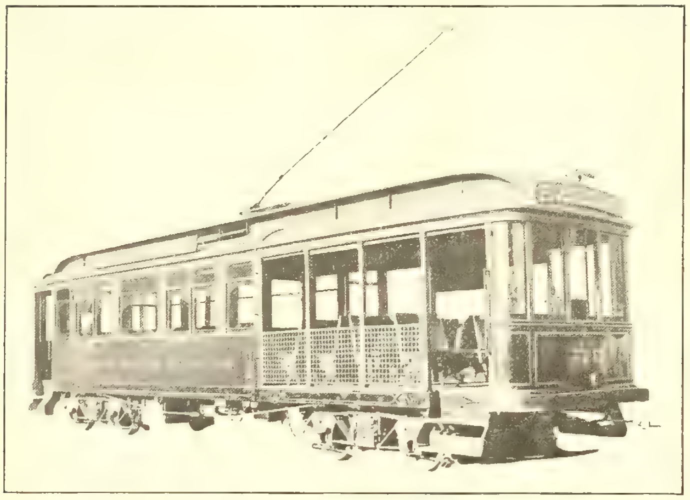


FIG. 15.—PASSENGER CAR OF "200" CLASS

The "200" type, shown in Fig. 15, has a length of 41 ft. 2 ins., seats forty-eight passengers, and weighs 41,000 lbs. The equipment is the same as the "150" class cars except that the gear ratio is higher. These cars are used on the lines of the Northern division, especially on the Pasadena Short Line, the Pasadena regular line and the Monrovia and San Gabriel branches.

FIG. 17.—PARLOR CAR "POPPY"

The latest type of car to be put into service is the "250" type, shown in Fig. 16. The company has fifty of these cars, and it is with them that the high-speed schedule to Long Beach and Whittier is maintained. They will also be used for the San Pedro and Newport Beach branches, twenty new cars of the same type now being built by the St. Louis Car Company for that purpose. These cars are 48 ft. long, seat fifty-six passengers, and weigh 64,700 lbs. The equipment consists of four No. 76 75-hp motors and L-4 controllers. The company has equipped all of these controllers with a stop on the running point, to prevent the motormen from using the multiple and series section improperly. The cars are equipped with the Greenamyer pneumatic trolley controller, which will be spoken of later. The air pressure carried on the "250" cars for the operation of the air brakes is 80 lbs.

The company's parlor car "Poppy," Fig. 17, is of the general type of cars used on some of the city lines, it being 36 ft. 3 ins. long, seating forty people and weighing 32,400 lbs. The equipment consists of four No. 12-A motors and K-11 controllers. The parlor car was refitted by the company and is luxuriantly furnished with easy chairs, carpeted floor, silk curtains, etc. It is used for trolley parties, and recently has been employed daily for an "Orange Grove Route" observation car, as will be mentioned later.

FIG. 16.—PASSENGER CAR OF "250" CLASS

President Henry E. Huntington is also having a magnificent private car constructed for him in St. Louis, which will be a model of its kind. It will be equipped with staterooms, buffet, parlor, etc., and will be built so that it can be operated equally well on the interurban lines of the Pacific Electric Railway Company and the steam railroad lines. Mr. Huntington owns several desirable tracts on his lines near Los Angeles, and it is probable that he will erect a handsome residence on one of them. In that case he will have a spur track run into his grounds, so that he can board his private car at his door and go to his office in Los Angeles, and if he desires to make a trip to San Francisco or other point in the State his car will be attached to a regular train, as in the case of any private car.

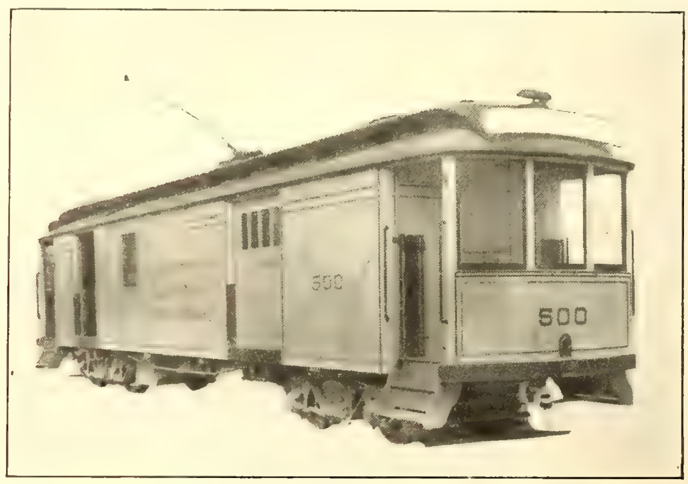


FIG. 18.—MAIL CAR

All of these standard passenger coaches, of which the company has 136 in service, are painted a dark, rich red, the

official color of the Pacific Electric Railway Company. Large destination signs, painted with white letters on a blue background, are used on the ends and sides of the roof. The cars are built in the style that has come to be known as the Los Angeles type, with both closed and open sections, as may be noticed in the illustrations. Christensen air-brake equipments are installed on all the cars in addition to the hand brakes, with the exception of the Rubio cars, which have the magnetic traction brake, as already mentioned. Other furnishings include walk-over seats (wood seats outside and plush seats inside), Anderson & Smith arc headlights and interior lights, trolley pole catchers, and the company's own type of sand-boxes. Some of the cars are fitted with Stanwood steel steps, and others with wooden steps, built in the company's shops.

The platforms of all the interurban cars are equipped with the combination gate and trap-door, illustrated and described in the STREET RAILWAY JOURNAL of Nov. 21, 1903. These are made in the company's shops and have proved very satisfactory additions to the equipment of the cars. The screens of crimped iron, used on the open sections of all the cars on the Pacific Electric Railway as well as the Los Angeles Railway, are also built by the company. All cars are now fitted with the Ohmer recording fare registers. The Long Beach, or "250"

FIG. 19.—LOCOMOTIVE FOR SWITCHING PURPOSES

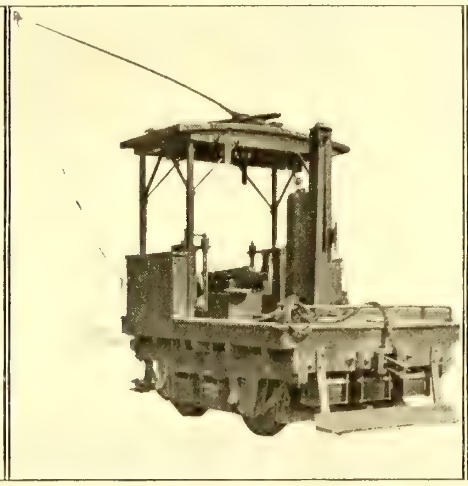


FIG. 20.—SHORT SWITCH CAR

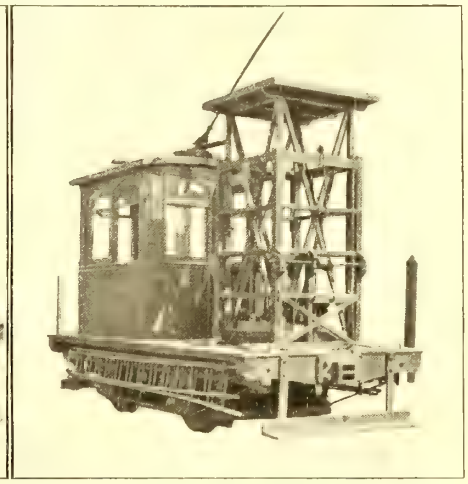


FIG. 21.—TOWER CAR

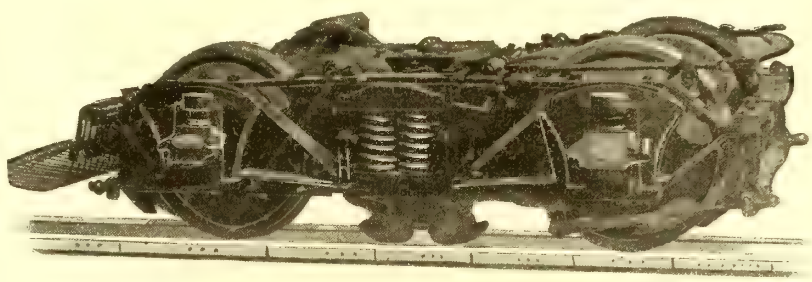


FIG. 23.—STANDARD P. E. TRUCK EQUIPPED WITH ELECTRO-MAGNETIC BRAKES

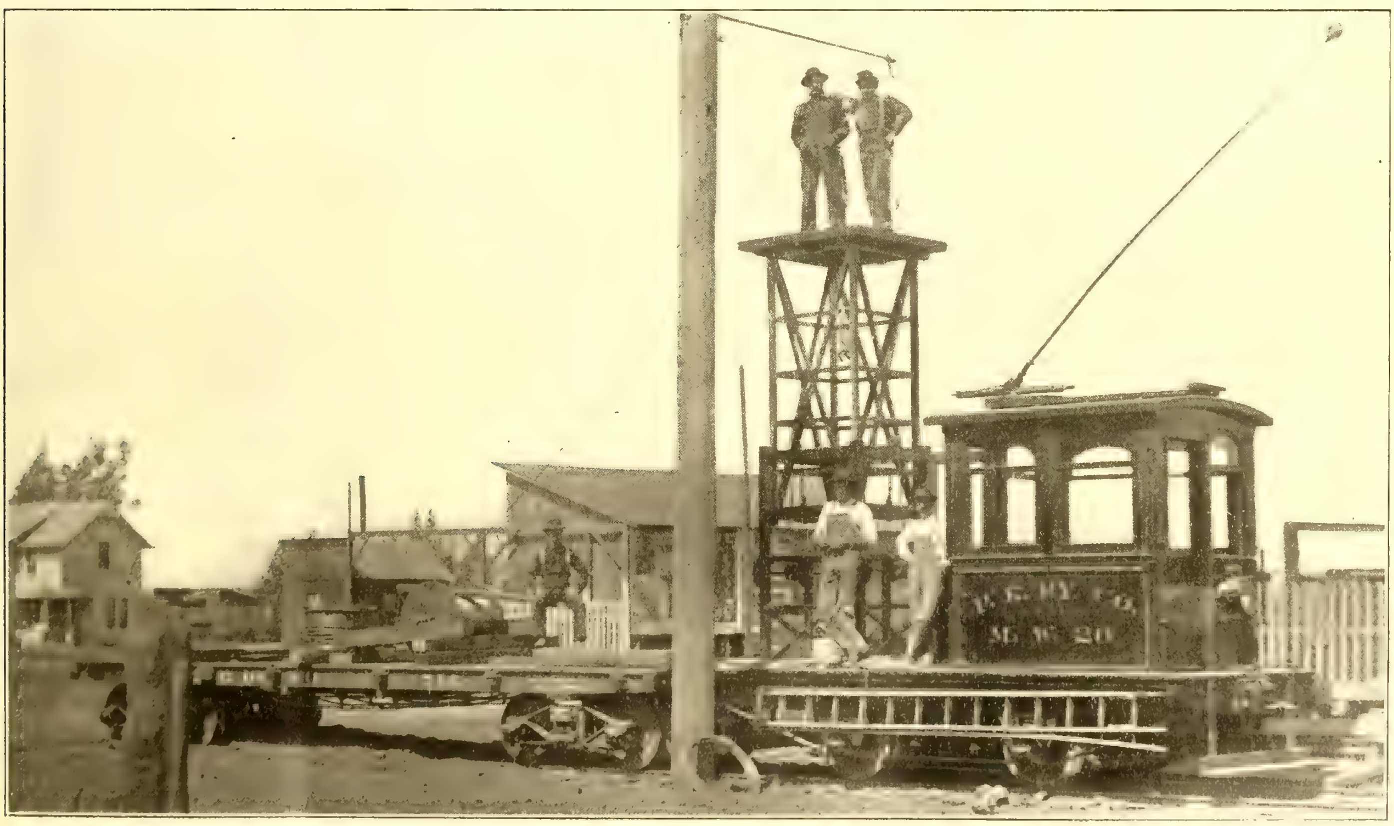


FIG. 22.—STRINGING LIVE TROLLEY WIRE WITH TOWER CAR

type, cars are fitted with wooden pilots, fashioned after the standard steam railroad pilots. All city cars and the other interurban cars are equipped with fenders of the company's manufacture.

The company has a regulation 42-ft. 5-in. mail car, Fig. 18, fitted up with all the fixtures for handling and sorting of mail enroute. It is used between Los Angeles and Altadena. Two combination passenger and mail cars are also used for carrying mail in closed pouches.

The Pacific Electric Express Company, a concern not allied with the railway company, uses two baggage and express cars in handling express and baggage between Los Angeles and Pasadena. It handles its business between brick depots, built in the business or wholesale districts of the two cities. As yet the Pacific Electric Railway Company has not gone into freight, baggage or express business.

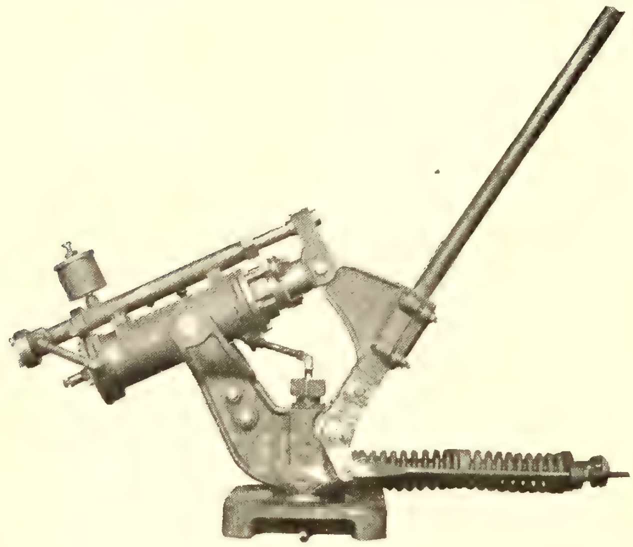


FIG. 24.—PNEUMATIC TROLLEY POLE CONTROLLER USED ON LONG BEACH CAR

Fig. 20 illustrates a short switch car, or yard motor, that was built to switch cars about the shops and yards of the company. It is 13 ft. 6 ins. long, and was designed so that it and a standard passenger car could be moved together on the transfer table. Its equipment comprises two 38-B motors and two K-10 controllers. It is provided with air brakes and has a vertical I-beam stand for use with a derrick.

For line repairs the company has built two tower cars of the type illustrated in Fig. 21. These cars are 18 ft. long, and are mounted on single trucks equipped with two Lorain motors and K-10 controllers. The tower is of the ordinary construction. Ladders are carried at the sides of the car as shown. Fig. 22 shows how this car is used in stringing live trolley wire, the reel being mounted on a flat car that is pushed ahead of the tower car.

Fig. 19 shows a 19-ft. narrow-gage motor car that was originally designed as a wrecker, but is now used in the yards for switching purposes. The company has also five maintenance of way or construction cars, 31 ft. 6 ins. long, with four No. 38-B motors and K-14 controllers. A small cab is placed in the center, and the rest of the car is used for carrying track and construction material, some rails always being left on the car to serve as ballast. Other rolling stock includes a pay car, a material car, an oil car and thirty-three flat cars of 10 tons, 15 tons and 30 tons capacity.

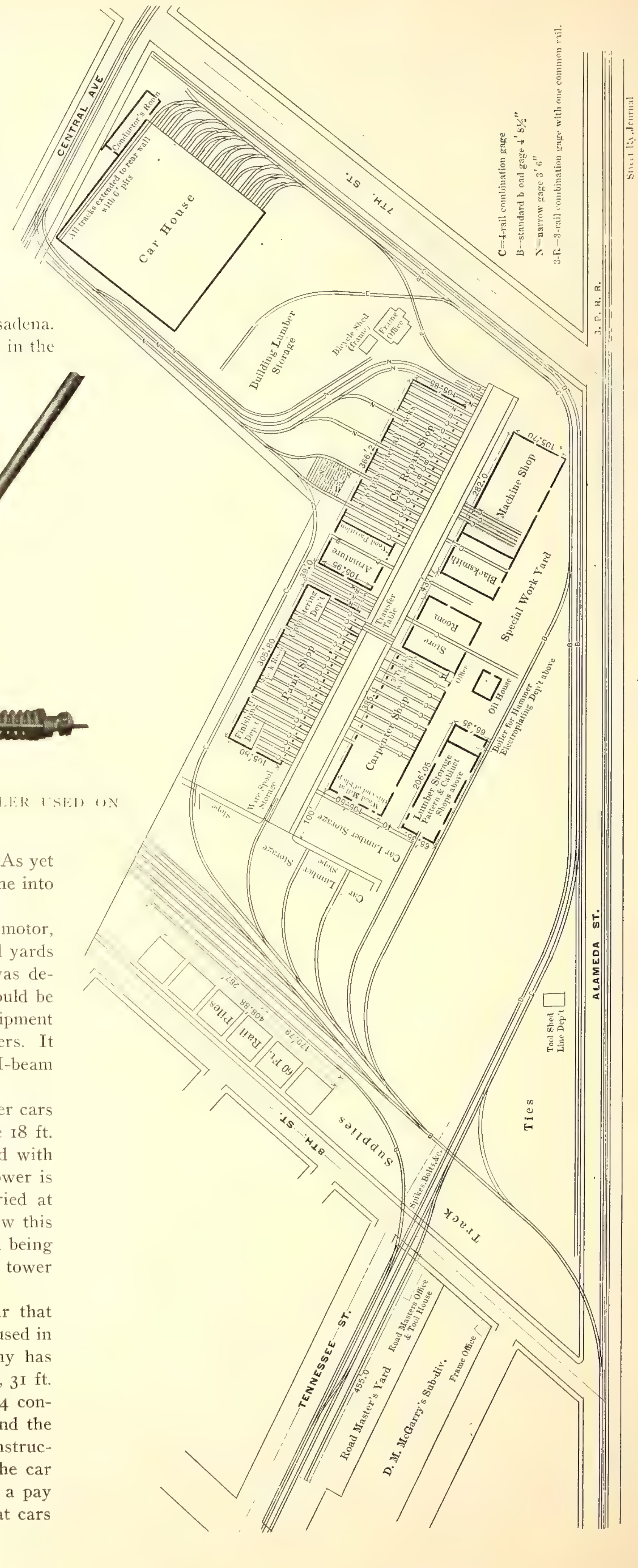


FIG. 25.—PLAN OF CAR HOUSE, YARDS AND SHOPS

TRUCKS

About 100 of the 150 or more cars owned by the railway are mounted on trucks designed and built by the company, and known as P. E. trucks. The other cars use St. Louis swing-bolster trucks. The P. E. truck, Fig. 23, has been gradually developed during the existence of the company, the chief features of the design sought being simplicity and durability. It has a rigid bolster and a flat-iron bolted truss frame with no ribs. The bolster is riveted to the top plate. For the bolster 1-in. x 6-in. forged iron is used, and for the side frame 1-in. x 4-in. iron. The details of construction may be noticed in Fig. 23. For a No. 76-motor equipment the truck has 33-in. wheels, mounted on 6-in. axles, and for No. 38-B motors 30-in. wheels on 4½-in. axles.

PNEUMATIC TROLLEY CONTROLLER

The cars on the Long Beach line are equipped with the Greenamyer pneumatic trolley-pole controller, Fig. 24, and its operation is said to be very successful. This device was described in the STREET RAILWAY JOURNAL of June 6, 1903, but a few facts concerning its operation will be of interest in this connection. The controller is operated by compressed air at any pressure above 60 lbs., supplied from the air-brake reservoir of the car, the consumption of air being very small. It holds the pole in firm contact with the trolley wire and keeps the same tension at all positions or altitudes, enabling cars to take curves at high speeds. It is stated that in actual tests and during several months' operation the trolley never runs off at any speed up to 60 m. p. h. on standard overhead construction unless there is a decided defect in overhead work. Even if it does come off it lowers itself instantly and automatically to a safe position below any spans. When it is desired to replace the trolley the conductor throws a three-way valve and the pole goes up with a very light pressure and assumes its normal pressure when the valve is thrown back. It has been demonstrated that the cost of operating the pneumatic trolley is practically nothing, as the damage resulting from burnt trolley wheels, broken or bent poles and broken overhead work and car roofs is almost entirely eliminated. The controller is very highly recommended by the officials of the Pacific Electric Railway Company, whose recommendations are backed up by the results of many tests. It is said to have repeatedly carried 350 amps. during a run of 7 miles at 60 m. p. h. with less than 5 volts drop and 27 lbs. pressure at the trolley wheel. During a twenty-days continuous service test, conducted under the direct observation of R. S. Masson, consulting electrical engineer of the company, without a moment's attention, on a car speeded at 50 m. p. h. on a level, straight track, carrying from 200 amps. to 300 amps. when running, and as high as 800 amps. on starting, traveling over 5000 miles, it left the wire but once, and this was due to a loose inverted bell hanger. Its wheel was not scored or burned, no spark was even visible at the contact of wheel and wire. At present the trolley controller is not on the market, but is being developed in the shops of the Pacific Electric Railway Company. It will probably be installed on all the cars of the company.

FIG. 26.—VIEW IN MAIN CAR HOUSE, SHOWING 6 FT. PIT AND HEADLIGHT AND SIGN RACKS

In view of the recent remarks of George Westinghouse on the trolley as against the third rail, it is interesting to observe that the management and engineers of the Pacific Electric

Railway Company are fully confident that the overhead trolley with some such controller as the pneumatic base just described, is the only safe and practical current-collecting method, and that it is not only feasible but the only practical device to use in high-speed operation. As already mentioned, this opinion has only been formed after long and practical tests with the Greenamyer trolley controller. It is stated that in about a year's operation with this controller, but two or three accidents have occurred, while with the ordinary spring trolley base they ran as high as six a day. The pneumatic trolley will be developed and changed as may seem desirable for high-speed tests, one idea being to make the end of the trolley weigh practically nothing, using aluminum in the construction, in order to come as near as possible to the theoretical condition, which is that the trolley should remain in contact merely with the current.

FIG. 27. PASADENA CAR HOUSE WITH OFFICES ON SECOND FLOOR, SHOWING WEST END FROM WHICH CARS ARE DESPATCHED

HIGH-SPEED EXPERIMENTS

Under the supervision of Mr. Masson, speed tests were begun by the company about a year ago, and have been carried on intermittently since then. One of the "250" type of cars, with the standard equipment of four No. 76 motors and L-4 controllers, has been used in the experiments, the motor being geared to higher ratios than those normally used. The efforts of those in charge of the tests are now being directed toward overcoming as much as possible the air resistance. Wind shields, or "splitters," have been used for this purpose, and with the standard equipment speeds of from 68 m. p. h. to 69 m. p. h. have been attained. The Long Beach line, which, as has already been pointed out, has several long stretches of tangent track, with very slight grades, has been used for the trials. The wind shields consisted of pointed cabs, built on over the regular cabs of the car, and with windows in the sides so that the motorman could see ahead from his regular station. Different designs of these shields are now to be used to determine which offers the least resistance to the air, as the experiments thus far have shown that more is to be gained in lessening the air resistance than by increasing the motive power. It has been suggested that should these tests convince the management that it was practicable to operate at high speeds, the motorman and his appliances for handling the car could be stationed inside this additional cab, thus giving more seating capacity in the car itself. It is Mr. Masson's intention to carry on the tests as time and occasion permit until speeds up to 90 m. p. h. are reached.

CAR HOUSES

The Pacific Electric Railway Company operates its interurban cars from large car houses in Los Angeles and Pasadena, and its Los Angeles city lines from a car house in that city. A small barn is also provided at Long Beach. The main car house is located on one corner of a 30-acre tract that is used for the company's yards and shops at Seventh Street and Central Avenue, Los Angeles. Fig. 25 is a plan of the grounds and buildings. The shops will be described later. The car house is a brick building, 260 ft. x 260 ft. in size, and contains twenty tracks, with room for 100 of the largest cars used on the system. The building is divided into four bays, and the front is entirely open, as the mild weather of Southern California does not require doors. A pit floor of concrete, 6 ft. below the

tracks, extends under all the tracks. Fig. 26 is a view in the car house, showing the pit, and at the left the racks for signs and headlights.

At the northwest corner of the car house is a two-story addition, 40 ft. x 120 ft., designed for the use of the trainmen. At the north end of the second floor is the office of the superintendent of the Southern division and the despatcher's room,

FIG. 28.—DOUBLE TELEPHONE DESPATCHER'S BOARD IN MAIN CAR HOUSE, AND POWER BOARD

where is located the telephone despatching board shown in Fig. 28.

There has recently been completed the car house shown in Fig. 27. This building is 354 ft. long and 100 ft. wide, and has six tracks, with room for forty-eight cars, of the type used on the Pasadena lines. It extends from Fair Oaks Avenue to Raymond Avenue, and is open at both ends. It is located at one end of a loop, over which the Los Angeles-Pasadena cars have to pass, so the cars enter at the east and are despatched from

FIG. 29.—DESPATCHER'S DESK IN PASADENA CAR HOUSE

the west, or Fair Oaks Avenue, end, which is illustrated in Fig. 28. Over each end of the building is a second-story, 18 ft. wide. That at the east is to be fitted up for quarters for the conductors and motormen. The west end is devoted to the offices of the superintendent of the Northern division, his assistant, the trainmaster and despatcher. Fig. 29 shows the despatcher's desk and power switchboard for the central energy telephone system which is employed.

For the city narrow-gage lines an old car house on Temple Street is used, the superintendent of the Los Angeles division having his headquarters at that place.

DESPATCHING SYSTEM

The company is doing all its car despatching by telephone, but is seriously considering the use of the telegraph for a portion of the work in addition to the present telephone system. On account of the existing conditions the interurban cars have to be despatched from the Los Angeles and Pasadena car houses, and those operating on the Los Angeles division from the Temple Street car house; but, as soon as the new terminal station at Sixth and Main Streets, Los Angeles, is completed the despatching system will be concentrated at that point and all cars handled from one board.

The switchboard now used at the car house, illustrated in Fig. 28, is the largest in service, and was designed so that it could be used in the terminal station. Its distinguishing feature is the use of two turrets. All the lines terminate in both turrets, so that any desired division of the lines may be made between the two operators. Double-fused connections are made to the board, a valuable feature for repair work, as a line with damaged connections may be instantly thrown to the other side while repairs are made. The board can accommodate eighty lines, forty to a turret, and there is room for 500 lines.

There are eighty-five instruments on all the lines at present that are used for despatching purposes, forty-three of which are on the Long Beach road, where they are stationed a half-mile apart, so that a conductor will never have to walk farther than a quarter of a mile to get in communication with the despatcher.

This board also handles a private exchange system for the shops and offices of the mechanical superintendent with twenty-four instruments. These instruments are inter-communicating, so that conversations can be carried on among the shop men without disturbing the despatcher. Separate lines are also run to all the power houses and sub-stations.

While the telephone is generally regarded as the most suitable for electric railway despatching, it is quite significant that the Pacific Electric Railway Company has been experimenting with the telegraph, and the trials have been so satisfactory that the management feels warranted in adopting it. There has always been more or less trouble from induction on the interurban divisions, as telephone wires are carried on the same poles as the high-tension wires, and, of course, the induction would not affect the operation of the telegraph system. At the principal terminal points where the business warrants the employment of an agent, it is figured that this agent could serve as a despatcher or trainmaster, as it is easy to procure men who are telegraph operators. On occasions, such as frequently occur at Long Beach when large crowds have to be handled in a few minutes, it is necessary to despatch cars every 3 or 4 minutes. By the present method the conductors take considerable of their time in communicating with the despatcher, frequently delaying the starting of their cars. This would be avoided to a large extent, it is thought, by the aid of a trainmaster, who would report the times of the cars by telegraph. If the telegraph is adopted it will be used in conjunction with the telephone system for the smaller terminal stations as at present.

An extensive telephone and telegraph system is to be constructed by the Los Angeles-Pacific Railroad Company. It will cover 135 miles, and many stations will be established along the Santa Monica and Hollywood lines. It is officially stated that the contract will be awarded to the Postal Telegraph Company. The company already has a telephone system in operation.

ELECTRIC RAILWAYS OF OHIO

Ohio has made tremendous gains in electric railway mileage during the past three years. In the STREET RAILWAY JOURNAL of Aug. 3, 1901, the writer presented an extended article detailing the development of electric railways in the State up to that time, and in connection with the article was a map showing the lines in operation, under construction and contemplated. At that time the writer estimated that there were in operation 898 miles of city lines and 868 miles of interurban lines. The roads under construction totaled 1435 miles, while it was estimated that rights of way and franchises for 4800 miles had been obtained.

Since 1901 a transition very similar to that which took place in the promotion of steam roads during the early 50's has been taking place. A large number of projects have fallen through, and there are grades in a number of portions of the State that will probably never carry cars. The map presented at that time showed a number of parallel routes, where rival promoters were actually building roads. These situations have been changed either by consolidation or the withdrawal of one of the contestants. Over one route at one time there were three companies actually at work on grades. The grades are still there, but the projects have all been abandoned—a case where stubbornness spoiled the game for all concerned.

The Everett-Moore embarrassment, which occurred early in 1902, had a most disquietening effect upon the electric railway situation all over the Central West. Not only were the building operations of this important syndicate wholly suspended and the immense system badly disrupted, but the crash was felt by all other operators in this district. Financiers became wary of all new electric railway propositions, while even syndicates that had capital and prestige decided it would be wiser to pause and develop the properties already built and under construction, before starting other projected roads. The situation was just clearing from this set back when there came another and worse —the financial depression which was accompanied by a decline of all stock values and the tightening of the purse strings by the Eastern bankers, who heretofore had furnished much of the capital for the new propositions.

But despite all these retarding influences the building of electric railways in Ohio has progressed with surprising strength. Instead of 1766 miles of operating city and interurban roads, as in 1901, there are now in operation 2917 miles of road. Not as great a gain as the estimated mileage apparently under construction in 1901, but still a handsome one in view of conditions. The new mileage includes twenty-five new companies, some of which are engaged on extensions at the present time. It is safe to say that the close of this year will see 3500 miles of electric roads in operation, since fully the required increase is well under construction at the present time, making no allowance for a number of propositions which the promotors claim to have financed. The roads under construction include two third-rail lines, the first in Ohio; one of these will be placed in operation within ninety days. The other is being designed for handling heavy freight, and will open up extensive coal fields, marking an interesting departure in electric railroading.

Probably two-thirds of the projected roads of 1901 have not materialized, and the majority of them are dead issues. Within the past few weeks the promotion of new lines seems to have taken on new impetus, and a number of projects are now in the field that seem promising of success, for, despite the tight money market many financiers seem to be taking a new interest in the industry.

It was pointed out in the previous article that one of the chief aims of the promotors at that time seemed to be the building up of through lines connecting up the leading centers of population. Ohio is peculiarly well adapted for trans-State lines. Approximately square, it has a city of over 150,000 in three of the four corners, with a fourth large city, the capital, approximately in the center. The earlier propositions were designed to take business into these centers. Gradually the lines have been extended until in some cases they have been connected, and the possibilities of through traffic from center to center have lately become apparent. The majority of the propositions now under construction and projected aim to cover the untracked gaps, and the work is fast being carried out.

Reference to the map here presented indicates that it is now possible to travel practically across Northern Ohio, there being an unbroken string of lines from Westfield, N. Y., to within a few miles of the Indiana line. Limited cars, giving service equal to that of the parallel steam road, now operate between Cleveland and Toledo. Roads under construction will soon give through connection from Buffalo to Chicago, closely paralleling the Lake Shore & Michigan Southern Railway (steam). Lines under construction and projected give promise that there will soon be three distinct electric routes from Toledo to Cincinnati. Except for 40 miles, part of which is already graded, electric travel between these centers is already possible. Between Cleveland and Cincinnati about 50 miles remain untracked, while between Columbus, Cincinnati and Indianapolis people are traveling by electric car every day, and sleeping cars are soon to be operated between these points. A person desiring to travel from Indianapolis to Wheeling, W. Va., may cover three-fourths of the distance on electric cars, and the only break is covered by a steam road owned and operated by an electric railway syndicate, and this line is soon to be equipped with electricity. Across the north central portion of the State, touching Van Wert, Lima, Kenton, Bucyrus, Massillon, Canton and Salem, paralleling the main line of the Pennsylvania Railroad, is a chain of electric roads that is rapidly being connected up. Much work has been done in the Ohio Valley. Nine district roads are in operation, which if joined together would cover nearly one-half the distance from Cincinnati to Pittsburg. Nine-tenths of the distance from Cleveland to Pittsburg is tracked; in Ohio only 10 miles are lacking. Two-thirds of the route from Cleveland to Wheeling, W. Va., is in operation. Dayton and Fort Wayne, Ind., will be joined by two routes, the missing links in both routes being under construction.

In the previous article it was pointed out that several of the leading Ohio syndicates aimed to consolidate connecting properties and operate through trans-State lines. The financial conditions of the past two years have effected these plans to a considerable extent. At the time of its embarrassment, the Everett-Moore syndicate lost control of the Cleveland, Painesville & Ashtabula Railway (6), the Canton-Akron Railway and the Canton-Massillon Railway (24), the Eastern Ohio Traction Company (2), the Scioto Valley Traction Company (74), the Detroit & Toledo Shore Line, now a steam road, and the Cleveland Electric Railway, the Cleveland city system, thus destroying, for the time being at least, its aims for through systems. However, the Everett-Moore interests still control the largest mileage of any syndicate operating in the State. The lines are as follows: Northern Ohio Traction & Light Company (1), Lake Shore Electric Railway (4), Cleveland, Painesville & Eastern Railway (5), Maumee Valley Railway & Light Company (16), and the Toledo Railway & Light Company, in Toledo, also the immense system of the Detroit United Railway Company in Michigan.

The plans of the Pomeroy-Mandelbaum syndicate for through lines have been blasted through the loss of control of the Cincinnati, Dayton & Toledo Traction Company (49), the keystone in its proposed line from Cincinnati to Toledo. This syndicate also appears to have lost control of the Miami & Erie Canal Transportation Company (51), which has a line on the canal bank, completed from Cincinnati to Toledo, but which

is now in the receiver's hands and its future shrouded in doubt. Control of the Springfield & Xenia Traction Company (43), and the Tuscarawas Traction Company (26), has also been sold by the Pomeroy-Mandelbaum interests; both of these lines figured in trans-State plans. The Ohio lines still in control of the Pomeroy-Mandelbaum people are: The Cleveland & South-Interurban Railway (52), and control the Miami & Erie Canal Transportation Company (51).

Tucker-Anthony & Company have a large mileage in operation, and by building 50 miles of road they will be enabled to operate through cars from Cleveland to Columbus, in connection with the Northern Ohio Traction & Light Company (1).

western Traction Company (3), the Ohio Central Traction Company (22), and the Western Ohio Railway (21).

The Cincinnati Traction Company interests, generally supposed to be backed by the Elkins-Widener syndicate of Philadelphia, are now figuring strongly in Ohio properties. They now control the Cincinnati, Dayton & Toledo Traction Company (49), and appear to be planning to connect this with their Indiana properties. They operate under lease the Cincinnati Their lines are as follows: Canton-Akron Railway (24), Canton-New Philadelphia Railway (25), Columbus, Newark & Zanesville Traction Company (33), and the Newark & Granville Railway (39).

The Appleyard system in Ohio, which is about to be consolidated into the Ohio Union Traction Company, includes the following operating roads: Columbus, London & Springfield Railway (38), the Columbus, Grove City & Southwestern Rail-

way (37), the Dayton, Springfield & Urbana Railway (40), the Urbana, Bellefontaine & Northern Railway (41), the Springfield & Western Railway (42), and the Central Market Street Railway, in Columbus. The syndicate owns the Ohio River & Western Railway (75), and the Dayton, Lebanon & Cincinnati Railway (76), steam roads which are to be equipped with electricity, and is building the Kenton & Southern Railway (68). In connection with the Tucker-Anthony interests the Appleyard people, speaking generally, aim to operate through trains between Cincinnati, Columbus, Cleveland, Pittsburg and Toledo.

The Winters-Clegg syndicate holds a strong position in any through lines that would pass through Dayton. In addition to controlling the City Railway and the Oakwood Street Railway, commanding entrance to Dayton, it controls the Dayton & Troy Railway (45), operating north, and the Dayton & Western Railway (48), operating west from Dayton, the latter connecting with a line operating to Indianapolis.

The Allen-Stone syndicate, of Cleveland, is figuring largely in the chain of lines that is paralleling the Lake Shore & Michigan Southern Railway, between Buffalo and Chicago. It is operating the Cleveland, Painesville & Ashtabula Railway (6), and the Toledo & Western Railway (14), and is building roads along this route in New York and Indiana.

Although not represented in trans-State plans the Scrugham syndicate, operating the Interurban Railway & Terminal Company (54), has one of the largest interurban systems in the State.

The eight syndicates above mentioned, with the Andrews-Stanley syndicate controlling the Cleveland Electric Railway, of Cleveland, together with the interests controlling the Columbus Railway & Light Company, operate about 1700 miles of road in Ohio. A recapitulation of the mileage of these interests follows:

Name	Interurban	City	Total
Everett-Moore	272	195	414
Elkins-Widener	141	226	367
Pomeroy-Mandelbaum	250	...	250
Andrews-Stanley	...	220	220
Tucker-Anthony	163	20	183
Appleyard	142	16	158
Winters-Clegg	80	40	120
Allen-Stone	110	...	110
Columbus Railway & Light	8	98	106
Scrugham	101	...	101

The gross earnings of electric roads for the year ending April 30, 1903, according to reports filed with the Auditor of State, these being the latest figures obtainable, were $18,927,-250. Of course, this is on a considerably smaller mileage than is in operation at the present, since a number of roads were placed in operation last year, and their earnings did not figure at all in this total. It should also be considered that several roads were placed in operation late in 1902, hence, did not figure for an entire year, neither were they up to their full earning power, on account of only partial operation in many cases. But it is safe to say that Ohio roads earned $20,000,000 in 1903.

It is manifestly impossible to separate the earnings of the city roads from those of the interurbans, because a number of companies operate and figure both together, but it is interesting to note that as, indicated by the following table, the city roads of the five leading cities of the State, with less than one-fourth the total mileage, earned over one-half the total gross receipts:

City	Earnings	Mileage
Cleveland	$4,500,000	220
Cincinnati	3,500,000	210
Toledo	1,500,000	102
Columbus	1,200,000	106
Dayton	785,000	63
Total	$10,985,000	701

The handling of freight and express is beginning to prove quite an important item in the earnings of some of the electric roads of Ohio, but as a general proposition it can only be considered as being in its infancy. Forty-one companies engaged in either one branch or the other during the year ending April 30, 1903, and the total receipts from both sources were $343,735. The largest earnings were made by those companies that handled freight at freight rates, rather than express, which tends to refute the growing impression that the earnings are larger where goods are handled as express at express rates. The showings of some of the best of the freight and express handling roads are shown in the accompanying table:

Name	Gross	Freight	Express	Both
Fairfield Tr. Co. (Lancaster)	$10,600	$5,200	......	......
Eastern Ohio Traction	197,000	44,000	......	......
Toledo & Western	122,000	23,000	......	......
Cincinnati, Dayton & Toledo	482,000	2,700	$11,000	......
Clev., Painesville & East	231,000	......	10,000	......
Cinci., Georgetown & P'tsmouth	130,600	87,500	10,200	......
Clev. & Southwestern Tr. Co	382,700	10,000	7,200	......
Col., Buckeye Lake & Newark	130,500	......	3,600	......
Col., London & Springfield	119,900	......	3,200	......
Col., New Albany & Johnstown	21,600	1,900	......	......
Dayton, Covington & Piqua	54,200	2,300	......	......
Dayton & Northern	96,900	9,300	......	......
Dayton, Springfield & Urbana	195,600	......	11,350	......
Dayton & Troy	117,700	4,700	......	......
Dayton & Western	80,200	7,400	......	......
Dayton & Xenia	98,900	3,500	......	......
Lake Shore Electric	494,000	26,200	4,700	......
Mahoning Valley Railway Co	411,000	12,200	......	......
Maumee Valley Ry. & Light Co	75,300	3,800	......	......
Newark & Granville Railway	63,500	1,300	......	......
Northern Ohio Tr. & Lt. Co	727,000	......	......	$15,800
Ohio Central Tr. Co	60,700	1,500	......	......
Ohio River El. Ry. & Power Co	45,400	......	......	2,900
Canton-Akron Railway	293,000	......	2,900	......
Pennsylvania & Ohio Railway	73,000	......	2,200	......
Tiffin, Fostoria & Eastern	47,400	......	......	3,100
Toledo, Fostoria & Findlay	59,000	2,064	......	......
Tuscarawas Tr. Co	56,800	2,500	......	......
Western Ohio Railway	121,000	......	3,800	......
Youngstown & Sharon	112,200	......	......	3,700

OPERATING ELECTRIC RAILWAYS

The following is a list of the electric railway companies of the State. The numbers which appear before the names of the companies refer to the index numbers on the map on page 407:

1 Northern Ohio Traction & Light Company....Akron
2 Eastern Ohio Traction Company....Cleveland
3 Cleveland & Southwestern Traction Company....Cleveland
4 Lake Shore Electric Railway Company....Cleveland
5 Cleveland, Painesville & Eastern Railway Company....Willoughby
6 Cleveland, Painesville & Ashtabula Railway Company....Painesville
7 Ohio & Pennsylvania Railway Company....Ashtabula
8 Ashtabula Rapid Transit Company....Ashtabula
9 Conneaut & Eastern Traction Company....Conneaut
10 Pennsylvania & Mahoning Valley Railway Company....Youngstown
11 Youngstown & Sharon Traction & Light Company....Youngstown
12 Toledo, Port Clinton & Lakeside Railway Company....Toledo
13 Detroit, Monroe & Toledo Short Line Railway....Monroe
14 Toledo & Western Railway Company....Toledo
15 Toledo & Indiana Railway Company....Toledo
16 Maumee Valley Railway & Light Company....Toledo
17 Toledo, Bowling Green & Southern Traction Company....Findlay
18 Lake Erie, Bowling Green & Napoleon Railway Company..Bowling Green
19 Toledo, Fostoria & Findlay Railway Company....Fostoria
20 Tiffin, Fostoria & Eastern Electric Railway Company....Tiffin
21 Western Ohio Railway Company....Lima
22 Ohio Central Traction Company....Galion
23 Mansfield Railway, Light & Power Company....Mansfield
24 Canton-Akron Railway Company....Canton
25 Canton & New Philadelphia Railway Company....Canton
26 Tuscarawas Traction Company....New Philadelphia
27 Stark Electric Railway Company....Canton
28 East Liverpool & Wellsville Street Railway Company....East Liverpool
29 Steubenville Traction & Light Company....Steubenville
30 Steubenville & Wheeling Traction Company....Wheeling
31 Consolidated Company....Cambridge
32 Columbus, Delaware & Marion Railway Company....Columbus
33 Columbus, Newark & Zanesville Traction Company....Newark
34 Columbus, New Albany & Johnstown Electric Railway Co....Columbus
35 Columbus Railway & Light Company....Columbus
36 Urbana, Mechanicsburg & Columbus Railway Company....Columbus
37 Columbus, Grove City & Southwestern Railway Company....Columbus
38 Columbus, London & Springfield Railway Company....Columbus
39 Newark & Granville Street Railway Company....Newark
40 Dayton, Springfield & Urbana Railway Company....Springfield
41 Urbana, Bellefontaine & Northern Railway Company....Springfield
42 Springfield & Western Railway Company....Springfield
43 Springfield & Xenia Traction Company....Springfield

44 Dayton & Xenia Transit Company....Dayton
45 Dayton & Troy Railway Company....Dayton
46 Dayton, Covington & Piqua Traction Company....West Milton
47 Dayton & Northern Traction Company....Dayton
48 Dayton & Western Traction Company....Dayton
49 Cincinnati, Dayton & Toledo Traction Company....Hamilton
50 Lebanon & Franklin Railway Company....Franklin
51 Miami & Erie Canal Transportation Company....Cincinnati
52 Cincinnati Interurban Railway Company....Cincinnati
53 Cincinnati, Lawrenceburg & Aurora Street Railway Company...Cincinnati
54 Interurban Railway & Terminal Company....Cincinnati
55 Cincinnati, Milford & Loveland Traction Company....Cincinnati
56 Cincinnati, Georgetown & Portsmouth Railway Company....Cincinnati
58 Ohio Valley Traction Company....Portsmouth
59 Wellston & Jackson Railway Company....Wellston
60 Camden Interstate Railway Company....Huntington
62 Ohio River Electric Railway & Power Company....Pomeroy
63 Parkersburg, Marietta & Interurban Railway Company....Parkersburg
64 Lorain Street Railway Company....Lorain
65 Victory Park Railway Company....Put-in-Bay

ROADS UNDER CONSTRUCTION

66 Cleveland & Sharon Traction Company....Cleveland
67 Youngstown & Southern Railway Company....Youngstown
68 Kenton & Southern Railway Company....Springfield
69 Toledo, Columbus, Springfield & Cincinnati Railway Company....Toledo
70 Fort Wayne, Van Wert & Lima Traction Company....Lima
71 Springfield, Troy & Piqua Traction Company....Springfield
72 Dayton & Muncie Traction Company....Dayton
74 Scioto Valley Traction Company....Columbus
77 Cincinnati & Columbus Traction Company....Cincinnati
78 Delaware & Magnetic Springs Railway Company....Delaware

STEAM ROADS TO BE ELECTRIFIED

57 Ohio River & Columbus Railway Company....Cincinnati
75 Ohio River & Western Railway Company....Woodsfield
76 Dayton, Lebanon & Cincinnati Railway Company....Springfield

PROJECTED LINES

79 Ohio & Michigan Railway Company....Toledo
80 Ohio Northern Railway Company....Wauseon
81 Fort Wayne & Northeastern Traction Company....Fort Wayne
82 Toledo & Fort Wayne Railway Company....Toledo
83 Findlay & Kenton Railway Company....Springfield
84 Findlay, Forest & Marion Railway Company....Forest
85 Cleveland, Ashland & Mansfield Railway Company....Cleveland
86 Mansfield & Eastern Railway Company....Cleveland
87 Warren, Cortland & Jefferson Railway Company....Cortland
88 New Philadelphia, Coshocton & Newark Railway Company....Newark
89 Sandusky Southwestern Railway Company....Wapakoneta
90 Dayton & Kenton Traction Company....Dayton
91 Indianapolis & Cincinnati Traction Company....Cincinnati
92 Columbus, Marysville & Bellefontaine Railway Company....Columbus
93 Perry County Electric Railway Company....New Lexington
94 Barnesville & Woodsfield Electric Railway Company....Barnesville
95 Lorain & Southern Railway Company....N. Amherst
96 Mansfield, Mt. Gilead & Delaware Railway Company....Mansfield
97 Lake Erie & Southern Traction Company....Toledo
98 Cleveland, Wooster, Mt. Vernon & Columbus Railway Co....Mt. Vernon
99 Felicity & Bethel Railway Company....Felicity
100 Mahoning Valley Western Railway Company....Youngstown
101 Mansfield & Mt. Vernon Railway Company....Mansfield
102 Indianapolis, Rushville & Cincinnati Traction Company....Indianapolis
103 Cincinnati & Suburban Belt Line Company....Cincinnati
104 Cincinnati, Toledo & Detroit Short Line Railway Company....Toledo
105 Lima & Kenton Traction Company....Akron

SCRANTON STREET RAILWAY COMPANY PURCHASES CULM BANK

The Scranton Railway Company has purchased the culm bank of the Richmond mine in Dickson City, and will carry the culm from this dump direct to the power house on Providence Road in big coal cars. The company owns a dump in the Notch, from which the culm is carried to the power house in wagons, but this proved an unsatisfactory arrangement.

It will not be necessary to erect a washery at the dump, as the boilers of the plant have been so constructed that they will burn unwashed culm. A chute, however, will be erected at the pile for the purpose of separating the rock from the culm, but further than that, it was stated at the company's offices that it will not be necessary to make any improvements.

East Lake, the summer resort of the Birmingham Railway, Light & Power Company, will be improved for the summer. An amusement company will furnish theatrical attractions. The railway company will build a new depot with different gates for embarking and discharging passengers.

TRANSFORMERS IN REPAIR SHOPS FOR TESTIMG ARMATURE AND FIELD COILS

Since the first article on the testing of motor armature and field coils, by means of an alternating-current transformer, appeared in the STREET RAILWAY JOURNAL of Nov. 1, 1902, great progress has been made in the application of this simple method of shop testing. Although the plans used in several shops have been described in a general way recently, it may be in order here to go into fuller particulars as to some of the latest and most perfect methods that have been worked out for testing motor armature and field coils for defects.

The principle upon which such transformer tests are carried on is by no means complicated. If a short circuited coil is placed surrounding an iron core, the latter being excited by an alternating magnetic field, the short circuit coil will act like a short-circuited secondary coil on any alternating-current transformer. That is, a large amount of current will flow in it, due to the fact that the alternating magnetic field induces an alternating electromotive force in the coil, and this alternating electromotive force will cause a current to flow in the coil whenever the circuit through the coil is closed. The alternating magnetic field for testing armature and field coils is derived from a laminated iron core, around which is wound a coil through which alternating current is passed.

One of the simplest and most easily manipulated form of core for testing armatures is that employed in the armature shop of the St. Louis Transit Company. The general scheme of operation of this core is shown in Fig. 1, and the dimensions of one of the cores are given in detail in Fig. 2. In Fig. 1 the laminated iron core is shown resting on the surface of the armature to be tested. The core is wound with a coil of wire which is energized from an alternating-current circuit. If we assume that the alternating current has been turned into the coil on the transformer core in Fig. 1, it is evident that an alternating magnetic flux will pass through the transformer core and also through the armature core which completes the magnetic flux as indicated by the dotted lines in Fig. 1. As long as the coils in the armature slots are on open circuit, as is the case on a wave-wound armature, when they are not short-circuited through defective insulation of some part of the circuit, no current can flow in the armature coils, although it is evident that an alternating electromotive force is set up in those coils surrounding the alternating magnetic lines of force caused by the transformer. All coils included between the pole pieces of the testing transformer are, of course, subject to this alternating electromotive force. If, however, there is a short-circuited armature coil in any position which surrounds the alternating magnetic lines of force flowing through the armature core, a current will be set up in that coil. Such a short-circuited coil is indicated in Fig. 1. Its presence will become manifest if the transformer test is continued long enough to overheat the coil. Since the coil is short circuited a large current will flow in it. There is, however, a much quicker way to determine the location of a short-circuited coil than this. The current flowing in the coil will tend to produce a magnetic flux across the top of the armature slot in which the short-circuited coil is located, consequently, a piece of iron held just above the short-circuited coil, as indicated in Fig. 1, will be strongly attracted to the armature core, and the position of the coil is at once known.

So much for the theory upon which the test is made, as which is probably familiar to most readers of this paper. In practice in the St. Louis shops the transformer core is of the dimensions shown in Fig. 2. It is hung from a block and tackle so that it can be quickly lowered on to any armature placed beneath it. In the St. Louis shops two cores are used, one for the larger 15-in. and 16-in. armatures and one for the 11-in. The same core does service on armatures of approximately the same size, as it is not necessary that the pole piece of the core fit abso-

lutely the surface of the armature core. The coil on the transformer core consists of twenty-eight turns of No. 6 wire. Alternating current is supplied to it from an 8-kw alternating-current generator, giving 110-volt, 125-cycle single-phase alternating current. This generator is direct coupled to a 500-volt motor. The current is turned on and off the transformer coil by a switch within easy reach of the operator making the test on an armature. In making a test the armature is placed on a truck, which is run under the testing core, and the latter is lowered onto the surface of the armature. The alternating current is turned into the transformer coil. The attendant then passes a piece of soft iron around those parts of the armature core, 90 degs. from the part included between the poles of the testing core. The presence of a short-circuited coil makes itself at once felt by the attraction of the piece of iron to the core.

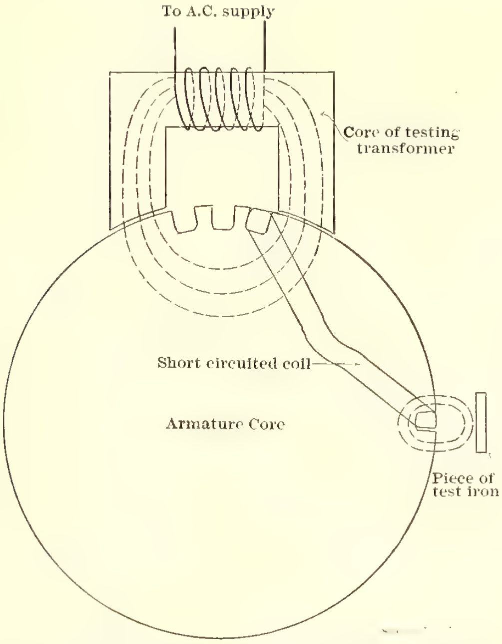


FIG. 1.—SCHEME OF TRANSFORMER TEST FOR SHORT-CIRCUITED ARMATURE COILS

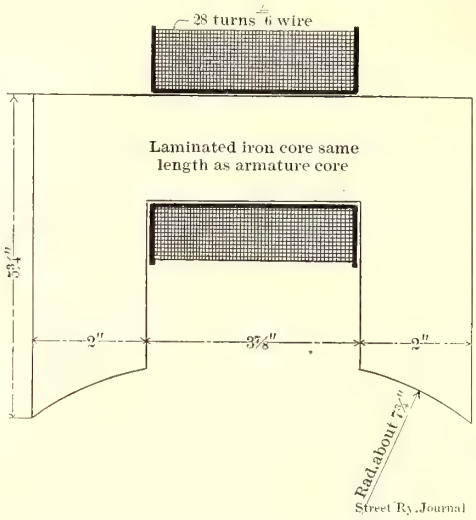


FIG. 2.—SECTION OF TRANSFORMER CORE FOR ARMATURE TESTS, AS USED IN ST. LOUIS

The test having been completed with the armature in one position, the attendant turns off current, and as a guide quickly marks with a piece of chalk the points of the armature core included between the pole pieces of the testing transformer. He then moves the armature core around to test another section of the armature, and so on until the entire armature has been tested, or, in other words, until every portion of the armature core has been brought between the pole pieces of the testing core. This test can be carried on very rapidly, and requires no special skill or delicate apparatus. In fact, it is the absence of delicate apparatus that recommends the transformer tests so strongly to practical electric railway shop men.

The testing of field coils for short circuits is carried on at St. Louis by the apparatus shown in Figs. 3 and 4. In this apparatus the transformer core has a hinged yoke across the top, which is counterbalanced by the cylindrical weight shown on the ends of the levers at the right. This top yoke is hinged and provided with a handle so that it can be raised, as in Fig. 3, to admit of placing the field coil to be tested on the core. After the coil has been put in position this top yoke is lowered as in Fig. 4. The coil of this transformer has seventy-eight turns of No. 5 wire. It is connected to the 8-kw, 110-volt alternating-current generator, from which the armature testing is done. Just above the transformer is a panel containing the switch which controls the circuit to this transformer coil and also an ammeter, which indicates the current flowing to the transformer. If there is no short circuit in the field coil which is being tested, the current flowing to the transformer coil will be so small as to be scarcely noticeable on the ammeter. If, however, there is a short circuit in the coil, even if it is but one turn, an appreciable current will flow, as indicated by the ammeter, and that one coil will shortly become red-hot. The counterbalance weight on the top yoke is arranged so that the yoke will remain either up or down, according to the way it is placed.

For testing armatures for open circuits, a plan used in the shops of the Metropolitan West Side Elevated Railway, in Chicago, gives quick and certain results. The armature is placed in a rack where it can be revolved by hand, and brush holders are mounted on this rack so that the brushes bear on the commutator, 90 degs. apart, just as on the ordinary railway motor. Alternating current is then passed from one brush to another and the armature is revolved by hand. If there is an open circuit in any of the coils it will be made manifest by flashing at the commutator between the bars where the open circuit is located. When the bars pass a brush in the Metropolitan

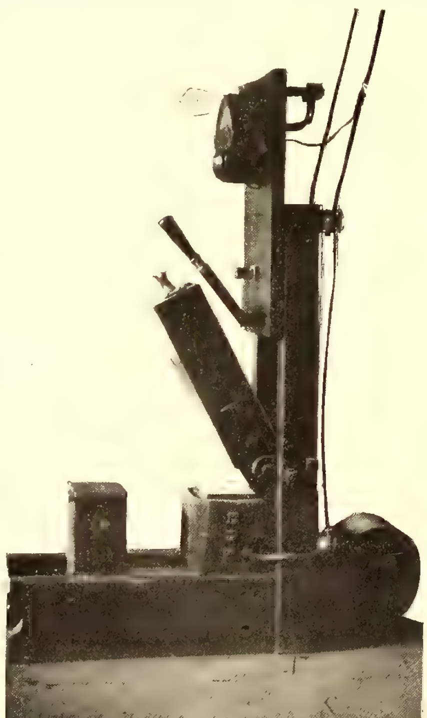


FIG. 3.—FIELD COIL TEST, TRANSFORMER CORE OPEN

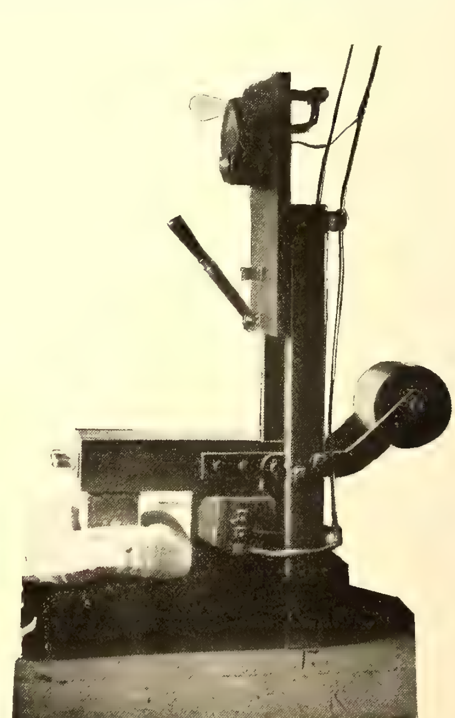


FIG. 4.—FIELD COIL TEST, TRANSFORMER CORE CLOSED

Elevated shops an alternating current of 250 amps. at 80 volts is passed through the armatures of G. E. 2000 motors. This current also serves to burn out any short circuits, due to pieces of copper or solder between commutator bars or short circuits

in armature coils. Either this test or the transformer test, before described, serves to burn out short circuits between commutator bars caused by small pieces of metal. Such short circuits will be burned out with a pop as soon as the current is applied, leaving the armature clear of such faults. The Metropolitan test is only useful when a large volume of current is passed through the armature.

A SUGGESTED NEW PLAN OF WORK FOR THE STREET RAILWAY ASSOCIATIONS

THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY
Milwaukee, Wis., Feb. 29, 1904.

Editors Street Railway Journal:

Most of your readers are probably aware that a movement is now on foot looking to the organization of an association of electric railroad "way" engineers and superintendents.

The numerous communications received to date indicate a general appreciation of the necessity for some such society, and tender a generous support for the association when formed.

It has been urged, however, that the isolation of this branch of the electric railroad business in another distinct organization is probably not the most effective method of handling the matter, and two other schemes have been proposed. The intention of this letter is to lay these propositions before the street railroad presidents, managers and other officials throughout the United States and Canada for their consideration and advice, and with the hope that definite opinions may be arrived at and sufficient interest aroused to guarantee the formation of some plan of action before the next meeting of the American Street Railway Association, and the due furtherance of such plan at that meeting.

The least radical and least comprehensive of the plans mentioned suggests a reorganization of the American Railway Mechanical and Electrical Association, under the name "American Society of Electric Railway Engineers," that society to include all the mechanical divisions of street railway work. Sub-divisions could then be effected, probably, as follows: "Rolling Stock and Shops," "Way and Structures" and "Power Houses," sub-committees being appointed to conduct each phase of the work. This plan would save the expense necessary to the formation of another distinct organization, and would serve to give the present organization much wider support.

However, it has been justly urged that the formation of these various distinct societies is gradually tending to strip the parent body (the American Street Railway Association) of all the functions for which it was organized. This is, of course, due in great measure to the fact that there has not been room, time or method in the meetings of that body to permit a satisfactory or thorough discussion of enough subjects in any one branch of the work. It may not be possible or advisable to extend the length of time of these meetings (that is a moot question), but it certainly does seem both possible and advisable to so change the method of these meetings as to make them thoroughly effective along all the lines embraced in electric railroading. It is, therefore, respectfully suggested that a reorganization of the American Street Railway Association, by the presidents and general managers representing companies therein, or who may wish to affiliate with such reorganized association, is possibly advisable.

The plan indicated and outlined in numerous letters received to date is approximately thus:

The association's active members to consist of owning or operating companies as represented by their presidents, general managers or other duly accredited representatives.

These active members to have full control of all executive matters and a general direction of the sub-divisions covering all the phases of the work.

The sub-divisions could be determined only after more thorough discussion, but would be approximately "Accounting," "Legal and Claims," "Transportation," "Way and Structures," "Rolling Stock and Shops," "Power Houses."

Each of the sub-divisions to constitute a sub-society represented in the main body by a vice-president, elected by the members of each sub-society. The active members to pay a small fee, and consist, as may be afterwards determined, of the persons having charge of that particular class of work on the electric railways affiliated with the main association.

This vice-president to appoint his committees, and the sub-association to carry on its work exactly as though it were a distinct organization, except that it will be under the general direction of the presidents and general managers constituting the parent body, at whose will all of the present organizations exist. The present accountants' association need not lose its individuality in any manner inconsistent with causes permitting its existence at this time. Sub-association meetings could be made to lap one another so that no one representing different departments need suffer. Thus the accountants and the way men might meet at the same time, as also the transportation and the power house men. The publication of the discussions would be information enough for those not directly interested, and methods could be devised within each sub-society that would tend to the maximum benefit within the minimum time. Papers should be published and distributed sixty days in advance of the meetings, discussions prepared, boiled down and methodically handled, sub-committee meetings held when necessary during the year, business handled by the various vice-presidents and sub-secretaries, so that each meeting of the reorganized association would be of such value to street railway work that no company could afford to remain unattached thereto.

An expression of opinion as to the above is earnestly solicited, in order that a plan of some kind may be decided upon. The necessity for some action which will give the "Way" men, the "Transportation" men and others whose work up to the present time has been neglected a chance to progress along lines similar to the two independent societies now in existence, is being widely recognized.

The scheme to reorganize the American Street Railway Association, as outlined above, has been suggested through letters received and opinions expressed by the following gentlemen, who are absolutely favorable thereto: John I. Beggs, president and general manager of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis.; S. L. Tone, vice-president Pittsburg Railways Company, Pittsburg, Pa.; C. D. Wyman, representing Stone & Webster, Boston, Mass.; R. B. Baer, president and general manager Galveston City Railway Company, Galveston, Tex.; J. F. Vail, general manager Pueblo & Suburban Traction Company, Pueblo, Col.; G. S. Kimball, chief engineer Boston Elevated Railway Company, Boston, Mass.; C. D. Emmons, general superintendent, Fort Wayne & Wabash Valley Traction Company, Fort Wayne, Ind.

Fred. S. Simmons,
Superintendent Construction and Maintenance of Way the Milwaukee Electric Railway & Light Company.

A bill has been introduced in the Ohio Legislature providing that in case of damage suits for personal injuries caused by electric cars, the company must turn over to the plaintiff the names of witnesses taken at the time by the crew of the car. Failure to comply shall be taken as evidence of negligence on their part. Another bill confers upon conductors and motormen of interurban cars the same police powers now enjoyed by conductors of steam railroad trains.

A COMPARISON BETWEEN DIRECT-CURRENT AND SINGLE-PHASE RAILROADS

At the meeting of the Cincinnati branch of the American Institute of Electrical Engineers, Feb. 16, W. A. Blanck, of the Arnold Electric Power Station Company, of Chicago, read a paper on "Single-Phase Railroads," which was also presented at the Chicago branch March 8.

By way of introduction Mr. Blanck says that in some sections of the country most of the best interurban railway propositions have been already taken up. There are, nevertheless, still a great many which would be profitable in case a system could be developed which would materially reduce the cost per mile. For some time the perfection of a single-phase motor has been suggested as the solution of this problem, since it allows great reduction in the cost of the transmission system.

In order to consider more in detail the relative merits of the alternating-current and direct-current systems of distribution from sub-stations, parallel computations and diagrams may be made for the case of a 60-mile single-track interurban road. The power house is assumed to be located at the center of the line, and to contain one sub-station, and that the four remaining sub-stations are located at equal intervals on the line. Although the alternating-current system would not require sub-stations at so frequent intervals, they are retained, as in the direct-current system, on account of the advantage to be derived from the sectionalizing of the line and the more advantageous distribution of power due to the larger number of feeding points. The schedule proposed consists of five local cars, having 1-hour headway, one express car, making the round-trip in 3 hours, and one freight and baggage car, making the trip between the two terminals in about 8 hours.

The average power required by the various cars in kilowatts will be as follows:

	Weight in tons	Schedule speed in m. p. h.	Watt-hours per ton mile	Kilowatt-hours per trip	Average power in kilowatts
Local car	30	25	80	144	60
Express car ..	35	42.8	110	231	165
Freight car ..	30	12.5	70	126	25

With the schedule outlined above, the average load on all five sub-stations will be about 500 kw, or 100 kw per sub-station, while the maximum load per sub-station, under certain conditions, is 450 kw, as when, for instance, the case arises that the express car is starting and two locals are running in one section. With a proper momentary overload allowance this assumed condition will require one 300-kw rotary converter per sub-station to be installed in the direct-current system. In the alternating-current system, however, a static transformer of 200-kw capacity per sub-station will be ample. The maximum load at the power house will be 800 kw, and two 400-kw units will suffice, if for the purpose of this comparative study no reserve capacity be provided either in power house or sub-stations. In both cases step-up transformers raise the total generator output to the high transmission voltage, and a step-down transformer set is placed in the power house. Although the power house sub-station could take its supply directly from the generators it was preferred to use one general form for all sub-stations, and thus avoid special switch arrangements.

For the three-phase transmission lines of the d. c. railroad system three No. 6 wires are assumed, and for the single-phase transmission line two No. 4 wires, costing, respectively, $10,000 and $11,500.

The proportions of the distributing system have been worked out along the following lines: For the direct-current system it was assumed the maximum drop of a car starting at its maximum distance from sub-stations should be approximately 200 volts, or about 30 per cent. This will be accomplished by installing two No. 000 trolleys and No. 0000 feeder capacity between sub-stations, and 500,000 circ. mils feeder for the stub ends. The cost of the copper under these conditions will be about $95,000.

For the alternating-current system the size of the trolley has been determined rather from mechanical than from electrical considerations. A No. 00 grooved trolley has been assumed installed throughout the length of the line, since for this class of service it is not practical to use a smaller size. The cost of the copper in this case will be $21,500.

In determining the drop for this system 80 per cent power factor has been assumed, and it will be noted that the maximum drop under the same conditions as above mentioned will be 190 volts between sub-stations, or 6.25 per cent, and 380 volts on stub ends, or 12.5 per cent, showing a very considerable advantage in favor of this system.

As to the motor equipment in the two systems, at present the alternating-current motor weighs somewhat more than the direct-current motor, and operates at a slightly lower efficiency. However, the smaller efficiency of the alternating-current motor is more than counterbalanced by the small percentage loss in the alternating-current distributing system. And, furthermore, with the rapid development now taking place in the alternating-current motor, it is safe to assume that in the very near future its characteristics as to weight and efficiency will soon equal those of the direct-current motor, thus making the advantage of the alternating-current railroad system still more evident.

An idea of the relative investments for the two systems may be best obtained by arranging in parallel columns the cost of the various items, as is done in the table below:

ESTIMATED COST OF THE ELECTRICAL EQUIPMENT OF A 60-MILE SINGLE TRACK INTERURBAN RAILROAD

Power House:—	D. C. System	A. C. System
Building	$10,000	$10,000
Foundations	2,500	2,500
Boilers and settings	12,000	12,000
Steam piping and covering	7,500	7,500
Engines	22,000	22,000
Generators: 2 400-kw	18,000	23,000
Exciters	1,000	1,000
Step-up transformers 800 kw	8,000	7,500
Switchboard	3,500	3,000
Wiring	3,000	2,500
Feed-water heater	800	800
Pumps	800	800
Coal storage	1,000	1,000
Smoke-stacks and flues	2,000	2,000
Fuel economizers	3,000	3,000
Stokers	3,500	3,500
Incidentals	4,400	4,400
Total	$103,000	$106,500
Sub-Station in Power House:—		
Building extension	1,000	600
Rotary converter, 300-kw	4,800	....
Transformer 300-kw; 200-kw A. C.	3,200	2,000
Switchboard	2,000	1,300
Wiring	1,000	500
Incidentals	600	200
Total	$12,600	$4,600
Forty-eight Miles Transmission Line:—		
Poles charged to trolley line	....	....
Copper	$10,000	$11,500
Insulators, pins and cross-arms	7,500	5,000
Erection	4,000	3,000
Incidentals	1,000	1,000
Total	$22,500	$20,500
Sub-Station Along the Road:—		
Building	$2,000	$1,000
Rotary converter	4,800	....
Step-down transformers	3,200	2,000
Switchboard	2,000	1,300
Wiring	1,000	500
Incidentals	500	200
Total	$13,500	$5,000

Four sub-stations	$54,000	$20,000
Trolley Line and Feeder:—		
Poles, 3,500	$17,500	$17,500
Poles distributed and set	4,000	4,000
Guys and anchors	2,000	2,000
Brackets with hangers	18,000	25,000
Copper, D. C.,		
Feeder, 12 miles, 500,000 cm; feeder, 48 miles, No. 0000; trolley, 120 miles, No. 000	95,000	....
Copper, A. C.,		
Trolley, 60 miles, No. 00	....	21,500
Feeder insulators	2,000	....
Erection	10,000	4,000
Incidentals	7,500	4,000
Total	$156,000	$78,000
Bonding of Rails:—		
Both rails bonded	$30,000	....
One rail bonded	....	$15,000
Cross bonds	2,000	1,000
Total	$32,000	$16,000
Rolling Stock:—		
Ten vestibule passenger cars each equipped with four motors and weighing about thirty tons	$75,000	$85,000
Two express passenger cars, equipped with four motors and weighing about thirty-five tons	18,000	20,500
Two baggage cars, each equipped with four motors and weighing about thirty tons.	10,000	12,000
Snow-plow and construction car	7,000	8,500
Total	$110,000	$126,000
RECAPITULATION		
Power house	$103,000	$106,500
Sub-station in power house	12,600	4,600
Transmission line	22,500	20,500
Sub-stations	54,000	20,000
Trolley line and feeder	156,000	78,000
Bonding	32,000	16,000
Rolling stock	110,000	126,000
Total	$490,100	$371,600

Cost per mile D. C. system .... $490,100 ÷ 60 = $8,168
Cost per mile A. C. system .... 371,600 ÷ 60 = 6,193

$1,955

The decrease of A. C. cost in terms of D. C. investment, 25 per cent.

The increase of D. C. cost in terms of A. C. investment, 32 per cent.

It is not necessary to take up in detail all the items, as they speak for themselves, but it may be of interest to note some items in which the costs vary more widely.

The single-phase generators, as would be expected, cost nearly 30 per cent more than three-phase generators, amounting to $5,000. Small savings on switchboard and wiring reduce the total for the power house $3,500 in favor of the direct-current system.

For the sub-station in the power house, principally on account of saving in converter and transformer capacity, the balance is $8,000 in favor of the alternating-current system.

The transmission systems are approximately the same, there being $2,000 in favor of the alternating-current system.

In the alternating-current distributing system, while the suspension of the trolley is noticeably more expensive than in the direct-current system, on account of special insulators, the immense saving in copper gives a balance of $78,000 in favor of the alternating-current system.

The necessity of bonding but one rail effects a saving of $16,000 in favor of the alternating-current system.

A very liberal allowance has been made by placing the cost of the alternating-current motor equipments one-third in excess of that of the direct-current motor equipment; this, as above noted, is the present cost of alternating-current equipment, and without doubt in the near future this difference will be greatly reduced.

Mr. Blanck also takes up the practical details of construction of a single-phase alternating-current railway system, beginning with the type of motor to be used. He describes briefly the use of a single-phase synchronous motor on a locomotive, to drive a direct-current generator, which in turn operates direct-current motors to drive the car axles, as proposed by H. Ward Leonard and as worked out by the Oerlikon Machine Works. He also sums up the status of the other motors as follows:

The alternating-current series motor, as proposed by Lamme and Finzi, and manufactured by the Westinghouse Company, possesses all the characteristics of a direct-current series motor, and is, therefore, directly applicable to railroad work. The current passes in series through the field and armature, which latter is similar to the ordinary direct-current drum type armature with commutator. Since the series commutator motor cannot be operated at high voltage, it is necessary to use a step-down transformer in connection with a high-tension trolley, thus increasing the weight of the car equipment.

The repulsion induction motor, developed by Steinmetz and Schuler, and manufactured by the General Electric Company, shows in general the same performance as the straight-series motor, and can be fed directly from the high-tension trolley, since the armature is independent of the field. The current is induced in the armature by transformer action, and can be of any desired voltage. The brushes are short-circuited and placed at such angle as will give best running conditions.

Repulsion Series Motor.—The repulsion series motor, developed by by Winter and Eichberg, and built by the Union Electric Company, Berlin, Germany, is similar to the repulsion induction motor with the addition of a second set of brushes, displaced 90 degs. from the short-circuited brushes. Through these brushes current is supplied by a series transformer, for the purpose of decreasing the sparking at less than synchronous speed, and at the same time securing the important additional advantage of raising the power factor nearly to unity.

Controllers.—In general, the operation of the last three motor systems is effected by master controllers operating suitable contactors to get the desired combinations. Induction regulators are used in all three cases to secure the voltage variation necessary for speed control, thus avoiding the losses consequent to the rheostatic control of the direct-current system.

Car Wiring.—In order to protect passengers and crew from the high potential used in this system, it is necessary that the wiring should be done in metallic conduit; this should be connected to the trucks so that any defect in the insulation of the circuit will result in the tripping of the automatic circuit breaker in the car. Moreover, it will be necessary to insulate the steps and hand-rails to guard the passengers from shocks, which might result from wet weather or car standing on a dirty rail.

Trolley Bow.—With the high-tension working conductor it is necessary to provide against any possible short-circuiting of the trolley and its suspensions. On account of the serious results which would follow the slipping of the trolley pole, so common in the present system, a suitable bow must be used instead. It should be of such length that no manipulation will be necessary in reversing the car. This trolley bow is mounted on a well-insulated platform on the roof of the car, which also supports the springs necessary to maintain the requisite pressure between the bow and the trolley wire. A small air cylinder, mounted on the same platform, operated by compressed air from the brake system, should be so connected as to lay the bow flat on the roof of the car, in case the necessity arises to temporarily disconnect the bow from the trolley.

The contact part of the bow can be made either of soft copper or aluminum, and the necessary lubrication is accomplished by

grease, applied in a slot extending the length of the bow.

The bow trolley in use on the Valtelina road, in Northern Italy, with a working pressure of 3000 volts, consists of copper cylinders rolling in insulated ball bearings. Brushes take the current from these revolving cylinders to the steel tubes carrying the contact piece.

Trolley Line Construction.—Great care must be given to the construction of the high-tension trolley line in order to avoid damage to life and property. Notwithstanding the prevalent idea that the danger of these high-tension trolleys will handicap the development of alternating-current railroads operated over public property, there is no reason why they should not be made as safe as the high-tension distributing systems of lighting companies, now so common on public property. It is of first importance to provide such a hanger as shall readily withstand the working pressure of the system, and can be easily replaced in case of mechanical or electrical defect.

The trolley construction on the Lansing, St. Johns & St. Louis, equipped for the Arnold experiments, was then described (see STREET RAILWAY JOURNAL, Jan. 2, 1904), and also a trolley line construction similar to that used on the Valtelina Railroad. If the road passes along a public highway special precautions should be taken to avoid accident. One solution is to suspend the working conductor at intervals of about 10 ft. from two steel wires. In case of mechanical break in the trolley wire the end cannot reach the ground or injure passers-by. This construction increases the carrying capacity of the trolley with but slightly greater investment. A construction somewhat similar to this is in use on the single-phase railroad near Berlin.

In regard to rail return, with the proposed frequency of 25 cycles per second, and the small current required with the higher voltage, this portion of loss will be even smaller than in direct-current work, so that for normal interurban service it will be sufficient to bond only one rail. This has the advantage (greatly to be desired in many cases) of leaving the other rail free for the purpose of block signals. Furthermore, the evils of electrolysis are completely avoided with the alternating-current system.

APPLEYARD SYNDICATE WINS IN TAX SUIT INSTITUTED BY COUNTY COMMISSIONERS

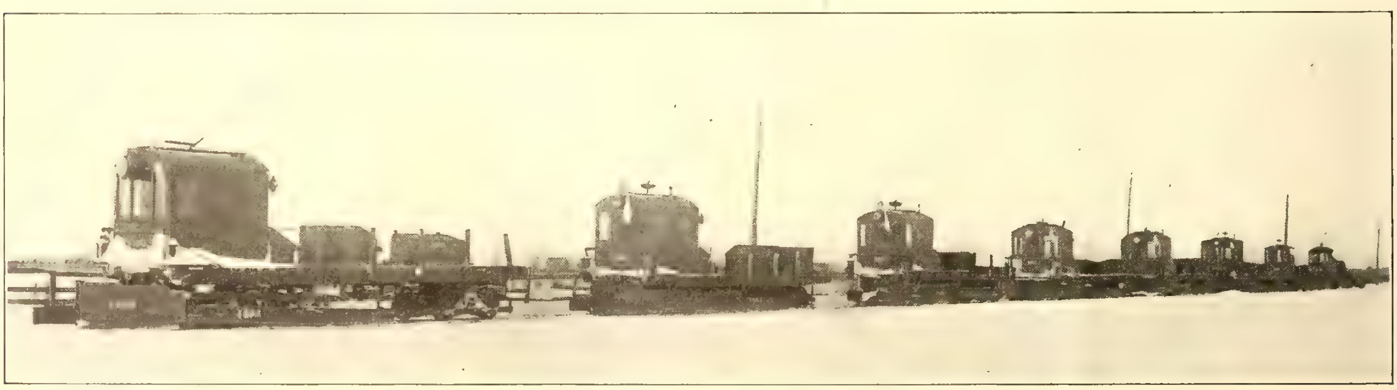
The Appleyard syndicate, owners of the Ohio River & Western Railway, a steam road operating from Zanesville to Wheeling, have been successful in the suit brought by the County Commissioners against the company to collect rental and back taxes of $70,000, claimed to be due on 7 miles of roadbed in Muskingum County. This civil suit has held up the plans of the syndicate for electrifying the road as planned. C. A. Alderman, chief engineer of the Great Northern Construction Company, which will rebuild the road, states that work is to start as soon as possible.

LARGE SNOW PLOWS IN DETROIT

The city and interurban system of the Detroit United Railway Company is so extensive that the provisions made for clearing snow necessarily have to be most complete. For the interurban lines, namely, the Rapid Railway, Flint, Pontiac, Orchard Lake and Wyandotte divisions, reliance is chiefly placed upon a number of large nose snow plows, which are of particular interest owing to the fact that the nose is operated pneumatically. The air cylinders are located directly over the plow, and can be seen in the engraving.

DETROIT SNOW PLOW AT WORK

The plow is set to the proper height by a turn-buckle in the bar connecting the plow with the horizontal bar joining the pistons of the two air cylinders. When in use the turn-buckle is so adjusted that about half the weight of the plow rests upon the track. When lifted up with air the plow is about 6 ins. from the track. The back ends of the large side bars, which are part of the frame of the plow, are pivoted at about the middle of the car. Each car and plow combined weigh about 24 tons. They are equipped with four G. E. 57 motors and an air compressor, and are also used as locomotives for handling heavy freight.



ROW OF ELECTRIC SNOW PLOWS

The side wings are about 18 ft. long, and are pressed out-

ward by a wheel at the rear of the vestibule. They have a movement outward of about 8 ft. The nose of the plow is fitted with a kind of rubber for taking the snow from the devil strip between two tracks, and which can be set to the right or left by a lever on top of plow. The company has erected a number of posts along the line to mark all gate and highway crossings in the track. When the operator notices one of these markers he raises his plow about 2 ins., until he is sure he is on the crossing, then he drops it immediately down on the rail. The boxes shown at the back of the car are for sand and salt.

One of the engravings shows car No. 1800 clearing a track on the Pontiac division of about 3 ft. of snow, and is from a photograph taken last month. The plows were designed by J. Kerwin, superintendent of tracks of the Detroit United Railway Company, and were built in the shops of the company.

SEMI-CONVERTIBLE CARS FOR KANSAS CITY-LEAVENWORTH RAILROAD

The Kansas City-Leavenworth Railroad Company has recently received four semi-convertible cars of the Brill patented type from the American Car Company, of St. Louis. As shown in the accompanying cut the cars have a combination of features making them suitable for both city and interurban service. The "Detroit" platform at the rear is distinctly a city car feature, while the enclosed vestibule, with motorman's cab at the forward end, gives the car an interurban character. The Brill 27-F trucks, on which the cars are mounted, carry the cars low and at the same time are capable of running 30 m. p. h. to 35 m. p. h. The platform steps are 17⅞ ins. from the rail-head, and from step to platform is 15 ins. The cars are furnished with transversely placed walk-over cane seats, seating thirty-five passengers. The interior view of the car gives an idea of the width of the aisle, maximum width being obtained by not having wall window pockets. The cars are 8 ft. 6 ins. over the posts at belt, which, allowing 2 ins. on each side for

INTERIOR OF KANSAS CITY-LEAVENWORTH CAR

the walls and 36 ins. for the seats, leaves the aisle 26 ins. wide. The window sills being extra low in this type of car, three-bar window guards, extending from corner post to corner post on either side, afford protection to passengers' arms when the sashes are raised into the roof pockets.

The motorman's cab in the vestibule is arranged similar to that of the cars of the Rapid Railway, of Detroit, recently built by this company. A partition extends at an angle from the vestibule corner post and is met with a swinging door hinged to

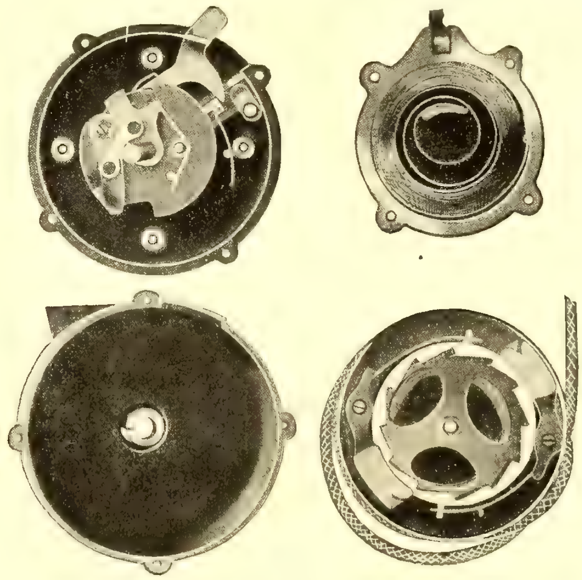
CAR FOR KANSAS CITY-LEAVENWORTH RAILROAD

the door post of the car. In the corner of the cab thus made a vertical brake wheel is situated.

The length of the cars over end panels is 25 ft. 4 ins.; over crown pieces, 37 ft.; from panel over crown piece at the forward end, 4 ft. 8 ins., and at rear end, 7 ft.; width over sills, 8 ft. 2½ ins., and over posts at belt, 8 ft. 6 ins.; from center to center of side posts, 2 ft. 8 ins.; thickness of corner posts, 3¾ ins., and side posts, 3¼ ins.; sweep of posts, 1¾ ins. The side sills are 4 ins. x 7¾ ins., plated with 12-in. x ⅜-in. steel, to which the posts are firmly secured, besides being strongly tenoned and strap-bolted. The end sills are 5¼ ins. x 6⅞ ins. The platform timbers are reinforced with angle-iron. Extra angle-iron knees at the center extend along the center body sills to a point well inside the body bolster. The floors are double, with mineral wool between. The trucks have a 4-ft. wheel base, 33-in. wheels, and are equipped with four 38-hp motors per car.

TROLLEY RETRIEVER FOR CITY AND SUBURBAN SERVICE

The Trolley Supply Company, of Canton, Ohio, has just completed its new Knutson retriever No. 3, the details of which



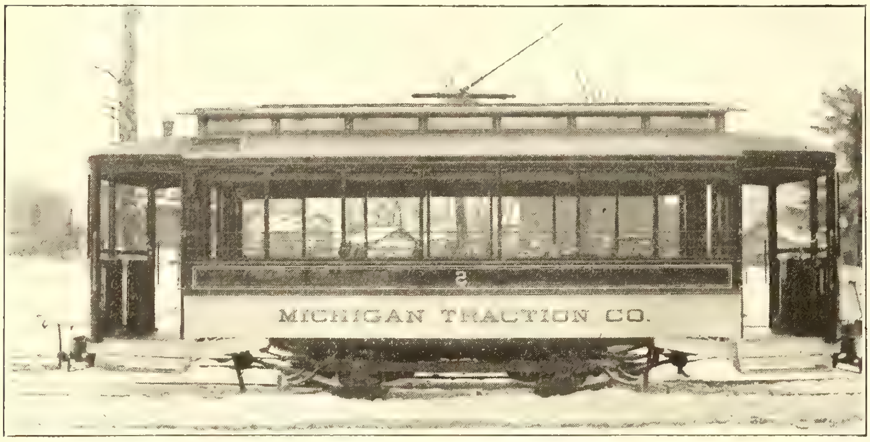
DETAILS OF TROLLEY RETRIEVER

are shown in the accompanying cuts, and claims that it is the best retriever it has ever put upon the market. Its retriever No. 2, which has been in general use for a long time, has been the medium through which the company has successfully established, in a practical way, the economic value of the retrieving principle in trolley catchers. Realizing the need for a smaller

and less costly retriever for city and suburban service, the No. 3 was built, and carefully experimented with for nearly half a year, until every chance of defective mechanism was eliminated.

Style No. 3 is 6 ins. in diameter, 7 ins. deep, weighs 18 lbs., and can be easily carried from end to end of car if desired. It is built upon the same mechanical principle as the No. 2, and the valuable feature of a retrieving mechanism that is set automatically without touching the machine has been preserved, a feature no other retriever is said to possess. The advantage of this is that when the retrieving mechanism is once set it cannot fail to act accurately, and there is no chance of its being rendered inefficient because of carelessness on the part of the operator. The mechanism is reset, after the trolley has jumped the wire and been retrieved, by allowing the trolley pole, slightly aided by the hand, to pull out rope till the wheel has been guided upon the wire, when the operator, by pulling out a few inches more of rope, brings the mechanism to a point where it locks itself automatically.

It is claimed in regard to devices that have to be set by pressing a button on the machine, that if the operator, in his hurry, puts the trolley back upon the wire without setting the retriever, it will, of course, not act; or, if he does not set it just right, it will retrieve too far, or not far enough, inefficient service being the result.



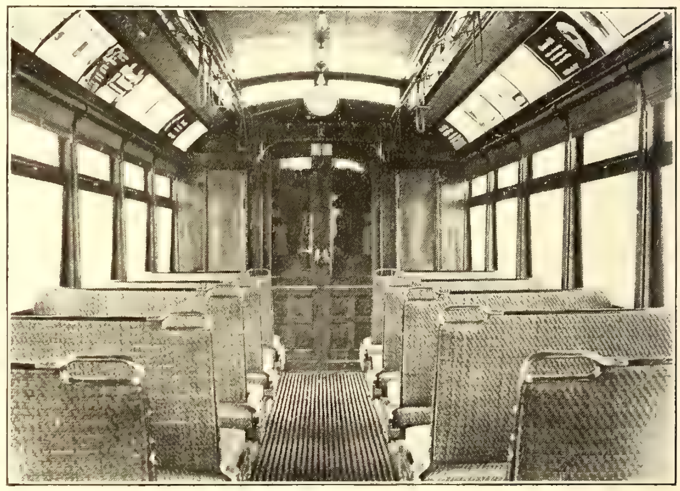
CAR READY FOR WARM WEATHER, WINDOWS DOWN AND VESTIBULES OPEN

SEMI-CONVERTIBLE CARS USED BY THE MICHIGAN TRACTION COMPANY

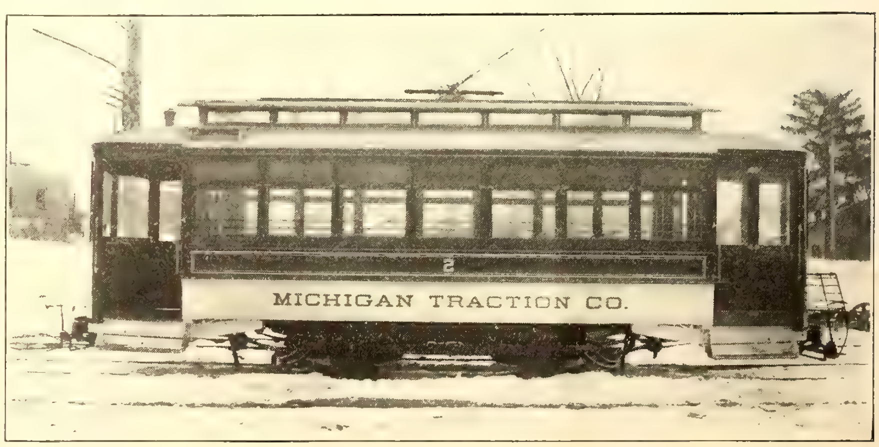
The accompanying cuts illustrate several semi-convertible cars that were built for city service in Battle Creek and Kalamazoo, by the John Stephenson Car Company, for the Michigan Traction Company. Fig. 1 shows the exterior of the car closed. Fig. 2 shows the car open for summer service, and Fig. 3 is a view of the interior.

The lines of both Kalamazoo and Battle Creek have been fully equipped with this type, and the old equipment formerly used has been discarded. The cars are 20 ft. 6 ins. over body, with 5-ft. platforms.

These cars are equipped with Brill 21-E trucks furnished with extension braces, Westinghouse 12-A-30 double motor equipments with platform circuit breakers, Consolidated Car Heating Company cross-seat heaters, Syracuse changeable incandescent headlights, Parmenter fenders, International registers and illuminated destination signs.



INTERIOR OF CAR USED BY THE MICHIGAN TRACTION COMPANY



CAR READY FOR COLD WEATHER, VESTIBULES CLOSED

CONVERTIBLE CARS OPERATED IN TORONTO

The accompanying illustrations show one of twenty-nine convertible cars built and operated by the Toronto Railway Company. The first car was constructed about a year ago, and in view of its satisfactory service during that time the railway company determined to build more. This type was designed by Michael Power, the company's master mechanic, and is controlled by the Convertible Car Company, of Toronto, Can.

The appearance of the car is in conformity with the general pattern adopted by the Toronto Railway Company. The car body is straight, all below the sashes being of 5/8-in. narrow-tongued and grooved hardwood, bevel-edged, stained and varnished a dark, rich natural color, ornamented with a gold striping. These strips can be kept in stock already stained and varnished, so when a car side is broken in collision with vehicles, the injured piece can be taken out easily and replaced. This method is claimed to be far superior and more economical than any other paneled or beveled construction. All the sashes are stationary and fixed in the movable side sections, and do not permit any possibility of drafts coming in underneath or around the sashes. This car, when closed, is unlike other convertible cars, in that there is nothing in the interior or exterior lines to affect the appearance, since no provision is necessary in the walls or roof for storage of the side sections. The only difference to attract attention is the stationary summer hand rails,

which remain permanent on the side posts behind the seat-back of the closed car. These rails, however, are so constructed as only to take up space which is occupied by the sash frame on the inside of the car. They do not interfere with the light of the car nor are they visible from the outside. The shades may be pulled down in a groove inside of the hand rails, and the winter sections placed in position without any interference. By using this construction the side of the car, when in the closed form, is not defaced by the removal of the hand rails.

As an open car this construction is said to possess all the features of the very best cars of that type. The seats, when converted, can always be used to ride facing the front. One small section of sash remains intact at each corner, so that proper anchorage may be obtained to prevent the wrack or straining which might possibly take place under certain conditions. The panel is, however, very low, and the narrow sash in each corner may be dropped to the car sill for summer purposes. The doors remain in position at the car ends, and in warm weather may be opened to allow freer ventilation. The removable side sections are made of ordinary seasoned wood, and are held in position by rounded iron buttons, made to conform or clip the iron band at the belt rail or sash bottom. These buttons are held in position by a sink bolt, the nut of which is imbedded in the car post. Above and adjacent to the car transom or sash top is fixed another type of button, in which rubber cushions are inserted in both ends, each of these ends bearing on the removable sections. The rubber is provided to keep a tension on the sections in the event of their becoming loose by reason of shinkage or from any other cause. These buttons are secured in the same manner as the other buttons.

INTERIOR OF TORONTO CONVERTIBLE CAR

These buttons present a very effective means of holding the sections in position and permit quick removal of the side sections at any time. It is not necessary to remove them from position at any time, it being only necessary to slack them for the removal of the side sections. While the car is in summer use the buttons are turned in an upright position on the posts.

The seats are of the cane or slatted type, so made as to be adapted for use longitudinally when the car is closed. Plush cushions, or any other covering, if desired, may be placed in these seats. The seats are made with solid metallic ends, strengthened by truss rods, which, when the car is open, are placed crosswise in the car, entirely dispensing with legs. This arrangement permits easy access to the motor trap-doors. The metallic ends prevent the seat ends from being damaged during conversion, and also permit bolting together whether the seats are placed longitudinally or crosswise. The short seats at each end of the open car and backing against the car have hinged backs, and are fitted with rubber buffers, so that they will not deface the woodwork of the car end when folded back.

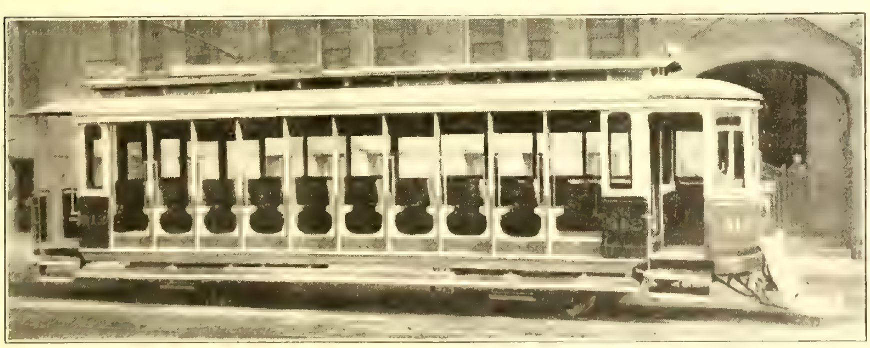
TORONTO CONVERTIBLE CAR, CLOSED

The floor of the car is slatted crosswise. The slats are fixed solidly to the floor and are easily swept. Provision for disposing of the sweepings is made by a small trap under the seat through which refuse can be discharged. The ends of the slats are reduced gradually flush to the floor, and offer no obstruction when the car is used as an open car.

Steel plates are used on the face of the car sills, to which are securely fitted malleable cast-iron panels, bolted through the car sills. On the face of these panels is a rim, which forms a slot into which the car posts pass. These, being bolted to the upright panel, pass down to the bottom of the car sill, and are securely bolted through the face of same, being also notched into the running board or top step, making the base extremely rigid. On the top of the posts are plates of unusual depth, which make a very stiff construction, being halved into the car posts and forming the top or outside panel.

In attaching the bottom step, "T" or angle-iron is used. It is securely bolted through beneath the car sill, projecting and supporting the top step and affording the attachment for the bottom or removable step, which is removed to convert the car to a closed car. The second step is interchangeable. The steps on back and front platforms are stationary, and are not removed to convert from closed to open car. The second step is necessary in double-truck cars, but where single, or maximum traction trucks, are used, one step is sufficient.

In Toronto, owing to close trackage, cars must be built with narrow body and wide track edge, consequently, double trucks have to radiate underneath the car sill, the wheels being of the highest diameter used on motor cars, namely, 33 ins. It is usually the case on ordinary standard gage roads that the trucks radiate between the sills, thus allowing the car body to run much closer to the ground than is



TORONTO CONVERTIBLE CAR, OPEN

Toronto under the foregoing conditions. The running board, when used on the closed car, acts as a guard to prevent the car-sides from being damaged by coming in contact with vehicles. It forms also a permanent rest for the removable sections.

The vestibule of this car is of special design and capable of standing great hardship from collisions. It is in the circular form, all the mouldings and belt rails being bent before ironing off.

The room required for storing the removable parts is very small, the space occupied by a single car being sufficient to store the side sections, seat backs, etc., of thirty cars.

NEW EQUIPMENTS FOR THE MILAN GALLARATE LINE

The train service of the Milan-Gallarate-Porto Ceresio Electric Railway, the third-rail Italian road which has been mentioned frequently in these columns, consisted initially of a motor car hauling a trailer, the motor car being equipped with four G. E. 55 160-hp motors, geared for a maximum speed of about 60 m. p. h. These equipments have been in service for about three years, but with the increase in traffic the company found it necessary to increase its rolling stock, and has added sixteen equipments with type-M control. They were supplied by the Cie d' Electricité Thomson-Houston de la Mediterranee, the Italian representatives of the General Electric Company, and the same type of motor is used as before, i. e., G. E. 55. Each motor car, however, now carries two motors, which enables the cars to be run either singly or in multiple, according with the demands of traffic.

Contrary to American practice the two motors of each car are not mounted on the same truck, but on separate trucks and on the outside axles, this arrangement being considered desirable by the railway authorities on account of the high speed, as it insures that the leading axle of the car shall always be heavily loaded.

The standard train consists, as formerly, of two cars, each capable of accommodating eighty passengers. The length of the new car bodies is 61 ft. over all, the distance between truck centers being 42 ft. 6 ins. The trucks are of specially heavy build, and follow the European design, having wheel base of 6 ft. 3 ins. An exceptional thickness of axle is used, being 6¼ ins. in the axle linings of the motor. The weight of each car, including electrical equipment, is 45 tons.

ONE RESULT OF OVERHAULING ACCORDING TO MILEAGE

On a large city system the practice was recently begun of overhauling motor cars according to the mileage they have run. Formerly they had been overhauled without regard to mileage. The change resulted in some revelations, which caused the mechanical department to decidedly change its policy as regards bearing metal. Formerly a cheap grade of bearing metal had been used, on the theory that it was more economical than genuine babbitt containing a high percentage of tin. As soon as it became necessary to determine just how many miles the cars were making before it was necessary to take them to the shops for armature bearing renewals, it became evident that high-grade babbitt metal was the thing to use.

Property owners along the route of the proposed Youngstown & Ohio River Railway, which was promoted by Max Goodman, of Cleveland, have brought action to have the conveyances set aside, because work on the line did not start at the time agreed upon. Construction of the line is being held up.

CONVERTIBLE CARS FOR SOUTH AFRICA

The J. G. Brill Company has lately shipped two of its convertible cars to Port Elizabeth, which is situated on Algoa Bay, on the southern coast of Africa, 425 miles due east from Cape Town. The city has a fine harbor, and is connected by steam lines with important cities of Cape Colony. A short distance back from the coast are high mountain ranges with foot hills extending to the water's edge. The lines of the tramway system are a series of grades, more or less steep. The cars are mounted on Brill "Eureka" maximum traction trucks, which it is claimed are particularly adapted to hill climbing. They are equipped with 35-hp motors, and have 33-in. driving wheels and 20-in. pony wheels. The climate is sub-tropical, with heavy rainfall in winter, so that by using cars of this type provision is made for every season of the year.

The cars include the solid paneling with cross bracing between the double corner posts and first side posts described in the STREET RAILWAY JOURNAL of Feb. 6, in an article on convertible cars for Spokane, Wash. This arrangement permits the use of longitudinal seats at the corners, accommodating three passengers each, and provides sufficient space near the doors to prevent crowding when the cars are closed. A somewhat novel feature is the use of folding seats hinged to the panels at the ends of the car body. Including the folding seats, each car has a seating capacity of forty-four. When the cars are open the entrances at one side may be closed by chain guards. The interiors are finished in dull cherry with bird's-eye maple ceilings. Spring cane upholstered seats are of the walk-over back type.

CAR FOR PORT ELIZABETH, SOUTH AFRICA

The cars measure 25 ft. 9 ins. over the end panels, and 34 ft. 3 ins. over the crown pieces; from end panels over crown pieces, 4 ft. 3 ins.; width over sills, including sill plates, 6 ft. 8¾ ins.; width over posts at belt, 7 ft. 3 ins.; from center to center of posts, 2 ft. 7 ins.; sweep of posts, 3½ ins.; size of side and end sills, 4¾ ins. x 7 ins.; sill plates, 8 ins. x ⅜ in. The corner posts are 3¾ ins. thick, and the side posts, 3⅜ ins. The cars are furnished with angle-iron bumpers, sand-boxes, platform and conductor gongs, folding gates, brake handles, radial draw-bars and other specialties of the builder's make.

A uniform has been decided upon for the special policemen who will be appointed by Police Commissioner McAdoo to guard the platforms at the points of congestion on the New York elevated roads. These men will be appointed from a list furnished by the Interborough Rapid Transit Company as soon as the Commissioner has finished his investigation into their character. They are to be paid by the Interborough Company. The uniform will be practically the same as that worn by the regular city policemen, except that instead of the city coat of arms on the helmets there will be a wreath, and the buttons on the coat, although of the same size, shape and color, will be plain instead of bearing the city coat of arms.

FINANCIAL INTELLIGENCE

WALL STREET, March 9, 1904.

The Money Market

The money position continues entirely satisfactory from the standpoint of the immediate future. Surplus reserve on Saturday, a week ago, reached the high level of the season—$32,000,000. It fell a little below $30,000,000 in the statement issued last Saturday. A year ago the surplus stood at the meagre total of $660,000, and two years ago it had sunk to $4,000,000. This comparison illustrates broadly the strength of the present situation as against that of the preceding years. The high state of the reserve has been brought about by several causes working in unison; first, the great increase in our credits in the foreign trade which has brought in a large quantity of gold, both from Europe direct, and from Australia and Japan; second, the decline in merchandise imports, which, by comparison with former seasons, has greatly reduced the current payments of the market to the government; third, the falling off in interior trade, which has acted both on the Treasury and the inland exchanges in such a way as to augment very largely the flow of currency to New York. In consequence of these several influences cash holdings of the local banks have been expanding steadily, until they have arrived now at a record total, and this movement has more than counterbalanced the record-breaking increase in bank loans. The loan account, after keeping relatively stationary during the latter half of February, rose again last week by $8,000,000. This was entirely due to the renewal of borrowing by the railroad companies, some of which, like the New York Central and the Missouri Pacific, have announced their intention of gradually providing funds for necessary expenditures by offering from time to time their notes for discount. Under the circumstances the bank surplus may be expected to fall during the next six weeks, and it is conceivable that the shrinkage may go far enough to cause some hardening of money rates. But the money market is exceptionally well-assured against any of the strain which is often witnessed in the early spring, by the unusually strong position of the bank reserve. The failure of sterling exchange to advance more than it has during the last week, must be taken to increase the probability that the Panama Canal payments will be handled without the export of gold.

The Stock Market

The stock market has changed very little in the fortnight since our last review was written. The Eastern war has developed nothing to indicate any more clearly when the end of the conflict may be expected. No decision has yet been handed down in the Northern Securities case. No new light has been thrown on the future tendency of trade throughout the country. In a word, the causes which have been paralyzing Wall Street's energies for so long, are present now with undiminished force. The market, on the whole, has behaved very well; that is to say, prices have not gone down in the face of the prevailing apathy and uncertainty, but on the contrary have in some cases improved. Liquidation has, to all appearance, pretty well ceased, and while there is no buying of any account outside the professional coterie, it has become evident to all practised traders that short selling at the present level is not a profitable operation. The market may be said to have reached a deadlock where substantial interests are equally unwilling to buy or sell, and where professional operators, living on one another's losses, afford the only diversion. Trading has been at the lowest ebb since the summer of 1900. Nobody expects that business will get out of the rut until some of the uncertainties just mentioned are cleared away. The Northern Securities verdict, because it promises to be decided ahead of the other questions of the day, is naturally attracting the greatest amount of attention. Nine-tenths of Wall Street believes the case will go against the company; still there is a strong feeling that, after the first shock of bad tidings is over, the market may shake off its lethargy and the larger interests take a more active part in the proceedings.

The declaration of an extra 1 per cent on Manhattan Elevated, while expected in well-informed quarters, nevertheless affords lively satisfaction. The only doubt now felt is lest the tunnel will take away enough traffic during the next year and a half to prevent anything more than a 6 per cent distribution, until the 7 per cent guarantee goes into effect in 1906. This, however, is the ultra-cautious. Nobody can be surprised, under present circumstances, that the stock holds as well in the market as it does. Metropolitan has felt the effects of scattered liquidation ever since the recent unfavorable statement for the December quarter. Brooklyn Rapid Transit has followed actively the fluctuations in the general share list, but it is said by people who should know that the recent buying has, on the whole, been better than the selling.

Philadelphia

Philadelphia has had a fairly good business in the traction stocks during the last two weeks, but prices have changed very little. Whatever speculative schemes might have been afoot have, of necessity, been postponed, owing to the unfavorable state of the general market. On the other hand, there have been no evidences of fresh selling in any quarter. Philadelphia Company common rose from 38¼ to 39, and fell back slowly to 38, the preferred fluctuated between 44 and 44½. Philadelphia Rapid Transit advanced from 14 to 14½ on unusually heavy trading. Ten thousand shares were traded in many of the orders coming from New York. In the late dealings, however, the stock lost all its gain on the sale of a few hundred shares. Philadelphia Electric was moderately active between 5¾ and 5⅞, Union Traction between 47½ and 47¾, and Philadelphia Traction between 97 and 97¼. American Railways fell from 44¾ to 44½ under scattering selling. Other transactions included a hundred Passenger preferred at 95, and odd lots of Pittsburg Traction preferred at 49¼, Fairmount Park Transportation at 24, and Consolidated of New Jersey at 62¼.

Chicago

Further liquidation has occurred in nearly all the traction stocks during the last fortnight, but as a rule prices have recovered from their lowest. On the sale of 300 shares North Chicago dropped from 67½ to 65, a new low record. Later the stock rallied to 70 on the purchase of a hundred shares. Two hundred shares of West Chicago sold at 40, also a new low price, but later 42 was paid for fifty shares. On the sale of a few odd lots, City Railway broke five points from 160 to 155. The feature among the elevated issues was Metropolitan preferred, which dropped from 47½ to 45 under heavy liquidation. This is the lowest figure at which the stock has ever sold. Dissatisfaction with the present management of the company is assigned as the cause of weakness, and it is expected that at the meeting in April a vigorous effort will be made to depose the directors. Of the other elevated stocks Lake Street has been traded in freely at 2, several hundred shares of South Side have sold at 92, and a few transactions have been reported in Northwestern common at 16¼, and the preferred at 47. Union Traction has held comparatively steady. There seems to be a better feeling all around regarding the outlook for the company, in the first place because of the belief that a favorable decision will soon be rendered in the franchise extension case, and in the second place because of the prevailing idea that the reorganization plan has now been fully worked out, and is only awaiting a more favorable occasion to be announced. It is said that the name of the company will be changed and placed under the control of the Chicago Railway Company, the concern incorporated in Springfield some months ago. The deal will be financed by Eastern capitalists. The entire debt of the underlying companies will be paid off at once, and the new securities of these companies will probably be placed on the guaranteed dividend basis.

Other Traction Securities

The Massachusetts Electric issues have been the active features in the Boston market of the last two weeks. The common stock was offered freely at one time, and broke from 18¾ to 16¾, but at the low level received good support and rallied to 18¼. The preferred fell from 74¾ to 72½, rallied to 74 and eased again to 73¼. The movement in both cases was accompanied by unusually large transactions. Boston Elevated was strong, advancing from 137¼ to 138½, relapsing later to 138¼. West End common held steady at 91, and the preferred at 109. Considerable interest was manifested in the opening of the Baltimore Exchange two weeks ago after its prolonged suspension following the fire. It was feared that the damage done to the property of the local street railway companies might cause considerable liquidation in the securities. These expectations were partially realized. On the first day of the new session United Railways income bonds fell to 49¾, a drop of 6 points from the last previous sale, and the lowest price of the

year. The stock lost a point and a half to 6¾, and the general mortgage 4s lost two points to 90. Sharp recoveries set in almost immediately. The incomes went back to 52½, the stock to 7⅞, and the generals to 91¼. From this level fresh declines set in, extending from 1 per cent in the stock to 1½ in both classes of bonds. Other transactions for the period comprise Baltimore City Passenger 4½s at 102½, North Baltimore 5s at 114, Anacostia & Potomac 5s at 90, Atlanta Street Railway 5s at 104¼, City & Suburban (Washington) 5s at 90¼, and Charleston Street Railway 5s at 103⅛. Scarcely any business has been doing lately in the traction specialties on the New York curb. Only twenty-eight shares of Interborough Rapid Transit changed hands all last week, this lot selling at 103. One hundred New Orleans common went at 8¾, and 150 preferred at 29¼. Brooklyn Rapid Transit 4s sold at 74 and Washington Railway and Electric 4s at 76 to 75¾. Five hundred St. Louis Transit sold yesterday at 9.

Detroit United featured in the selling at Cincinnati last week; about 425 shares sold during the week, opening at 62 and advancing to 63¾. Cincinnati Street Railway sold at an advance touching 136½; sales were small. Cincinnati, Newport & Covington preferred sold at 82 to 82½ on several lots, aggregating 300 shares. Two small lots of Miami & Erie canal sold at 8 to 9⅛. The future of this proposition is still very much in doubt. Cleveland Electric featured at Cleveland and gained two points, advancing from 72¼ to 74¼. The political outlook for this property seems to be improving, and offerings are few. Transfers were 400 shares; one sale being made for future delivery at 75½. Cincinnati, Dayton & Toledo is in demand, the inquiries seemingly coming from Cincinnati. It seems evident that some step will soon be made whereby the Cincinnati Traction interests will acquire this property, either by purchase or lease. Sales were 518 shares at 20 to 20½. Northern Ohio Traction was in some demand, 311 shares selling on an advance from 15⅝ to 15¾. Northern Texas Traction sold to the extent of 110 shares at 31. A block of the bonds sold at 81½. Monday another lot of these bonds sold at the same price. Cincinnati, Dayton & Toledo dropped to 19½.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with two weeks ago:

	Closing Bid Feb. 23	Closing Bid March 8
American Railways	44	43
Aurora, Elgin & Chicago (preferred)	a55	a54
Boston Elevated	137¾	138
Brooklyn Rapid Transit	38⅞	40¼
Chicago City	160	156
Chicago Union Traction (common)	4¼	5
Chicago Union Traction (preferred)	29½	30½
Cleveland Electric	71½	73
Consolidated Traction of New Jersey	62	62
Consolidated Traction of New Jersey 5s	105½	105½
Detroit United	60¼	61¾
Elgin, Aurora & Southern	—	—
Interborough Rapid Transit	101	102½
Lake Shore Electric (preferred)	—	—
Lake Street Elevated	2	1¾
Manhattan Railway	141	143¾
Massachusetts Electric Cos. (common)	18⅝	18½
Massachusetts Electric Cos. (preferred)	74½	73
Metropolitan Elevated, Chicago (common)	17	15¼
Metropolitan Elevated, Chicago (preferred)	47	44
Metropolitan Street	114⅝	113½
Metropolitan Securities	86½	82
New Orleans Railways (common)	8	8
New Orleans Railways (preferred)	29½	29
New Orleans Railways 4½s	79½	79
North American	82½	80
Northern Ohio Traction & Light	14¾	15
Philadelphia Company (common)	38	38
Philadelphia Rapid Transit	14	14
Philadelphia Traction	97	97
St. Louis Transit (common)	7	9
South Side Elevated (Chicago)	92	91
Third Avenue	119	120
Twin City, Minneapolis (common)	87½	87½
Union Traction (Philadelphia)	47¼	47⅛
United Railways, St. Louis (preferred)	52	51
West End (common)	90½	91
West End (preferred)	108	109

a Asked.

Iron and Steel

The principal incident in the iron market of the last two weeks was the meeting of iron ore producers, at which no agreement was reached regarding the schedule of prices for the ensuing year. Some interests contended for a reduction, others held out for no change, and the result now threatened is an "open" market, which will necessarily involve considerable disorganization for the trade in general. Next to this in point of interest was the purchase of 100,000 tons of pig iron by the United States Steel Corporation at an advance over the prevailing market quotations. This action has aroused a great deal of comment of one sort or another, but the impression in well-informed quarters is that this was done in order to steady the market, and in order to provide a more stable future for the manufacturing trade, a good part of which is arranged on the sliding scale system, and is therefore adversely affected by price changes in the basic material. Quotations are as follows: Bessemer pig iron $13.50, Bessemer steel $23, and steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 12⅜ cents, tin 27⅞ cents, lead 4⅝ cents, and spelter 4⅞ cents.

THE HEARING OF THE NINETY-NINE YEAR ACT CASE IN CHICAGO

The trial of the case to determine the rights of the Chicago Union Traction Company under the ninety-nine year act, which involves the authority of the company to occupy some of the most important streets, took place before Judge Grosscup, of the United States Circuit Court, and Judge Jenkins, of the United States Court of Appeals, at Chicago, March, 1, 2 and 3. The trial, however, failed to bring out any arguments which have not before been presented. The traction interests were represented by Attorneys J. S. Auerbach and Brainerd Towles, of New York, and W. W. Gurley, Henry C. Crawford and John S. Miller, of Chicago. The city was represented by David T. Watson, of Pittsburg, special counsel; John C. Mathis and Edwin Burritt Smith, attorneys for the local transportation committee of the City Council, and Corporation Counsel Tolman.

Briefly stated, the points in controversy are these: In 1865 the State Legislature passed what is called the ninety-nine year act. This act was for the avowed purpose of extending the charters and legal life of several of the street railway companies then operating and enjoying franchises on the streets of the city of Chicago. These companies were created originally under a special act of the Legislature in 1859 at the time they were incorporated. This act of the Legislature gave them charters for twenty-five years. These charters were extended ninety-nine years by the ninety-nine year act of 1865. The controversy has arisen because the city of Chicago maintains that the ninety-nine year act extended only the charters and corporate life of the companies named in the act and not the franchises. The companies have maintained that the act was intended to extend both the charters and the franchises enjoyed by the companies at the time the act was passed. The case, therefore, is a question of the interpretation of the act. The exact language of the ninety-nine year act is as follows: "All contracts, stipulations, licenses and undertakings made, entered into or given, and as made or amended, by and between the said Common Council and any one or more of said corporations, respecting the location, use or exclusion of railways in or upon the streets, or any of them, of said city, shall be deemed and held and continued in force during the life hereof as valid and effectual to all intents and purposes as if made a part, and the same are hereby made a part, of the said several acts."

The position taken by the attorney for the city in the trial of the case was that if it was intended that the franchises, as well as the charters of the companies, were to be extended ninety-nine years, it would have been expressly stated in the act and not left to be implied. They argued that, since the original act of 1859 creating these companies left the granting of franchises to the city of Chicago, it is therefore to be implied that the amendment of the act extending the corporate life of the companies, also left the granting of franchises to the city. David T. Watson, for the city, also called attention to the fact that the North Chicago City Railway Company is not mentioned in any way in the act, that its charter therefore expired in 1884, twenty-five years from its date of issue.

The attorneys for the company maintained that it was the intention of the act to extend the franchises. There were at the

time the act of 1865 was passed no restrictions on the Legislature which would prevent that body from making a perpetual franchise grant. This is a point which was denied by the city in its original argument. The traction attorneys further called attention to the investment which had been made on the strength of the action of the Legislature in 1865 and to the great injustice which would be done to investors if the rights to its property were now wiped out by an adverse decision.

It is expected that a decision will be handed down early in April. As the case will be appealed to the United States Supreme Court, it is unlikely that it will be settled before early in 1905.

RAILWAY OFFICIALS TAKE TRIP ON ELECTRIC SLEEPING CAR

A party of railway officials and bankers enjoyed a trip on one of the beautiful Holland palace sleeping cars Friday, Feb. 26. It was the initial trip into the city of Richmond of the car "Francis," named after the son of the general manager of the Holland Palace Car Company, Joseph W. Selvage.

This car is of the type described in the STREET RAILWAY JOURNAL of Aug. 15, 1903. It is furnished with ten compartments of twenty berths, or twenty chairs when the berths are not in use. The finish is in green, with chairs and carpet to match, contrasted with unique and brilliant brass trimmings and grille work, which, together with the mahogany inlaid panels, give a rich effect, especially when the electric lights are turned on. The car, which weighs about 50 tons, ran as smoothly as a Pullman, although this road is not as finely ballasted as a well-regulated steam road.

Notwithstanding that it was the first trip a speed of 50 miles was obtained. It was thought unwise to attempt a higher speed, though that was possible. The car was run over the Indianapolis & Eastern Railway Company, through the courtesy of the officials of that road, by a crew furnished by them, and over the Richmond Interurban Street Railway, whose officials gave personal attention to the comfort and convenience of the visiting delegation.

The Indianapolis party consisted of the following gentlemen: M. B. Wilson, president of the Columbia National Bank, and treasurer of the Indianapolis & Eastern Traction Company, H. F. Holland, president of the Holland Palace Car Company, A. K. Hollowell, vice-president; J. W. Selvage, general manager; Judge McCullough, general counsel; Charles N. Wilson, general manager of the Columbus, Greensberg & Richmond Traction Company, August M. Kuhn, director of the same company, together with several newspaper representatives, who were joined at Cambridge City by a delegation from Richmond. Dinner was served at Cambridge City, after which the car made the run to Richmond and was open for inspection to the public. Leaving Richmond at 4 o'clock, supper was taken at Knightstown, and the party returned to Indianapolis at 9 o'clock. Congratulations were extended to the officers of the Holland Palace Car Company, and the car pronounced a magnificent success.

THE EFFECTS OF THE BALTIMORE FIRE

A postscript to the annual report of the United Railways and Electric Company, of Baltimore, recites facts of interest in connection with the recent fire, such as the renewal of arrangements with the Baltimore & Ohio for current from its power house, pending repairs to the Pratt Street power house; also the resumption of operations by the Preston Street house, which, together with the Light Street and Falls Road houses and the alternating machinery in the new Pratt Street house, working through the sub-stations, are now furnishing current to the system. While the original Pratt Street house was seriously damaged, the three large engines and generators escaped with but little injury, and will soon be in condition for service. Owing to the fact that the company's transmission lines throughout the burned district are in subways, the damage was almost entirely confined to the destruction of poles and trolley wires, which are being rapidly restored.

The company has 32 of its lines in full or partial operation The revenue results are surprising for the amount of service operated. The expenses, other than those chargeable to the insurance companies, have been greatly reduced, so that the net results are well maintained. Owing to the great activity in building operations which must ensue, it is believed that the year will yet, from a revenue point of view, prove the greatest in the history of the company.

THE BOSTON & WORCESTER FINE WINTER SHOWING

The Boston & Worcester Street Railway, operating between Boston and Worcester, Mass., has made a fine record this winter. When fall came, the company arranged to cut the service between the cities from a half-hourly to an hourly schedule. It was soon found, however, that the demands of traffic would allow of no such reduction, and the schedule of a car every half hour. adopted when the road was placed in operation last summer, has been maintained throughout the entire winter. Despite the severe weather there were no serious interruptions of traffic, and on several occasions when the schedule of the steam railroad lines between Boston and Worcester was smashed because of the snow and ice, the electrics operated on time. The results are best shown by the earnings. The gross receipts for the six months ending Dec. 31, 1903, amounted to $166,547, the operating expenses were $80,715, leaving a net profit of $85,832. From the net profit the sum of $28,125 interest was deducted, leaving a surplus of $57,707, equivalent to 4½ per cent on the stock for the year, after charging against net earnings six months' interest on the bonds.

NEW OHIO ASSOCIATION

At a meeting of interurban railway managers held at the Phillips House, Dayton, Ohio, Feb. 29, preliminary plans were laid for the formation of an association to be known as the Ohio Interurban Railway Association. The meeting was called by F. D. Carpenter and J. H. Merrill, of the Western Ohio Railway, primarily for the purpose of effecting arrangements between the various roads centering at Dayton for interchangeable mileage. The various roads and the representatives present were as follows: Dayton & Troy Electric Railway, H. P. Clegg, general manager, E. R. Larter, superintendent, and C. M. Paxter, auditor; Dayton & Western Traction Company, Howard Fravel, superintendent; Dayton & Xenia Transit Company, C. J. Ferneding, president, and A. W. Anderson, superintendent; Dayton & Northern Traction Company, R. E. DeWesse, superintendent; Dayton, Springfield & Urbana Railway, E. B. Gunn, general superintendent; Dayton, Covington & Piqua Traction Company, E. W. Spring, general superintendent; Western Ohio Railway, F. D. Carpenter, general manager, J. H. Merrill, assistant general manager, R. H. Carpenter, general ticket agent; Cincinnati, Dayton & Toledo Traction Company, J. A. Boyer, auditor.

The situation was thoroughly discussed and the advantages of uniform cash fare and mileage rates were generally acknowledged. A canvass of the situation showed that cash fares ranged from 1¼ cents to 2 cents per mile with mileage rates from 1⅛ cents to 1½ cents per mile. One road had no mileage, while no two roads appeared to have the same rates of fare. The opinion seemed to prevail that an interchangeable mileage based on 1½ cents per mile should be adopted, but objection to this was made by a representative of the Dayton, Springfield & Urbana Railway on the grounds that his company is affiliated with the systems centering at Columbus, which have an interchangeable mileage based on 1¼ cents per mile. The question of permitting the use of mileage by several persons in one party was discussed, and it was voted to make the books good only for the parties in whose name they are drawn.

A committee composed of J. H. Merrill, E. B. Gunn, E. W. Spring, Howard Fravel and J. A. Boyer was appointed to prepare samples of interchangeable mileage. It was understood that any action taken at the meeting or by the committee was subject to the approval of the board of directors of the various companies.

The question of a permanent organization was then discussed, and the advantages of an organization similar to the New England Street Railway Club were pointed out. It was voted to call the organization the Ohio Interurban Railway Association.

Officers were elected as follows: H. P. Clegg, president; E. W. Spring, vice-president; J. H. Merrill, secretary-treasurer; E. B. Gunn, J. A. Boyer, R. E. DeWeese, H. Fravel and A. W. Anderson, executive committee.

It was the opinion of those present that the organization should be open to managers, superintendents, master mechanics, electricians and heads of departments of electric railways in Indiana, as well as Ohio. At a meeting of the executive committee to be held in the near future, a number of vice-presidents will be chosen, covering the various districts in Ohio and Indiana, and in this way a membership for the organization will be worked up. A general meeting of the organization is expected to be called soon.

MORE ADIRONDACK TROLLEY RUMORS

Following the announcement that the New York & Ottawa Railway, extending from Tupper Lake to Cornwall Bridge, was to be converted into an electric road, mention of which was made in the STREET RAILWAY JOURNAL of Feb. 27, comes the statement from Charles S. Taylor, proprietor of Taylor's-on-Schroon Hotel, that interests associated with the Delaware & Hudson Railroad Company are back of a project to build an electric railway from Warrensburg to Elizabethtown, N. Y.

In fact, surveys have been made for part of the distance, and Mr. Taylor's statement has been confirmed from another source equally trustworthy.

This line would be an extension of the Hudson Valley Electric Railway, running from Albany to Warrensburg, and would pass through the most picturesque part of the Adirondacks. The road would touch at Schroon Lake, North Hudson and other well known summer resorts, run east to Mount Marcy, and thence to Elizabethtown, according to present plans. The route is about 70 miles or 80 miles long.

An abundance of power could be secured from the Hudson River Water Power Company, which has within a year completed a big dam across the Hudson at Spier Falls, and is already supplying power for the Hudson Valley, Schenectady, Troy and Albany Railway lines, as well as for numerous manufacturing plants.

MEMORIAL TO JAMES WATT

The movement to erect a memorial statue to James Watt, the father of the modern steam engine, in Greenock, Scotland, on the site of the humble cottage where the inventor was born, is progressing very favorably. An American committee has been formed to receive contributions. Andrew Carnegie is chairman of this body, which is made up of the presidents of the four leading engineering societies, representatives from the different labor brotherhoods, and others. Theodore Dwight, of 99 John Street, New York, is secretary and treasurer.

It is the purpose of the committee to solicit and receive subscriptions in small amounts only and from many countries, as it is felt that the memorial should represent the contributions of the thousands who know and appreciate what the invention of the steam engine has meant to the material progress of the world. Those who desire to contribute, therefore, are requested to send any amount not exceeding $5 to the treasurer and accompany the contribution with an autograph. The latter is desired for transmission to Greenock, to show the number of the American contributions.

The United States has, probably, been the greatest beneficiary of Watt's labors, and the committee hopes that the response from this country will exceed that of any other country in point of numbers, as the number of subscribers is a greater tribute than the amount subscribed.

PORT CHESTER AND WESTCHESTER COMPANIES RENEW APPLICATIONS TO CITY COUNCIL OF NEW YORK

The New York & Port Chester Railway Company and the New York, Westchester & Boston Railway have renewed their applications to the Aldermen of New York for permits to cross streets in Bronx Borough in the construction of an electric railway.

Each company has tried to meet the conditions imposed by Mayor McClellan in his memorandum which accompanies the veto of the former grant to the New York, Westchester & Boston Road, although the methods of that company on its renewal and of the New York & Port Chester Company differ in details.

Both companies in the applications agree to pay the city for the permit, and both agree to construct all crossings over, or under, streets entirely at their own expense. The New York & Port Chester Company does not offer to pay any specific price for the franchise, but agrees to leave the matter to the board of estimate to fix the compensation. The New York, Westchester & Boston Company offers to pay the city annually 75 cents per lineal foot for crossing up to 60 ft. wide, and a proportionately larger sum for wider crossings.

In connection with the application of the New York, Westchester & Boston Company is a statement from Dick & Robinson, bankers, saying that $13,125,000 is ready for the work as soon as the grant is approved, and the assertion also is made that the road has no connection with the New York, New Haven & Hartford Road. The company agrees to construct its road so that traffic on the highways shall not be disturbed, to fence the road within the city limits, and to light it by electricity, and to charge 5-cent fares within the city limits, and to use electricity as a motive power.

The New York & Port Chester Company in its application agrees to build all structures at its own cost, such structures to be of a character to meet the approval of the Mayor and the President of the Borough of the Bronx. The company also agrees to stand all the expense of replacing water and sewer pipes and to restore disturbed streets to their original condition.

Both applications have been referred to the railroad committee.

FURTHER ALLIS-CHALMERS DEVELOPMENTS

Further developments with regard to the entrance into the field of heavy electrical machinery, as well as the development of steam turbines, hydraulic turbines, gas engines, etc., by the Allis-Chalmers Company, announced as the STREET RAILWAY JOURNAL goes to press, seem to indicate that the management is not yet at the end of the radical and decisive moves which are to be made under the new régime just entered upon.

One of the most important events within the past few days has been the conclusion of an alliance between the Allis-Chalmers Company and the Bullock Electric Manufacturing Company. It now appears that the Bullock Electric Manufacturing Company, of Cincinnati, which is a New Jersey corporation, has been leased by a new Bullock Company organized under the laws of Ohio. This new corporation is one in which the Allis-Chalmers Company is financially interested as principal owner, and it takes over the business of its predecessor as a going concern. In this manner the Allis-Chalmers Company is at once able to fill orders ranging throughout the entire field of direct-current and alternating-current generating apparatus. It is understood that the Bullock output now includes street railway motors, and that some of these have already been supplied to a road in Indiana. In this connection it is interesting to record that the new company has made a personal contract with President George Bullock, under whom the old company was vigorously and successfully built up, so that the administration of the company will remain unchanged, a contract having also been made with Mr. Neave for the retention of his services as vice-president.

In connection with the affairs of the Allis-Chalmers Company, itself, and its own internal management, it would appear that some vital and important changes are being made. The first and most noteworthy of these is the resignation of Charles Allis, whose wife has been ill, and is now proceeding to the Mediterranean under medical advice for an indefinite stay. Mr. Allis felt that under these private conditions he could not possibly give all the attention to the business of the company that its affairs demanded at this juncture, and preferred, therefore, to take this step. His place in the management is to be filled by B. H. Warren, formerly vice-president of the Westinghouse Electric & Manufacturing Company. It is also understood that Edward D. Adams, the banker, who has been identified with the company since its organization a few years ago, has consented to take the chairmanship of the executive committee. Mr. Adams will make his offices at the New York headquarters in the Empire Building and give a large amount of his time to Allis-Chalmers affairs.

It has already been stated in these columns that John F. Kelly, formerly of the Stanley Company, has been made head of the electrical engineering department of the company, with William Stanley, Jr., as consulting electrical engineer; and to this may now be added the fact that Mr. Kelly has begun his work and taken up affairs at Allis-Chalmers offices.

As a result of this deal with the Allis-Chalmers Company, the present capacity of the Bullock electrical works is to be enlarged. The first thing that will be done will be to erect another large shop, with an area of 40,000 sq. ft., where motors for street cars will be manufactured. This will mean the employment of about 400 more hands. It is the intention of the new leasing company to enter actively into the street car equipment field. The lease is for twenty-five years with the privilege of renewal for another twenty-five years on the same terms. It is expected that when the plants that are now under way have been completed the Bullock electrical works will give employment to from 2000 to 3000 hands.

While the papers in the deal have all been signed, the deal will not go legally into effect until after the stockholders of the present Bullock Electric Company have had their special meeting at Jersey City on Wednesday, March 16.

TEMPORARY TERMINAL FOR NEW BRIDGE IN NEW YORK

In a sincere effort to do his best to relieve congestion of traffic at the Brooklyn Bridge, and to provide a ready means of traffic over the new Williamsburg Bridge, Mayor McClellan, of New York, has ordered Bridge Commissioner Best to prepare plans for a temporary terminal station for the Williamsburg Bridge, in Manhattan, to be ready when the operation of cars over that structure is begun in July. The station will also be used temporarily as a terminal for the elevated lines that will cross the structure from Brooklyn, which are expected to be ready for service about Oct. 1. Nothing like a definite plan for a suitable permanent terminal has been agreed upon, as the plans for connecting the two bridges by underground, surface or overhead car lines are still in an embryonic state. At present there seems to be no end to these plans, but the temporary measures of relief that the Mayor has adopted give promise of materially increasing the efficiency of the new structure, and of lessening the congestion on the old structure by inducing some of its regular users to abandon it in favor of the new bridge. The dissatisfaction with the present facilities for traffic over the new bridge are in a large measure chargeable to the administration which went out of office Dec. 31. Under the guise of consideration for the public, the members of that administration really opened the new bridge months in advance of its completion, in order that the names of certain public officials might go down in the public records as having participated in the opening.

STEAM LINE ABSORBS CONNECTICUT TROLLEYS

The purchase by the New York, New Haven & Hartford Railroad of the Fair Haven & Westville Railroad, of New Haven, to which reference was made in the issue of March 5, has been consummated. From New Haven comes the statement that the terms have actually been arranged, and that their submission to the directors of the two companies is the only thing now standing between the actual transfer of the securities. It is stated that the basis of the merger is the exchange of New York, New Haven & Hartford fifty-year 3½ per cent debentures for the Fair Haven & Westville stock, the latter being taken at a valuation of $50 for each share of par value of $25. The shareholders of the Fair Haven & Westville thus get 7 per cent on the debentures in place of the present 5 per cent dividend on stock. As the stock of the Fair Haven & Westville amounts to $5,000,000, it will be necessary for the New York, New Haven & Hartford Railroad to issue $10,000,000 of bonds.

The purchase by the New Haven Company is of special interest, in that it seems to indicate a policy of the new president of the company, Mr. Mellen, toward the electric railways directly opposite to that of Mr. Clark, his predecessor. Under the old management any electric railway enterprise that threatened the New York, New Haven & Hartford was fought from its very inception and pursued relentlessly if carried to completion. The policy seemed to be one of millions for defense, but not one cent for purchase. Just at this time, however, it seems that the most significant thing about the deal is the heading off by the New York, New Haven & Hartford Company of its most formidable competitor, the Connecticut Railway & Lighting Company, which now operates 170 miles of line in the State. Not so long ago rumor had it that the Connecticut Railway & Lighting interests were seeking to purchase the Fair Haven & Westville. The latter company operates 104 miles of track in New Haven and nearby towns.

IMPORTANT FRANCHISES GRANTED IN PITTSBURG

Ordinances providing for an elaborate street railway system of 22 miles have been passed by the City Council of Pittsburg in favor of Murry A. Verner, Thomas S. Bigelow and E. M. Bigelow. The system provided for will extend from the downtown section to the east end and may be described as using the Grand Boulevard for the trunk line with ramifications downtown by Liberty and minor streets, and throughout the east end by various branches. One of the lines in the east end will be carried by a high bridge over the Pennsylvania Railroad and Junction tracks from the boulevard to Bloomfield. Mr. Verner and his associates have secured the franchise in the interests of companies chartered at Harrisburg Jan. 26, 1902. It is said that the new companies are in no way connected with the Philadelphia Company, which now controls all the lines operating in Pittsburg, and that the latter will very likely oppose the construction of the new lines. The grants are in perpetuity. They have been signed by the Mayor.

IMPORTANT DEAL PENDING AT SYRACUSE?

Rumor has it that the Andrews-Stanley syndicate, of Cleveland, is negotiating for the purchase of the stock of the Syracuse Rapid Transit Street Railway, of Syracuse, N. Y., held by J. W. McClymonds, of Massilon, Ohio, brother of the late L. K. McClymonds. It is said that Mr. McClymonds has not the real interest in street railway securities and work that his brother had, and that he stands ready to dispose of his holdings at a reasonable figure. A few years ago the Stanley-Andrews syndicate acquired its first interest in New York electric railways by the purchase of one of the systems in the Mohawk Valley. Since then other roads have been purchased by the syndicate, and extensions have been built, until now it controls a formidable number of roads, including the Fonda, Johnstown & Gloversville Railway, the Herkimer lines, the Utica & Mohawk Valley Railway, the city system of Utica, and the Oneida Railway, all east of Syracuse.

THE NEW BONDS OF THE ST. LOUIS COMPANY

The announcement is made that the directors of the St. Louis Transit Company have arranged with the Mercantile Trust Company, of St. Louis, to form and manage a syndicate to purchase $8,000,000 of the 5 per cent refunding and improvement bonds of 1903. These bonds are part of an issue of $20,000,000, due April 1, 1923 (but subject to call at par on and after April 1, 1905), and guaranteed by the United Railways of St. Louis as to principal and interest, as well as secured by collateral.

None of these bonds has heretofore been issued. The $8,000,000 included in the present arrangement will provide for the floating debt, and for construction and equipment for the year 1904. A further amount is reserved to refund $5,776,000 outstanding 5 per cent collateral trust notes due Nov. 1, 1904, and the remainder is issuable only for future acquisitions, construction and equipment at not exceeding $500,000 yearly after Jan. 1, 1905.

The life of the syndicate is for six months, with the privilege of extending it for another similar period.

THE HARTFORD-SPRINGFIELD AND HARTFORD-WORCESTER PROJECTS

The prospects for the successful termination of the projects to connect Hartford, Conn., and Springfield, Mass., and Hartford and Worcester, Mass., by electric railways have recently been brightened by two important deals. One of these is the announcement that Tucker, Anthony & Company, of Boston, have become interested in the Windsor Locks & Rainbow Street Railway, and the other is the announcement that the Worcester & Hartford Street Railway Company has secured the last franchise needed for its line.

The purchase by Tucker, Anthony & Company of the Windsor Locks & Rainbow Street Railway means the early completion of a through electric railway between Hartford and Springfield on the west side of the Connecticut River. The same interests already own the Hartford & Springfield Street Railway, which operates on the east side of the river. The new line will be about 10 miles long, running from the tracks of the Suffield Street Railway Company through the town of Windsor Locks and to the center of the town of Windsor, where connections will be made with the Hartford Street Railway. The distance from Hartford to Springfield over the new route, however, is about 32 miles. Traffic arrangements have been negotiated with the Hartford Street Railway Company and with the Springfield Street Railway Company, which controls the Suffield Company. The present plan is to run the cars from Hartford to Springfield on one side of the river, and then to run them back to Hartford on the other side, making a circuit of more than 60 miles.

Immediately after the purchase of the new property officers were elected as follows: William A. Tucker, president; Arthur Perkins, secretary; S. Reed Anthony, treasurer; William A. Tucker and S. Reed Anthony, of Boston; Authur Perkins, of Hartford; Frank E. Healy, of Windsor Locks, and Henry A. Huntington, of Windsor, directors.

The franchise to the Worcester & Hartford Street Railway Company was granted by the town of Leicester, and completes the rights of the company to build between Hartford and Worcester. In Leicester the road will cross private land almost wholly. The tracks, it is said, will be laid as soon as the frost is out of the ground. The line will run from Worcester to the Connecticut State line at Stafford, and from Stafford it will come to Rockville, Conn., where connections will be made with the tracks of the Hartford, Manchester & Rockville Tramway Company.

DUPED THE MOTORMEN OF NEW YORK

A man who recently inserted in the New York daily newspapers an advertisement for street car motormen and conductors has disappeared from the city after having obtained $2.35 apiece from some 200 men whom he had promised jobs. The advertisement was for 300 motormen and conductors to go out of town at $2.50 per day, and the address was given of the man authorized to contract for the help. At the headquarters of the advertiser the applicants were met by a very suave person, who explained that there was trouble on an electric railway within a short distance of New York, perhaps in Connecticut, and that he wanted from two to three hundred men. He guaranteed each man a month's contract at $2.50 a day, and possibly a permanent position, but demanded $2.35 for transportation to the point in question. It is said that most of the men who called gave the required amount without question, receiving an ordinary receipt. They were told when to report for "work," and when they did report they found that the advertiser had left the city.

MORE STRIKE TALK AT PITTSBURG

Again is Pittsburg threatened with a street car strike. Demands were recently made on the company for the reinstatement of several employees who had been discharged, and on the refusal of the company to comply with the request the question of a strike was discussed. Last Friday a meeting of the employees was held at which the vote was in favor of a strike.

ANOTHER RECORD RUN

This time it is the Pacific Coast that offers a candidate for high-speed electric railway honors. The record was made over the new line recently placed in operation between Los Gatos, San Jose and Saratoga, Cal., and is for a distance of 5 miles made in 4 minutes and 45 seconds, or a trifle better than a mile a minute. That the figures are correct is attested by the fact that the run was made over a straight stretch of track for 5 miles, and that the time was recorded by stop watches. When it is considered that the roadway of this line has not had time to become seasoned, and that the equipment has not yet properly limbered up, even better figures may be expected in the future.

CYPRUS BRONZE BEARINGS

The use of cyprus bronze for journal bearings on street railway cars is increasing. This material is manufactured by the Brady Brass Company, which was a pioneer in the matter of bronze bearings for steam railroad cars, having been engaged in the manufacture of copper, tin and lead compositions for such purpose for many years past. Cyprus bronze is a preparation of copper, tin and lead, treated by a process especially devised by the company, so that the tendency to segregation of lead is eliminated.

This material has given great satisfaction when used for bearings and wearing parts on locomotives and railroad cars. It shows a great resistance to wear, as it has a low coefficient of friction, it requires a very small amount of oil to lubricate. This material is not claimed to be a frictionless or self-lubricating alloy, but requires oil like any other bronze, though in very much diminished quantity.

The success of cyprus bronze for steam railroad work suggested to the Brady Brass Company its employment in electrical railway service, and the many thousands of street railway cars equipped with bronze motor bearings made from cyprus bronze testify to its value for this purpose. It has a high strength in compression, equal to 50,000 lbs. per square inch, under a compression of 10 per cent, and a tensile strength of 25,000 lbs. per square inch, combining, therefore, in all its properties, the essence of a first-class engineering material.

Although cyprus bronze is the only product of the Brady Brass Company which has been discussed in this article, it is only one of many to which the company has given a great deal of attention during its period of existence, and with which it is meeting with great success. A great deal of babbitt is manufactured at its works on Tenth Street, Jersey City. The company recommends cast-iron shell babbitt bearings for armature and solid bronze for main motor axle bearings, according to the preference of the consumers. The bronze used is of special composition, which has given excellent service in steam railroad work, and which has also been found to be very well adapted to this particular service. In addition, the company manufactures a large number of other metals for different purposes, including phosphor and manganese bronze, brass, solder, battery zincs, etc.

ANNUAL MEETING OF THE INDIANA UNION TRACTION COMPANY

The annual meeting of the stockholders of the Indiana Union Traction Company and its allied companies, the Union Traction Company, of Indiana, and the Indianapolis Northern Traction Company, was held in Anderson, March 1.

The financial report of the Indiana Union Traction Company shows that the gross earnings for the last year are $1,118,951.54; operating expenses, $620,136.64; total net earnings, $498,814.90; fixed charges, interest accounts, taxes, licenses and dividends on preferred stock, $358,511.19; net income for the year, applicable to rental payments, $140,303.71.

For the Union Traction Company, of Indiana, the following directors were elected: Philip Matter, of Marion; J. Levering Jones, of Philadelphia; James A. Van Osdol, of Anderson; William C. Sampson, of Muncie; Ellis C. Carpenter, of Anderson; Hugh J. McGowan, of Indianapolis; Arthur W. Brady, of Muncie. The board organized by electing Mr. Matter president, Mr. Carpenter vice-president, Mr. Van Osdol secretary, and Mr. Sampson treasurer.

For the Indianapolis Northern Traction Company directors were elected as follows: George F. McCulloch, of Indianapolis; Randall Morgan, J. Levering Jones, Henry H. Kingston and John A. Harris, Jr., of Philadelphia; W. Kesley Schoepf, of Cincinnati; Arthur Brady, of Muncie.

The same board was elected for the Indiana Union Traction Company. There was not a quorum of directors present for the Indianapolis Northern or the Indiana Union Traction.

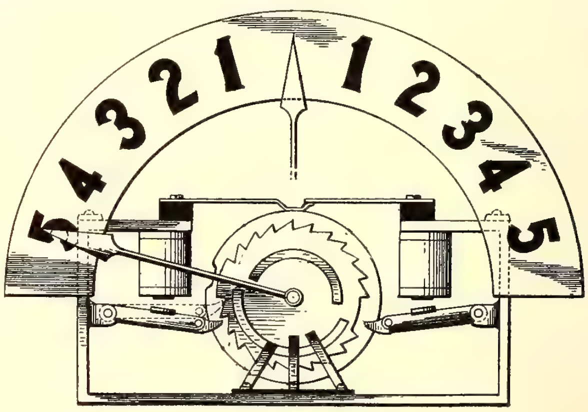
STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED FEB. 23, 1904.

752,718. Railway Switch; Wilber K. Smith, Denver, Col. App. filed April 1, 1903. The switch tongue is connected with a lever pivotally secured in position between the railway tracks and adapted to be operated by means secured to the car.

752,719. Automatic Signaling System for Electric Railways; Harry B. Snell, Cement City, Mich. App. filed July 17, 1903. A dial-plate and index at the ends of each block indicate the number of cars upon the block, and in which direction they are running.



PAT. NO. 752,719

752,824. Electric Railway Switch; Harry H. Chandler, Waltham, Mass. App. filed Oct. 24, 1903. Details of a magnet, by means of which the switch tongue is actuated.

752,828. Clamp Handle; William P. Devine, Dorchester, Mass. App. filed March 27, 1903. Details of a clamp handle adapted to be attached to the rods connected with the fare registers in street cars.

752,861. Vestibule for Cars; Michael Power, Toronto, Canada. App. filed June 17, 1903. A vestibule for the motorman which is adapted when not in use to be folded and stored under the hood of the platform.

752,892. Tongue Switch; George M. Ervin, Johnstown, Pa. App. filed June 17, 1903. A continuous main rail, a casting secured to the inner side thereof and forming a part of a turnout or branch track, the casting having an under-cut and recessed guard portion, and a switch-tongue pivoted to the casting, and having a base-flange which engages the recessed guard portion.

752,984. Vehicle Brake; Jake Knuth and Charles Read, Oswego, Ill. App. filed Oct. 25, 1902. A shaft deriving rotation from a ground-wheel, a clutch member having a flange, a co-operating

clutch member mounted to slide longitudinally upon the shaft, and having radially presented friction-blocks adapted to engage the inner surface of the flange, radial stems carrying said blocks, radial bearings in which the stems are adjustable, and bolts for securing the stems in place.

UNITED STATES PATENTS ISSUED MARCH 1, 1904

753,341. Safety Guard on Electric Cars; Charles A. Willard, St. Louis, Mo. App. filed Jan. 29, 1902. Details of construction of a guard rail adapted to be projected from the rear of the car by the motorman to prevent persons, upon alighting from the car, passing around the same in front of a car passing on the adjacent track.

753,345. Automatic Releasing Device for Safety Trolleys; Andrew C. Wolfe, Pittsburg, Pa. App. filed July 6, 1903. Details of construction.

753,418. Register; John O. Morris, Richmond, Va. App. filed May 23, 1903. Details of construction.

753,436. Safety Apparatus for Motor Cars of All Kinds; Karl Schmidt, Cothen, Germany. App. filed Oct. 12, 1903. Rotary brushes mounted in front of the car on a spring-mounted sliding frame, are adapted when an obstruction is encountered, to be pushed back and engage gears which rotate the brushes to thereby roll the obstruction off the track.

753,535. Register; Francis R. Beal, Northville, Mich. App. filed May 6, 1903. A register particularly adapted for use on lines where the amount of the fares is liable to differ considerably.

753,526. Contact Device for Electrically Propelled Railways; Henri Berthoud, Neuchatel, Switzerland. App. filed July 10, 1902. A contact strip is provided on the roof of each car, running the full length thereof and overlapping the strip on the adjacent cars, the electrical terminals being suspended above the track and bearing upon these conductors to deliver current to the vehicle.

753,542. Trolley; Alexander C. Calderwood, Gloversville, N. Y. App. filed Aug. 6, 1903. When the wheel leaves the wire, a trolley replacer is tripped and allowed to move into operative position.

753,545. Car Seat; Eugene Chamberlin, Brooklyn, N. Y. App. filed June 1, 1901. A seat structure, a pivotal support therefor eccentrically arranged with regard to the ends of the seat structure, whereby the structure may be directed transversely or longitudinally of the car and may at the same time be moved relatively to the car floor, and means for locking the seat structure in different positions.

753,552. Trolley for Electric Cars; William A. Daggett, Vineland, N. J. App. filed Sept. 3, 1903. A yielding connection between the trolley harp and pole to prevent pounding or jumping of the trolley.

753,554. Trolley; Arthur S. Deem, Reading, Pa. App. filed Aug. 8, 1903. Two trolley wheels, one arranged in advance of each other, one wheel being pivoted on a horizontal axis, while the other is pivoted on a vertical axis.

753,617. Trolley Replacer; Francis A. Nolan, St. Paul, Minn. App. filed Jan. 16, 1902. Tension on the trolley cord throws guide arms to operative position.

753,759. Electrical Connection; Edward G. Thomas, Cambridge, Mass. App. filed July 15, 1902. For soldering terminals of the rail bonds to the under face of the rail, said terminals have spout-shaped extensions into which the melted solder is poured and by which it is conveyed to the abutting surfaces of the bond and rail.

753,794. Track-Sanding Device; John H. Hanlon, Somerville, Mass. App. filed Nov. 4, 1903. Vibrators placed in the blast nozzle and movable by the discharge of compressed air, to keep the blast nozzle free from foreign substances.

753,802. Combined Third and Traction Rail for Electric Railways and Switching Systems Embodying Same; Edmund C. Morgan, Chicago, Ill. App. filed Aug. 27, 1902. The third rail is slotted to accommodate gearing carried by the truck and operated by the motor thereon for causing the truck to move along the track.

753,803. Combined Third and Traction Rail for Electric Railways; Edmund C. Morgan, Chicago, Ill. App. filed Dec. 3, 1903. Details of construction of the rail used in the system described in the preceding patent.

PERSONAL MENTION

MR. F. L. FULLER, general manager of the New York & Queens County Railway Company, has also been elected to the office of vice-president of the company.

MR. CHARLES T. CHAPIN, formerly president of the Rochester Car Wheel Works, and recently vice-president of the National Car Wheel Company, has been elected president of the company, in place of Mr. C. V. Slocum, who has resigned.

MR. GEORGE B. DOVEY, superintendent of the Broadway division of the St. Louis Transit Company, has resigned from the company to become connected with the St. Louis Car Company.

MR. T. W. SHELTON, chief engineer of the Northern Ohio Traction & Light Company, of Akron, has resigned. He has been succeeded by Mr. Robert J. Turnbull. Mr. William Roberts has been appointed chief electrician of the same property.

MR. EDWARD J. BALDWIN has resigned as secretary of the Evansville & Princeton Traction Company, of Evansville, Ind. Mr. Baldwin has not announced his plans for the future, but is understood to have several offers under consideration. One of these is said to be from a company in California.

MR. GEORGE H. CAHILL, formerly superintendent of the Bayonne division of the Public Service Company's electric railway lines, in New Jersey, has accepted the position of superintendent of the New Paltz, Highland & Poughkeepsie Electric Railway, of Poughkeepsie, N. Y.

MR. L. C. HANNA has been elected a member of the directorate of the Cleveland Electric Railway Company, succeeding his late brother, Senator M. A. Hanna. In accordance with the wishes of the late Senator, Mr. L. C. Hanna has also succeeded to nearly all official positions held by the Senator.

MR. LAWRENCE A. YOUNG was elected first vice-president of the Chicago City Railway, to succeed Mr. Joseph Leiter, and Mr. A. W. Goodrich was elected second vice-president, to succeed Mr. George T. Smith, at the meeting of the directors of the company on Feb. 29. The other officers were all re-elected.

MR. FRANK VAN VRANKEN has been appointed superintendent of the Los Angeles division of the Pacific Electric Railway Company to succeed Mr. J. B. Rowray, who will now devote his entire time to the northern division. Mr. Van Vranken is also superintendent of the southern division, operating the Long Beach and Whittier branches, and the two positions will be combined. The change took place March 1.

MR. F. E. FISHER, superintendent of the Chicago & Joliet Electric Railway, of Joliet, Ill., was recently presented with a gold watch, a chain and a charm by the employees of the company as a token of esteem. As previously stated in the Street Railway Journal, Mr. Fisher will, on April 1, become connected with the Fisher Construction Company. Mr. Fisher has been at Joliet six years.

MR. WILLIAM LINTERN has resigned as master mechanic of the Cleveland & Southwestern Traction Company, of Cleveland, to devote his time to the interests of the Nichols-Lintern Company, of Cleveland, manufacturers of track-sanders, with which he has long been identified. His shop associates tendered him a reception a few evenings ago and presented him with several valuable presents. Mr. Lintern has been succeeded by Mr. Fred Strail, who for thirteen years has been shop foreman with the Rochester Railway Company, of Rochester, N. Y.

MR. E. N. HIBBS has resigned as general auditor of the Public Service Corporation, of New Jersey, his resignation to take effect March 15. Mr. Hibbs came to Jersey City about nine years ago, when the late Mr. B. M. Shanley was connected with the Consolidated Traction Company. He served in the auditors' department, and when the North Jersey Street Railway Company leased the property of the Consolidated Traction Company his ability was recognized and his services rewarded with a continuance in the same capacity. Last year, when the Public Service Corporation came into being, Mr. Hibbs was retained and advanced to the position of general auditor. Mr. Hibbs resigned so as to become connected with the United Railways, of San Francisco.

MR. WALTER B. JACOBS, president of the Shreveport Traction Company, of Shreveport, La., died at his home in Shreveport at 2:00 a. m. Thursday, March 3. Mr. Jacobs succeeded his father eight year ago as president of the street railway lines in Shreveport, and during his incumbency rebuilt the entire system, putting it in first-class physical condition, beginning with new power station, then cars, heavy steel in paved streets, etc. The very day before his death Mr. Jacobs concluded negotiations for the erection of a magnificent park for amusement purposes. Besides being president of the Traction Company, he was also interested in a number of important industrial and other companies, and was a prominent clubman. He was very popular with the employees of the street railway company, with whom he came in daily contact, and was a man liked and respected by all classes. His successor in the Traction Company will probably be one of the vice-presidents.

NEWS OF THE WEEK

CONSTRUCTION NOTES

WALNUT RIDGE, ARK.—Construction of the Walnut Ridge & Hoxie Electric Railway is reported begun. S. C. Dowell and Mayor H. L. Ponder and others are interested.

NAPA, CAL.—The Vallejo, Benicia & Napa Valley Electric Railway has purchased a site here for its terminal station.

OAKLAND, CAL.—The San Francisco, Oakland & San Jose Railway has filed with the Council a franchise application for the construction of the tunnel along Fortieth Street, from Broadway to Howe Street, according to plans. Another franchise application, made on behalf of the company is for crosstown tracks on Fifty-fifth Street from the present ferry tracks on Adeline and Linden Streets to Telegraph Avenue.

PUEBLO, COL.—Leading citizens of Bessemer are the promoters of a plan to establish an electric railway here. It is proposed to run a line from Carlile Park, in the west end of the city, to the zinc smelter and Riverview Cemetery on the east, the line to run through the principal streets of Bessemer.

SAN FRANCISCO, CAL.—The United Railroad has petitioned the Board of Public Works for the necessary permission to reconstruct its steam line on California Street. The double tracks will be retained, but the road will be changed into standard gage, and equipped for operation by electricity.

BRIDGEPORT, CONN.—The Connecticut Railway & Lighting Company is enlarging the capacity of the power station for the Bridgeport division of its system. The plant has been extended and an 800-kw generator, directly connected with a 1200-hp engine, is now being installed. It will be at least two months before the new generator will be ready for use. The plant will then have a capacity of 3600 hp, and will supply power, not only for the local lines, but for the Milford and Westport branches.

HARTFORD, CONN.—The Hartford Street Railway Company has applied to the municipal authorities for approval of its plans to extend its lines within the city limits. The company has also under contemplation the extension of its suburban lines.

WATERBURY, CONN.—The local municipal authorities have granted to the Cheshire Street Railway Company the necessary rights to construct the Waterbury end of the proposed line between this city and Cheshire. The Cheshire Company is an underlying corporation of the Connecticut Railway & Lighting Company. The work of construction will be commenced this spring. The road will complete a through line between Waterbury and New Haven.

GAINESVILLE, GA.—The North Georgia Electric Company expects soon to purchase electric launches, a merry-go-round, and perhaps an electric fountain, for the company's Chattahoochee Park.

PARIS, IDAHO.—The Bear Lake Valley & Electric Company has been incorporated, with a capital stock of $100,000, to build an electric railway to connect several small towns in Bear Lake County. The directors are: C. R. Slusser, H. E. Slusser and others. Milton Smith will act as attorney for the corporation. C. R. Slusser and H. E. Slusser already own and operate an electric lighting plant at Paris.

CHICAGO, ILL.—The City Council has extended the permit of the Chicago City Railway Company to operate until March 15.

CHICAGO, ILL.—A proposition has been made that, pending the settlement of the terms of a franchise extension ordinance for the Chicago City Railway Company, the company be allowed a temporary permit to put an overhead trolley on Wabash Avenue, north of Eighteenth Street, to make it possible to run cars downtown electrically over the cable tracks. The Council, at present writing, has taken no action.

HILLSBORO, ILL.—The Hillsboro Electric Railroad Company has been organized, with a capital stock of $15,000, to build an electric railway here. The incorporators are: Isaac Hill, T. M. Jett and L. V. Hill.

MOLINE, ILL.—Work on the last of the forty cars ordered by the directors of the Tri-City Railway Company is under way in the car shops in Rock Island. Twelve of the cars are on the floor for completion. None of these will be used on the Elm Street or Prospect Park lines, because they are too large to be serviceable. The company has plans for constructing new smaller cars for these lines, and there is work in sight to keep the shops busy on the company's equipment for a year to come. The cars now being completed are 42 ft. long.

ROCK ISLAND, ILL.—The Tri-City Railway Company, serving Rock Island and Moline, Ill., and Daveport, Ia., is perfecting plans for concentrating all its power-generating plant into one large station on the site of the present plant in First Avenue, Rock Island, from which it will be able to furnish current for the operation of all its lines in the three cities. At the present time the Rock Island plant only furnishes sufficient power for the operation of the cars on the Illinois side of the river, and it has been found necessary to obtain power from the People's Power Company for the operation of the lines in Davenport. The improvements will involve a large investment of capital, and will be made gradually so as not to interfere at all with the traffic of the company.

SPRINGFIELD, ILL.—Yeager & Son, of Danville, Ill., have been awarded the contract for building the sub-stations along the line of the Illinois Central Traction Company's road. The Illinois Central Traction Company is the name under which the McKinley syndicate is building its Decatur-St. Louis line.

WAUKEGAN, ILL.—The Chicago & Milwaukee Electric Railroad Company is asking for a long-term franchise over certain business streets.

FT. WAYNE, IND.—The Ft. Wayne, Logansport, Lafayette & Lima Traction Company has filed amended articles of association with the Secretary of State, changing its name to the Ft. Wayne & Wabash Valley Traction Company. The articles also provide for the extension of the system to Goshen, Elkhart, Mishawaka, South Bend, Ligonier, Millersburg, Kewana, Culver, Hibbard, Plymouth, Lapaz, Lakeville, North Manchester, Claypool, Warsaw, Leesburg, Milford, New Paris, Rochester and Argus, in the counties of Elkhart, St. Joseph, Fulton, Marshall and Kosciusko. The directors of the newly-formed company are: H. C. Paul, J. L. Jones, Randall Morgan, Bayard Henry, S. B. Fleming, James Murdock, and G. F. McCulloch.

INDIANAPOLIS, IND.—Four of the seven members of the County Council have voted not to appropriate money to build new and much-needed bridges over White River in this city, on the ground that the Indianapolis Traction & Terminal Company uses the bridges. The sentiment expressed by the negative members is that "the city doesn't want to build bridges for the electric railways." Under the Traction & Terminal Comapny's franchise, it has a right to use the bridges. The action of the County Council leaves the city in an embarrassing position.

LAPORTE, IND.—The Buchanan Power Company has submitted a proposition to the directors of the Chicago & South Shore Railway Company to furnish power from its plant at Buchanan sufficient to operate cars on the interurban system. It is proposed to run a power transmission line a distance of 26 miles, and to establish stations at Laporte and Michigan City. There is a well defined report that in the event of such a contract being made capitalists will organize a company to build an electric railway from Michigan City to Buchanan and other Michigan points.

RICHMOND, IND.—The Richmond & Northwestern Electric Railway Company has been incorporated to build an electric railway from Richmond to Anderson. The capital is $50,000, and the directors are: George M. Hodges, G. G. Bambach, W. D. Riddel and L. I. Lowman, of Dayton.

SHELBYVILLE, IND.—Application has been made of the City Council by the Indianapolis & Cincinnati Traction Company for privileges to extend its lines to the southern corporation line of the city, that it may continue to Greensburg. It is provided that work on the extension shall begin not later than January, 1906.

WABASH, IND.—The contract for all the material to be used in the completion of the Wabash & Rochester Electric Railway has been awarded to a New York firm. The contract includes rails and overhead work, power-house machinery and cars. The work of grading for the road began March 1.

WARSAW, IND.—The City Council has granted a franchise to the Goshen, Warsaw & Winona Electric Railway. This system, when completed, will be in the form of a cross. The main line will be built from Goshen to Winona, and the cross section will center at Milford, running east to Wawasee Lake, and west to Nappanee, Cleveland capitalists, headed by J. B. Hanna, are behind the project, and there seems to be no doubt about the building of the road.

DES MOINES, IA.—General Manager G. B. Hippee, of the Des Moines City Railway Company, says that it will be sixty days before the company will have finally decided upon extensions and improvements to be made this year. The company has under consideration the extension of the Sixth Avenue line north across the new Melan Bridge to Highland Park, and the diverting of passenger traffic to and from that portion of the city from the Belt Line. If this is done, the Belt Line will be used almost entirely for freight purposes in connection with the Interurban and the Fourth Street line extended from Fourth and School Streets north past Mercy hospital, and thence across the north bottoms to take care of the passenger traffic now carried over the Belt Line. Another contemplated improvement is the building of a crosstown line from the vicinity of Union Park west to Sixth Avenue, thence south to Washington and west on Washington Street to Thirteenth, south on Thirteenth to Clark and west on Clark Street line to about Thirtieth, and south from Thirtieth to an intersection with the Ingersoll Avenue line. This line is planned to relieve park traffic and shorten the distance to be traveled between the parks by nearly a mile. Some changes in the lines south of the Coon River are also under contemplation.

EDDYVILLE, IA.—Rumor has it that plans are under way for the construction of an electric railway between Council Bluffs and Ottumwa, passing through Buxton, Bridgeport and South Ottumwa.

MARSHALLTOWN, IA.—It is reported that a contract has been closed with J. G. White & Company, of New York, for the construction of the Marshalltown Electric Street & Interurban Railway. The road will be built from Marshalltown to Grundy Center, 30 miles, and then, if feasible, will be extended to Parkersburg and ultimately to Charles City, on the north, and to Ferguson, south of Marshalltown, in order to connect with the Milwaukee there. The power house will be built at Marshalltown.

OSAGE, IA.—A mass meeting of business men and farmers from Winnebago, Worth, Howard, Mitchell and Winneshiek Counties was held here a few days for the purpose of considering the feasibility of constructing and operating an interurban electric railway from Decorah, Winneshiek County, west through Winneshiek, and the other counties to Forest City, Winnebago County. The towns of Northwood, Fertile, New Haven, Rice-

INDEX

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, MARCH 19, 1904. No. 12

Published Every Saturday by the
McGRAW PUBLISHING COMPANY

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues)............................... $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Light-Weight Wheels

To some railway companies a wheel is a wheel, whereas to others there are wheels and wheels. The former view may have been true to a certain extent in horse car days, when there was comparatively little weight to be supported, but in modern electric cars the design, as well as the composition of the material in a wheel, counts for everything, not only so far as its life is concerned, but for the safety of the car as well. A broken wheel is a serious thing, and wheels which have proved strong enough for 18-ton cars, operating at 12 m. p. h., should not be used under heavier cars, or even the same car when running at 25 m. p. h. or 30 m. p. h., unless care is taken to ascertain that the wheel is amply strong enough for the service. Two recent instances of broken wheels caused by using light-weight wheels under heavy cars have occurred during the last two or three weeks, and emphasize the importance of the injunction laid down.

We believe that if accurate records were kept of the performance of individual wheels for different service, a great deal more discrimination would be exercised in their purchase, but if the official in charge of this department does not know what mileage the wheels are making, it is perhaps not reasonable to expect that the purchasing agent will not buy the cheapest wheels that he can, pound for pound. There is no doubt that wheel makers can make a cheap wheel if they desire to do so, and if there is no demand for any other. But this kind of wheel is the most expensive in the end, and the sooner this fact is realized the better.

Coke in Heaters

Just now at the close of another winter (and a severe one at that), during which coke has probably been used in more electric railway stoves and hot-water heaters than ever before, it would be interesting to compare notes as to the results. Coke has the well-deserved reputation of being a fuel which, when once started, makes such an intensely hot fire that it is likely to do damage to the fire pots of stoves in which it is burned. As the stove on an electric railway car is likely to be neglected at times, there would seem to be an excellent chance for overheating and the burning out of fire pots. Nevertheless, it has been used on at least one very large city system the past winter, and apparently without excessive stove repairs. It should be said, however, that this city is one where the thermometer seldom goes far below the freezing point, and both conductors and passengers are likely to demand that the stoves be kept considerably below white heat.

In more northern latitudes, where fires would be forced harder on cold days, coke would not work out as well. When it comes to using coke in hot-water heaters, the proposition would appear to be less risky, as the fire-bed is always surrounded with water, and the temperature is not likely to get so high as to destroy the fire pot. In most cities west of Pittsburg, coke is decidedly cheaper than hard coal. It gives an equally smokeless fire, but is a little less cleanly as far as handling is concerned. Its cost makes it well worth considering as a substitute for hard coal, providing repairs on the heating apparatus can be kept within reasonable bounds.

Fires on Motor Cars

The number of small fires on electric motor cars, due to electrical causes, taken the country over, is remarkable, but the greater number of them are undoubtedly due to carelessness in the car wiring or its maintenance. Indeed, even the number of fires on motor cars in elevated service, where such fires would be least expected, is great enough, so that it is not altogether to be wondered at that steel cars are receiving serious consideration by at least two of the large elevated railway companies in this country. On elevated roads these fires would often be of little importance were it not that the public seems to be in a peculiar frame of mind, in view of the terrible disaster on the Paris Underground road and the Iroquois Theater fire in Chicago. Recently the daily press has helped to increase, rather than reduce, the public fear of fire. The other day two very small fires, one in New York, the other on one of the elevated roads of Chicago, as described in the daily papers of those cities, were very dramatic incidents, in which the motor car, which, in each instance, had taken fire, raced for several

miles, full of panic-stricken passengers, until finally it got to a station where a fire engine was waiting for it. These reports, if simmered down to the actual facts, would become very tame reading, but the reading public does not know this.

To illustrate the panicky feeling which exists a recent incident will suffice. A Chicago elevated train stopped an unusually long time at a certain station the other day, until the passengers began to wonder at the cause of the delay. Some one called "fire," and in an instant nine-tenths of the people in the car were upon their feet, rushing frantically to the door. They sheepishly returned to their seats after the alarm proved to be a fake.

Single-Phase Railway Systems

We earnestly hope that during the coming season there will be an opportunity to try out the various forms of single-phase motors on a practical scale. Several contracts for single-phase equipments have already been reported in our columns, and more are likely to come on. We trust that no untoward circumstances will prevent the prompt equipment of these roads so that the whole matter of alternating motors can be given a trying out that will amount to something. We have plenty of respect for shop tests, and do not in the least sympathize with the feeling of those who denounce as "experimental" every improvement with which they are not personally familiar. Nevertheless, there are some matters with respect to single-phase railway motors which cannot readily be settled by shop tests unless they cover a long period. The two questions which the practical railway man asks about the single-phase motor are: "Will it give trouble from sparking?" and "Will it, as a practical matter, operate well on a direct-current system?" As to the first count, one can only get a crude idea from shop tests, since the sparking trouble is to a considerable extent cumulative, appearing very slightly at first and then gradually with more and more severity as the commutator gets out of condition. How much can the commutator of an a. c. railway motor get out of condition before serious trouble begins? Nobody yet knows. How well will such motors perform under large variations of current and voltage after the commutator has begun to wear? As to the second matter there is no reason to doubt that the a. c. motors can be made to work on a d. c. system, but the quality of the service is another matter. Will it be good enough to permit a. c. cars running freely in a press of d. c. cars on a crowded system without running chances of a blockade, or will parallel trolley wires be used, one for each kind of current? These are questions which are of great practical importance, and can be answered only by working the motors day in and day out under severe practical conditions. Hence, we hope to see the alternating-current motor cars put promptly into service and kept at it.

Police Whistles for Motormen

In view of the various "hold ups" which are being reported from outlying districts in different parts of the country it would seem advisable to provide the motorman or conductor with a whistle to summon the police, if necessary. Probably the motorman would be the better one to entrust with the signal, as the conductor, being the fare collector, is usually the victim of the highway robbers. By conference with the police department it is probable that an arrangement could be made by which either member of the crew, or both, of those cars which have to traverse dangerous sections of the city, would be permitted to carry these whistles, and the cost of providing them would be trifling.

The Sociological Value of the Interurban Railway

A great deal has been said, and justly, as to the sociological benefits conferred by the modern electric railway. Probably no other recent agent of modern civilization has exercised a greater influence upon the domestic habits and happiness of a large number of the denizens of our cities. It gives the wage earner an opportunity to live and bring up his family in the suburbs, under conditions which are conducive to his and their moral and physical welfare. It changes the environment of the home from one of brick and stone with little light and air, and still less freedom, to a place where the wife and children are permitted to breathe pure air, enjoy plenty of room and live a more wholesome life. It converts the narrow tenement into a suburban cottage with ground around it, and confers all the benefits which sanitary conditions and healthy surroundings can impart to the individual and indirectly to the community. All this has been done and is being done on an increasing scale by the modern electric railway. It has been described and extolled by writers and thinkers on social questions, and its manifold benefits have been proved by statistics over and over again.

It is not our purpose, however, to refer here at any greater length to this phase of the situation, but to mention one result in the development of interurban electric roads, which seems to have escaped the attention of many writers on the subject. This is the somewhat corresponding but no less important benefit which is conferred upon the country dweller by the electric road. Fifteen years or so ago, the story was told throughout the country of the Virginia darkey, who, seeing the new electric cars mounting the hills of Richmond, exclaimed upon the mighty power of the Yankee who had "first freed the black man and now had freed the mule." The interurban electric road has performed even greater wonders than its predecessor at Richmond, for it has emancipated the farmer and his wife in more ways than one.

In the first place it has brought to their doors, or within easy reach, a convenient and cheap means of access to the outer world, which, independent of the material advantages which it confers, cannot but exercise an important effect upon their intellectual growth. The crushing monotony and mental starvation of country life to adults can be appreciated only by those who have lived for a considerable length of time isolated, or practically isolated, from all contact with considerable numbers of one's fellow beings. While the city is dependent to a certain extent for mental development on the country, the latter can be benefited to a still larger degree by a means of access to the educational and other advantages which the city affords. In fact, one of the chief drawbacks to country life is the fact that the children especially are deprived by this isolation of these educational privileges which those in the city enjoy.

Still another phase of the situation, and one entirely apart from that of transportation, is the possibility which the installation of an interurban electric railway, or of a power transmission circuit, affords in the farmers' homes of an easily available and convenient source of power. We may be too sanguine as to the future of the electric motor in farm life, especially as comparatively little so far has been done in this direction. Nevertheless, we believe the time will come when electric motors will be as much of a reliance in country work as horses are now. They will not necessarily supplant the horse, for a great deal of the work which the latter does, but they will do a great deal of which he is not capable.

As a substitute for manual labor they can perform many of the chores, such as pumping water, sawing wood, churning butter and other duties inseparable from farm life. Cheap available power will "free" the farmer's wife as well as the farmer himself of a great deal of the work which now renders their life a burden, and afford them an opportunity to devote their energies to other pursuits which are both less arduous and more inspiring.

Again, when we consider the facilities for the cheap transportation of produce afforded by the interurban lines, we expose a new vista of their usefulness. In the regions in which interurban electric roads have been built, they not only can but are through this very reason effecting a change in the agricultural products of the territory through which they run, at the same time giving the farmer opportunity to produce from his land what it can yield with the greatest profit.

Take, for example, the dairy districts of Ohio. Each creamery is, or was, before the introduction of the electric road, surrounded by a certain limited district, say, 10 miles in radius, within which farmers could dispose of their milk, but to one customer only. The advent of a trolley road through this district immediately extends the area of marketable milk to within 5 miles of the trolley line and also gives the farmer two customers—the creamery and the city or town supply. It betters the price received and reduces the cost of delivery. A somewhat similar change, but in another way, has been effected in the small fruit section in Michigan. The process of hauling this fruit over country roads is to make it deteriorate rapidly, and the distant grower cannot deliver his fruit to the city markets at a profit in competition with the fruit growers adjacent to the steam road lines. On both sides of the new Michigan interurban electric lines the traveler can now see new peach orchards set out and extensive berry patches on land whose profitable utilization was previously prevented by lack of transportation facilities. The farmer can now pick his fruit in the afternoon and can have it offered for sale the next morning in Chicago or Milwaukee. The same is true of grape culture along the lake shore in Ohio, from Toledo to Cleveland. The electric road permits the transportation of grapes to points of distribution and consumption under better conditions than were before possible, and with a larger profit than when they are converted into wine or vinegar.

Every road in the suburbs of towns or cities runs through a truck farming district, which in some cases extends many miles distant. The old way of transporting this produce was to load the wagon the night before, and start to drive for market anywhere between midnight and early morning. How the trolley roads can best secure the haulage of these goods is worthy of careful study. The character of this form of traffic is such that can be done at hours when the railway property is idle. The fixed and operating expenses to be charged against it would not be large, and profits could be made at a low rate of cost if it could be handled with despatch and with a small amount of labor. One method which has been tried is to put the loaded wagons on a flat car, and deliver them in town, but there are difficulties at the city terminus which make the plan an objectionable one in some particulars. Any method which could be devised by which the trans-shipment of the produce could be avoided, and in which the difficulties present in the plan of loading the wagons themselves on flat cars would be eliminated, is certainly worthy of careful consideration.

We expect to refer to this subject at greater length in a later issue. In the meantime it is well for interurban railway managers to remember that the swift moving passenger trains on steam railroads are not the dividend earners of the property. It is the facility for handling freight and long, slow-moving freight trains that determines the possible profits derived from the operation of the steam railroad. The interstate laws and merger cases are the results of strenuous efforts made by the steam railroads to gain this class of business at fair prices, while the electric roads are, as yet, just feeling their way into this class of business.

Widening the Streets

Most of the larger cities on this continent, and all of the older ones, were laid out at a time when no one had any idea of the density of the street traffic which the needs of a modern city require. In some instances broad boulevards were wisely provided by our forefathers, but in most cases the attempt to force the traffic of a large city through streets designed for the needs of a frontier village, as most of our streets were, is about as satisfactory as that of leading the proverbial camel through the eye of a cambric needle. If cities could easily be redesigned, the solution of the question would be a simple one, but as this is impossible the only other recourse is to utilize such space as is available. In many cases we believe that a narrow and crowded thoroughfare, such, for example, as Broadway in New York, could be very easily widened, without serious inconvenience to anyone, by a slight encroachment upon the sidewalk space. As a rule, the sidewalks in our American cities are more than ample in width, and a few feet taken from each side to add to the street would hardly be noticed by pedestrians. On the other hand, this same space in the width of the street would add greatly to the facility of movement of the vehicles on it. At any rate, the plan is worthy of consideration in some instances.

A still more radical solution of the problem would be to throw into the street the entire sidewalk width and provide for the sidewalk by taking a strip of the necessary width from either the ground floors of the abutting buildings, or from the second-story, as in Chester, England. We are inclined, however, to favor the ground floor plan, and a proposition of this kind is not so impracticable as it might appear at first thought. The front and side walls of the buildings would not have to be changed above the first story, and there would be no encroachment upon any of the renting space within the building except upon the ground floor, whose entrances would be moved back a distance of 15 ft., or whatever the width of sidewalk selected should be. Those who have visited certain of the Italian cities where this style of street construction is common, such as Sienna, Pisa or Padua, or are acquainted with the colonnade construction of such streets as the Rue de Rivoli, in Paris, know that these covered sidewalks are not only practical from an engineering standpoint but provide an ideal passage for pedestrians, being shady in summer and protected from rain in bad weather.

It is true that there are probably very few, if any, streets in this country where such a radical innovation is at present necessary. But with the increase in travel upon our public streets, cases may arise, as, for instance, on Fifty-Ninth Street, in New York, where, by a combination of circumstances, an exceptionally narrow street is being made to serve as a great artery of trade. In such an instance an improvement of the kind mentioned, even if confined to one side of the street only, would not only be not difficult, but would be of tremendous benefit to the city at large.

REPAIR SHOP PRACTICE OF THE PACIFIC ELECTRIC RAILWAY COMPANY

On account of their size and completeness the shops of the Pacific Electric Railway Company possess many points of interest to street railway men. Los Angeles is far removed from the large manufactories of street railway material, and when Mr. Huntington began to build up his interurban system, he realized that it would be necessary to carry in stock extensive standard supplies as well as to have facilities for making all kinds of repairs, and even for building complete cars, if necessary. Accordingly the present plant was laid out, it being completed in the summer of 1902. Since then it has been running steadily, frequently with night crews. It handles all the repairs for the Pacific Electric Railway Company, as well as all the important repairs for the Los Angeles Railway Company, besides doing a great deal of job work for all the electric railways in Southern California. The shops are equipped to build and repair cars from the trucks up, all the parts being manufactured on the spot with the exception of the car wheels. As yet only work and construction cars have been built completely in the shops, but the equipment and facilities are ample for constructing the largest double-truck passenger cars used on the system. With a force of 400 men constantly employed the shops present a busy aspect.

FIG. 1.—PANORAMIC VIEW OF PACIFIC ELECTRIC RAILWAY COMPANY'S SHOPS AND YARDS, LOS ANGELES

In the Street Railway Journal of Aug. 23, 1902, was given a brief description of the shop buildings as they then were, although they had hardly been occupied at that time. Now that the shops have been in successful operation for several months the following description of the leading features is timely. Special attention will here be given to the arrangement and simple design of the buildings, the system of making car repairs, methods used in the armature shop, manufacture of car axles, special work yard, machine, wood and paint shops, electroplating department, oil storage, shop orders and general methods.

LOCATION AND ARRANGEMENT

The yards and shops are well situated on an irregularly shaped tract, 30 acres in extent, at the corner of Seventh and Alameda Streets, in the center of the city, and about a block from the company's power house just described. The arrangement of the buildings and the yards for supplies is indicated on the plan, Fig. 25, in the last issue, while Fig. 1 is a general view of the grounds from the corner of Seventh and Alameda Streets. Connection with the narrow-gage tracks of the Los Angeles Railway system is made at the north end from Central Avenue, while the standard gage Pacific Electric Railway tracks come in from the south along Tennessee Street. Facilities for steam road shipments are provided by the Southern Pacific Railroad tracks on Alameda Street by means of a spur into the yards connecting with the company's own standard gage tracks.

The general arrangement and design of the shop buildings is such as to expedite and concentrate the work as much as possible. There are six buildings, five of which are devoted to shop purposes, the sixth and smallest being used for oil storage. Each building contains more than one department or shop, with the exception of the paint shop, which occupies an entire building by itself. The four principal buildings are arranged in two rows with a pit between for a transfer table, which connects with all the shops and the store room. The buildings are simply and substantially constructed of red brick with combination wood and iron roof trusses. The machine shop building is built in three longitudinal bays.

The car repair shop building is 360 ft. long, 100 ft. wide and 22 ft. high in the clear. At the south end 80 ft. is partitioned off for the armature shop. In the repair shop there are eighteen tracks connecting with the transfer pit and extending across the entire width of the building, while four of them are carried out on the west side for connection with the narrow-gage tracks of the Los Angeles Railway. One of the tracks in the shop is narrow-gage, five are standard gage, and the other twelve are of the four-rail combination gage, the narrow-gage rails being equally spaced between the standard-gage rails. For all the shop and transfer-table tracks the company has used the center-

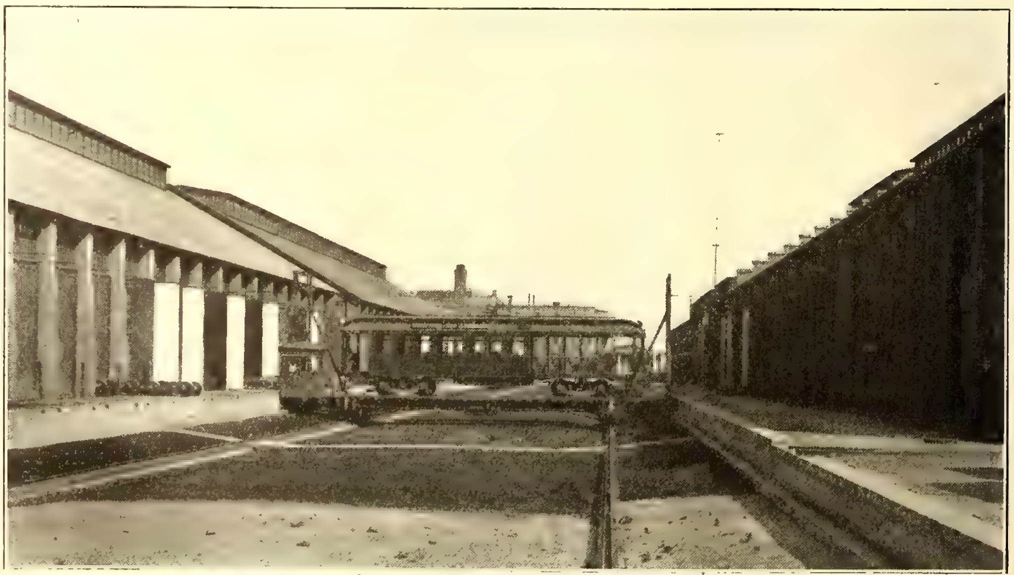


FIG. 2.—TRANSFER TABLE BETWEEN ROWS OF SHOP BUILDINGS

slot rails that were removed from the old cable tracks in the city. Through the center of the armature shop is run a four-rail combination gage track. At the north end of the building are some storage tracks, and one of standard gage for connection with the Pacific Electric car house described above.

South of this building is one devoted to the paint shop, 300 ft. long, 100 ft. wide and 22 ft. high. This shop has twenty tracks, of the four-rail combination gage, which cover all the floor space except that devoted to the upholstering and finishing departments and the stock room.

The carpenter shop building, across from the paint shop, is 380 ft. long, 100 ft. wide, and 22 ft. high in the clear. At the north end is a store room, 100 ft. square, with a track through the center for handling heavy supplies. In the carpenter shop are ten combination-gage tracks, and at the south end, in a space about 100 ft. square, is located the mill machinery.

The machine shop building, north of the carpenter shop and across from the repair shop, is 276 ft. long and 100 ft. wide. At the south end is a blacksmith shop, 76 ft. long, with one track connecting with the transfer pit. The machine shop is divided into three bays, the central one, 35 ft. wide, being traversed by a 10-ton electric crane. Three tracks near the south end afford facilities for handling car trucks and cars if necessary.

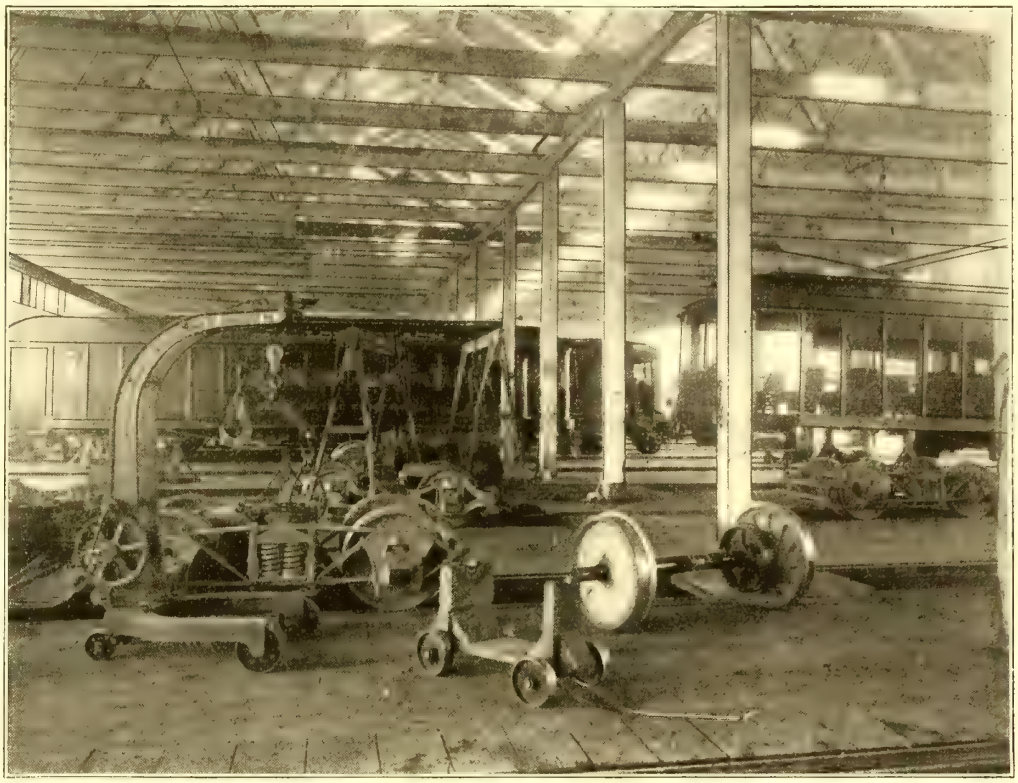


FIG. 3.—VIEW IN CAR REPAIR SHOP, SHOWING PORTABLE CRANE AND HOIST, ARMATURE WAGON, STANDARD "P. E." TRUCKS, "A" HORSES FOR SUPPORTING CAR BODIES, ETC.

FIG. 4.—CAR REPAIR SHOP, SHOWING METHOD OF REMOVING ARMATURE

FIG. 5.—ARMATURE SHOP, SHOWING ARMATURE HORSES FOR DIFFERENT SIZES OF ARMATURES, ALSO ARMATURE RACK AT LEFT

West of the carpenter shop is a building 200 ft. long, 60 ft. wide and two stories high, with a boiler room and lumber storage below and an electroplating room and pattern and cabinet-making shops above.

The group of six buildings, already described, is completed by the oil house, which is 40 ft. long by 34 ft. wide, and is provided with a 10-ft. basement.

TRANSFER TABLE

The transfer table mentioned above and shown in Fig. 2 has a run of 866 ft., and is of a novel construction in that it has only four wheels, traveling on two rails, spaced 40 ft. apart. The table is 60 ft. long and 13 ft. wide, and has a four-rail combination-gage track. Its construction is similar to a girder bridge, the weight being carried by two box girders, which run the entire length of the table. Each girder is formed of two 15-in. I-beams and 1/2-in. plate, which are supported near each end by two 15-in. I-beams, to which are fastened the bearings for the wheels. These wheels have steel tires, and are 48 ins.

in diameter. On the axles of two of them are mounted large gears which engage with pinions at the ends of a long shaft. Near the center of the table and under the platform is mounted

FIG. 7.—ELECTRIC DRYING OVEN IN ARMATURE SHOP, WITH TYPE OF ELECTRIC CAR HEATER SHOWN ON FLOOR

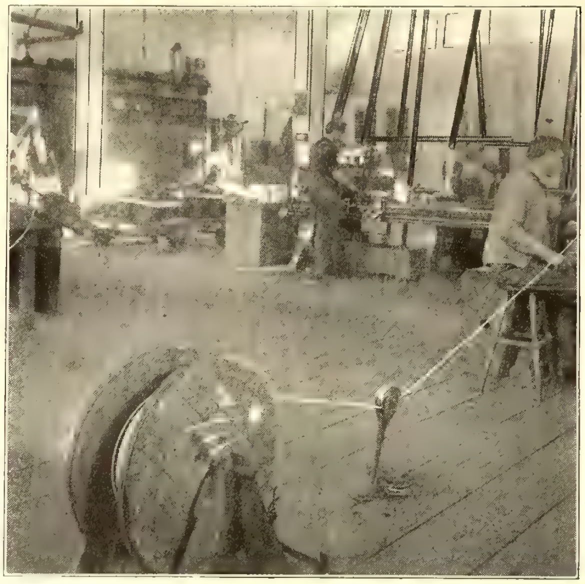


FIG. 8.—VIEW IN ARMATURE SHOP, SHOWING APPARATUS USED FOR WINDING FIELD COILS

a 12-A Westinghouse motor whose pinion engages with a large gear on this long shaft for propelling the table. At one end of the table is a small house, from which it is operated by means of a standard controller, current being taken from an overhead wire through an ordinary trolley pole. No brake is used on the table, dependence being placed on reversing of the controller for braking purposes. The table is provided with a live trolley wire, and connection is made at each track with a T-iron, which is fastened to a trolley wire inside the building. This table

FIG. 6.—ARMATURE SHOP, SHOWING ARMATURE COIL WINDING

was built by the Llewellyn Iron Works, of Los Angeles, and is designed to carry a load of 160,000 lbs. It is in constant use transporting cars, trucks and axles among the different shops as well as supplies to and from the store room. The transfer pit has walls and cross-walks of concrete, and is nicely sodded.

CAR REPAIR SHOP

The system for the repair of property is as follows: All wrecked or damaged cars go first into the car repair shop, where they are dismantled, and if the damage is slight the repairs are made there and the car sent out again. When a car needs general repairing, however, the car body is sent to the carpenter shop, the motors to the armature shop, and the truck to the machine and blacksmith shops. The cars are assembled there after the repairs are made, and all new cars are passed upon by the foreman. No special hoists are used in this shop, ordinary lever jacks being used to raise the body off the trucks, unless the car is a heavy one, in which case hydraulic "whiskey" jacks are used. The entire repair shop has a concrete pit floor 4 ft. 3 ins. below the tracks and the wooden floor, which are supported by wooden posts resting on concrete foundations. Pit repair work is only done when necessary, as when the brake-shoes or motors can be repaired without taking the trucks out from under the car.

When it is desired to take both trucks out from under a car it is generally set up on wooden A-horses, such as those shown in Figs. 3 and 4. These horses are also used for supporting the car bodies in the paint and carpenter shops, as may be noted in Fig. 19. Iron sockets are provided also in the sides of the pits for supporting posts in case it is desired to build scaffolding under a car.

After a truck is removed from under a car a motor jack, or "pit wagon," such as that shown in Fig. 4 (manufactured by the Van Dorn & Dutton Company), is used to raise or lower the motors. The company has four of these pit wagons, and they can be readily moved over the concrete floor from one pit to another. To raise the armature from the motor, a horse,

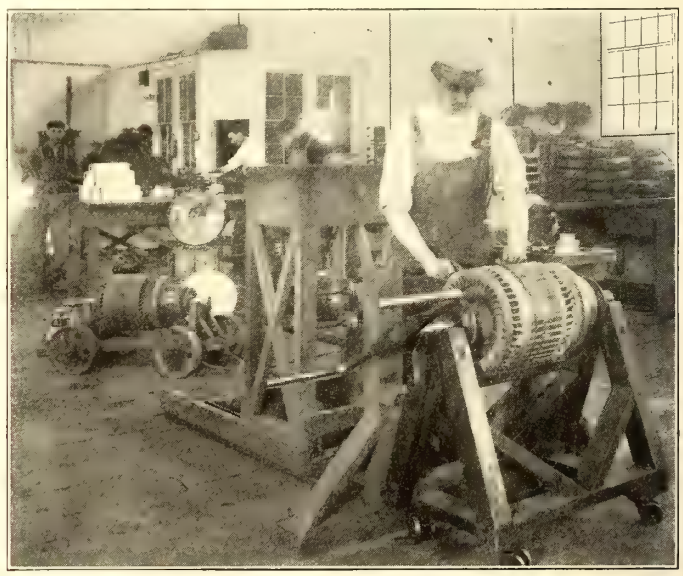


FIG. 9.—ARMATURE SHOP, BAND WIRING APPARATUS AND ARMATURE HORSES AND WAGONS, IN BACKGROUND FIELD-COIL DEPARTMENT

with block and chain, such as that shown in Fig. 4, is used. The armature being suspended at the pinion end by means of a thin steel hook, and at the commutator end by a leather strap, the whole being supported by a steelyard arrangement to the hook of the block. The block is suspended from a small grooved wheel, which rolls on an iron rod, placed on top of the horse. By means of this arrangement the workmen can readily raise an armature from its bearings and move it to one side of the pit. If the armature needs simply inspection or light repairs it

is not removed from this saddle device until it is replaced in the motor. As a rule, however, the armature is set on a special four-wheeled armature truck, which carries it to the armature room. One of these trucks is shown at the left in Fig. 4, while others are shown in Figs. 3 and 9. Fig. 3, which gives a general idea of the car repair shop, also shows a four-wheeled portable hoist, made by the Franklin Portable Crane & Hoist Company, that has been found to be of much use in handling armatures and other heavy pieces about the shop. The only machinery equipment in this shop consists of a drill press and emery wheel, belt-driven from an electric motor.

ARMATURE SHOP

It is in the armature shop that all motor repairs are made, switchboards built for power houses and sub-stations, electric heaters constructed, and general repair work done on headlights and controllers, as well as special work for the line department. This shop has about 1000 motors to keep in repair. When the armatures are received from the repair shop they are placed on wheeled horses, built in different sizes to fit all the different types of armatures used on the system. Each horse is marked on both ends with the number of the armature which it is supposed to carry, thus avoiding disastrous upsets likely to happen by using the wrong horse. These horses are used to carry the armatures while the bands are being put on them and while they are being painted. The armatures are also kept on them ready for use when completed, as shown in Fig. 5. Racks, such as that shown at the left in this illustration, are also used for holding completed armatures.

Fig. 6 shows the armature coil winding end of the shop. The coils are formed on wooden forms, which are turned by hand, as shown. For 12-A Westinghouse coils an iron form is used. For placing the paper insulation on the coils the hand machine shown in the center of the picture is employed. This consists of a screw press operated by a hand wheel, and an iron for holding the wires together that is worked by the foot. With this arrangement a very solid coil is formed, and its wearing qualities seem to justify the careful labor put on it. The use of power has been considered for the operation of this press, but it is believed that greater care is given to the work when it is performed by hand.

After the coils are taped with linen tape they are painted with armature compound and hung on rods in the drying oven, as shown in Fig. 7. Field coils are placed at the side of the oven, and completed armatures are run in on the wheeled horses spoken of above. This oven is built of brick and is heated electrically by two car heaters, whose construction will be mentioned later.

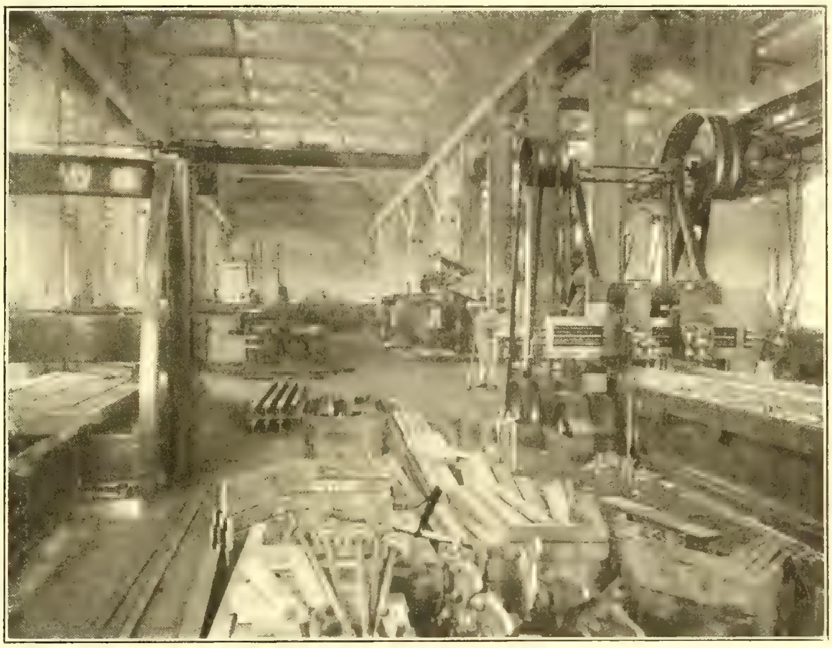


FIG. 10.—MACHINE SHOP, VIEW DOWN CENTRAL BAY, SHOWING TRAVELING CRANE, TWO PLANERS, ETC.

For winding field coils the apparatus shown in Fig. 8 is used. The form is mounted on a shaft, which is belt-driven by means of a motor in the basement. This belt is normally loose on the motor pulley, but is tightened so as to drive the machine when desired by means of a friction pulley controlled by a foot lever.

Several points in the construction of the motors most commonly used on the cars have been changed by special order with the factory, so that the motors will conform to the company's practice in repairing and maintaining its motors. One of these points was the low shoulders on the commutators of Nos. 49 and 76 Westinghouse motors. It was found that when these motors were run long distances at high speeds with little chance for inspection there was a tendency for the commutator to arc over the low shoulder to the windings. To remedy this the com-

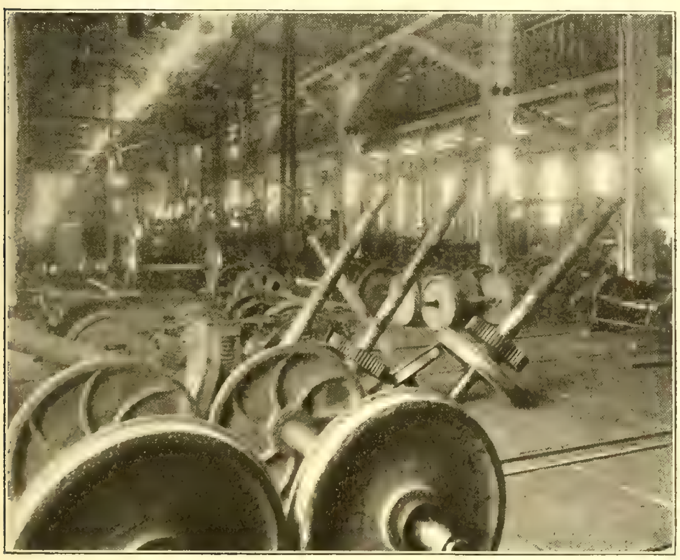


FIG. 11.—MACHINE SHOP, MACHINE TOOL SIDE

FIG. 12.—MACHINE SHOP, SHOWING WHEEL PRESS AND WHEEL BORING MACHINE, ALSO AT LEFT, TYPE OF WASH BASIN USED IN SHOP

pany has insisted on having the shoulders built 1½ ins. deep instead of ½ in., and in this way they are made to conform more with the commutator construction of other standard motors. Another point was the specification of heavier taping on the coils near the commutator end, where the wires cross and are apt to wear through.

FIG. 13.—SCRAP BIN AND PILES OF WROUGHT-IRON SCRAP READY TO BE FORGED INTO SLABS FOR CAR AXLES

FIG. 14.—BLACKSMITH SHOP, SHOWING AT RIGHT 3000-LB. STEAM HAMMER, AND BACK OF THAT, OIL FURNACE FOR AXLE AND OTHER FORGINGS

Instead of winding the wire bands on the outside of the armatures the company has adopted the practice of slotting the core so that the bands can be wound flush with the armature surface, thus decreasing the tendency for the armature to hit the field coils when the bearings become worn. For this, band wiring No. 19 tinned-steel broom wire is now being used instead of spring brass or steel wire, and the results are said to be very satisfactory, while the cost is reduced. The apparatus employed in band winding is shown in Fig. 9. The reel of wire is supported in the wooden frame shown back of the operator, and the wire is run over pulleys to the armature, which rests on a horse that sits next to the frame. The wire is held taut by a weight supported by a pulley. In order to keep the weight from the floor when the sizes of the bands vary, the frame is arranged so that it can be moved back and forth on the base, and held in place by pegs at the desired point.

The company has recently standardized all its armature bearings, and in boring new boxes they are given the smallest size in use. Then in reboring the sizes are varied by thirty seconds of an inch or by sixteenths down to 3¼ ins. Every bearing is stamped with its size so that no calipering is necessary to find the required boxes.

The direct-current voltmeter test is used in testing for defective armature coils, the transformer test not being regarded as safe enough on account of the liability of spoiling good coils. No shop tests are used for repaired armatures, they being placed directly on the trucks and tested on the car in service. Cases of trouble with rebuilt or repaired armatures are very rare.

The electric car heaters mentioned above are built in the armature shop, and are said to be very satisfactory as well as comparatively inexpensive. They were designed by S. H. Anderson, chief electrician of the company, and consist of a slab of Catalina marble, 1 in. x 7 ins. x 15 ins. in size, wound with No. 21 tinned-steel broom wire. The marble is recessed slightly at the sides, so as to provide circulation for the air back of the wires. The heater is mounted vertically in iron castings, as shown in the foreground of Fig. 7. The mornings and evenings in Southern California are quite chilly, and four of these heaters are placed in every interurban car, one under each corner seat of the closed part of the car. For use in offices and buildings the company makes a heater 4 ins. longer than the car heater, and wound with more turns of wire.

It is in this shop that the Anderson & Smith arc head and interior lights have been developed, the inventor being S. H. Anderson. The headlights are being marketed by the St. Louis Car Company, but development work is being carried on in the Los Angeles shop, under Mr. Anderson's direction. The headlights are hung on two hooks on the dashboards of the cars, these hooks being connected to ground. The other side of the circuit is formed by inserting a plug attached to the lamp into a socket on the sill of the car. The resistance used on the Pacific Electric Railway cars for two lights consists of a 9-in. galvanized iron cylinder about 9 ins. long, wound with asbestos and fifty turns of No. 22 Climax wire.

FIG. 15.—SPECIAL TRACK WORK YARD

MACHINE SHOP

In the machine shop are made all the car repairs that require machine work; axles are turned and car wheels bored

and pressed on. The truck work is done there as well as all the machining on special track work. The pneumatic trolley drills, planers, saws, etc. Fig. 10 is a view of the central bay of the shop, where the heavy work is handled, and shows

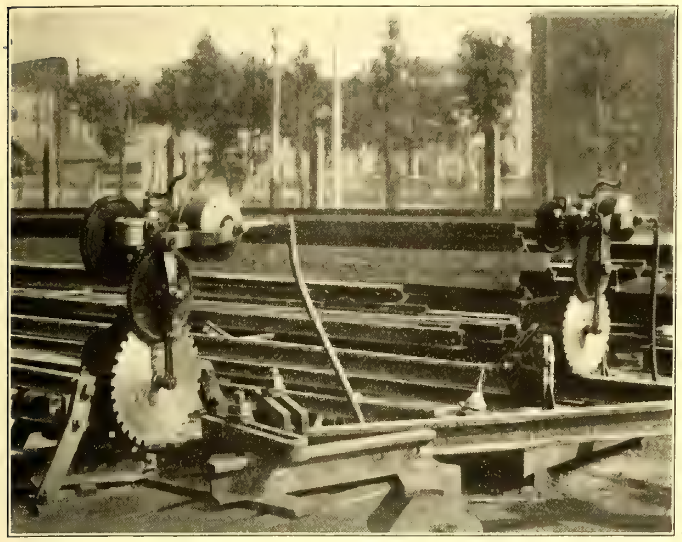


FIG. 16.—RAIL SAWS DRIVEN BY PNEUMATIC MOTORS IN SPECIAL WORK YARD

FIG. 17.—CABINET AND PATTERN MAKING SHOP

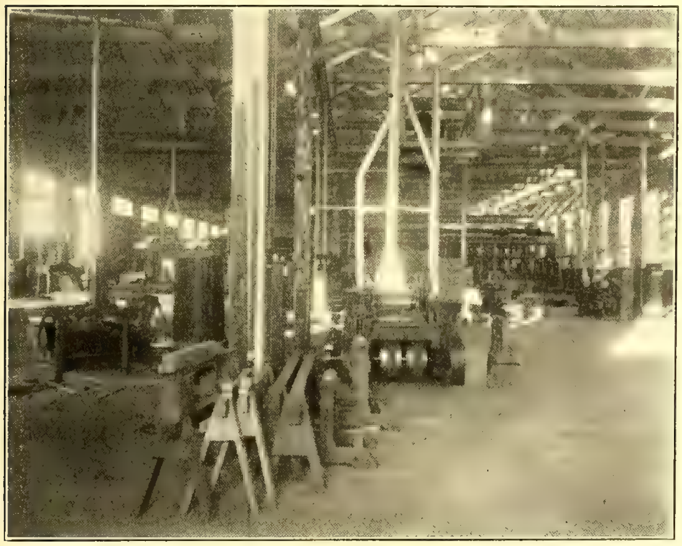


FIG. 18.—WOOD MILL AND CARPENTER SHOP

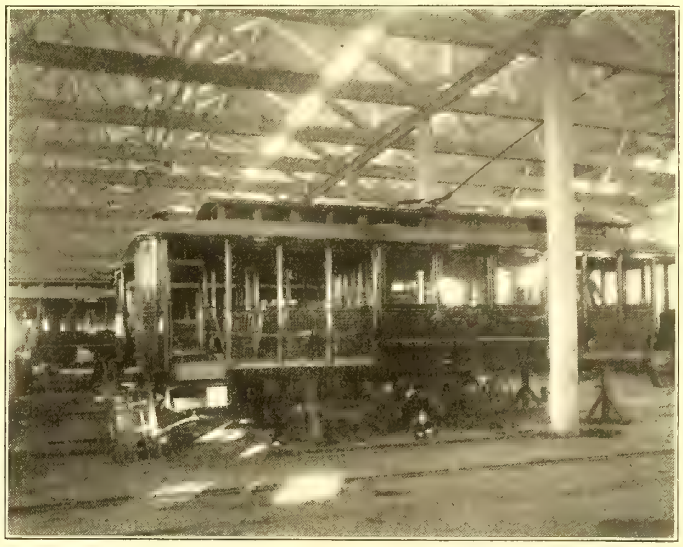


FIG. 19.—PAINT SHOP, SHOWING "A" HORSES USED IN SUPPORTING CAR BODY

FIG. 20.—STOCK ROOM IN PAINT SHOP

FIG. 21. ELECTRO-PLATING DEPARTMENT

controllers used on the Long Beach line are being made at present, and all brass and iron castings are finished in this shop. The equipment consists of about fifty machines, comprising the usual shop tools, such as lathes, shapers, milling machines, a 36-in. and a 60-in. planer, both with 18-ft. platens. Fig. 11 is a view of the west wing, in which most of the machine tools are located, and Fig. 12 illustrates the hydraulic wheel press and 42-in. wheel boring machine. These last two views show the

method of handling car axles and wheels by means of pneumatic lifts. When the machines in this shop were first installed the individual motor system of driving was used almost exclusively, but it has been found advisable to eliminate many of the smaller motors and make groups of several machines on a single motor. These changes to a combined motor-drive system have only recently been made, but they have been warranted by the economical results of operation since the alterations.

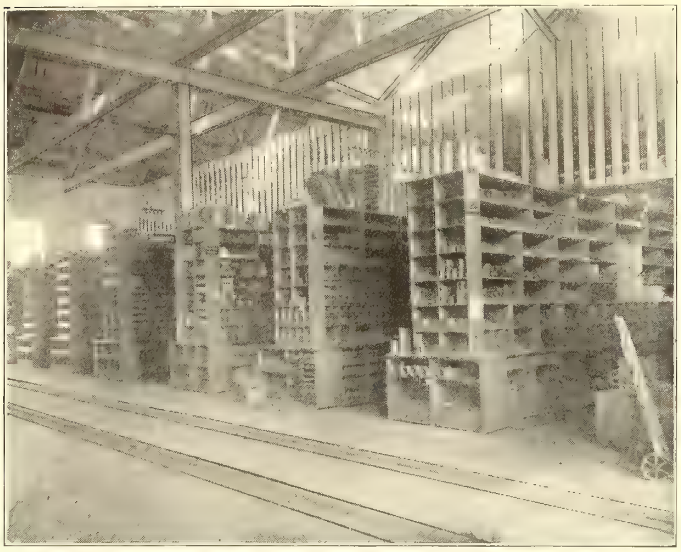


FIG. 22.—PORTION OF STOREROOM IN SHOPS

BLACKSMITH SHOP

The blacksmith shop is equipped to turn out all the necessary forgings used on the trucks, car bodies, and special track work, and also make car axles, a provision found in but few street railway shops, and not in many of the large steam railroad shops. These axles are forged out of wrought-iron scrap, which was formerly sold, as the company does not own a foundry. This scrap is put into bins, from which piles, 18 ins. x 10 ins. x 10 ins. in size, are made, as shown in Fig. 13. At night they are worked up into slabs approximately 3 ft. 6 ins. x 6 ins. x 2 ins. in size. These slabs are kept on hand, and are worked into forgings for axles by the day force. Three slabs are required for the smallest sized axle and six for the largest axle, which weighs about 800 lbs. finished. Sixteen axles is regarded as a day's work, and about 30 tons are turned out every month. A double-door reverberatory oil furnace, constructed in the shops, is used for all forgings, both light and heavy. Forgings as large as 21 ins. in diameter have been handled in this furnace. In the background of Fig. 14 is shown this furnace, and the same view also shows the 3000-lb. steam hammer used in connection with the furnace.

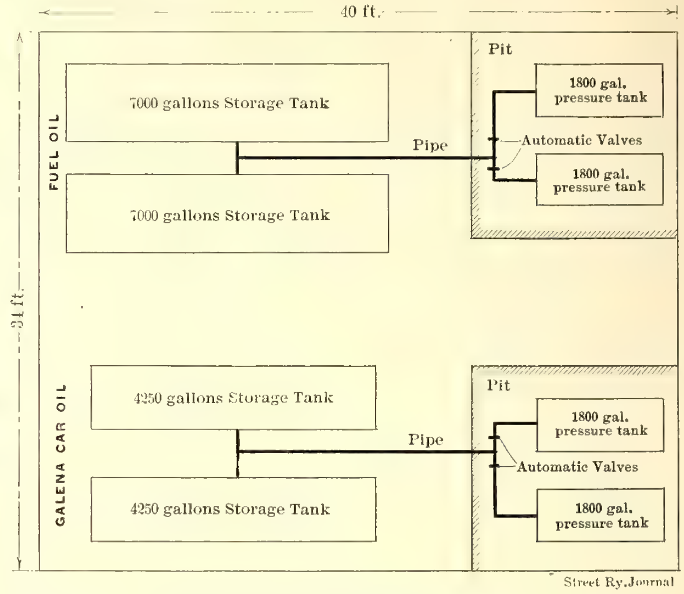


FIG. 24.—DIAGRAM OF ARRANGEMENT OF OIL TANKS IN BASEMENT OF OIL HOUSE

The truck springs are also made in this shop, they being heated in a special oil furnace. All bolts and nuts used in the shop are roughed out by special machines here. The remainder of the equipment includes eleven fires, punch, shear, bulldozer and two small steam hammers.

SPECIAL TRACK-WORK YARD

The yard for special track work adjoins the machine shop, as shown in Fig. 15. The work is usually laid out on heavy wooden horses, so it may be drilled and fitted more conveniently. A hydraulic rail bender is used and two saws. These saws are of the ordinary type usually operated by hand, but they have been fitted with pneumatic motors, as may be seen in Fig. 16, thus greatly adding to the convenience and ease of their operation. One of the saws was built complete in the shops, and is mounted on a heavy iron bed-plate. Forgings made out of wrought-iron scrap are used for all tongues, fillers and angle-bars of special work.

FIG. 23.—REAR VIEW OF SHOP BUILDINGS, SHOWING CAR LUMBER STORAGE

PATTERN AND CABINET MAKING SHOPS

A general view of the pattern and cabinetmak-

ing shops is given in Fig. 17. Here are made all the patterns used for the regular shop castings as well as those used in the power house and on other parts of the system. As mentioned above the company has no foundry of its own, but contracts for

PACIFIC ELECTRIC RAILWAY COMPANY

To Superintendent Mechanical Dept

to be charged to ______ *account*

You will furnish shop number for this work

GENERAL MANAGER

FIG. 25.—GENERAL ORDER, OR AUTHORITY BLANK

all of this work, keeping five foundries in the city busy most of the time. In the cabinet shop desks and office furniture are constructed as well as the finer woodwork required on the cars.

WOOD MILL AND CARPENTER SHOP

The heavy woodwork required for the repairing of the car bodies is fashioned in the mill which is located in the south end of the carpenter shop, as shown in Fig. 18. All shavings are carried by means of a blower system through galvanized-iron pipes to the 80-hp boiler located in the end of the lumber storage room. This boiler is arranged for burning shavings at the front, and at the rear end an oil burner is introduced.

a car is not sent to the paint shop until all the carpentery work has been completed, since it is not desirable to have such work done there. Where priming coats are necessary the painters go to the carpenter shop. The plan is generally followed of completing the repairs on damaged trucks and motors in time for a damaged car to leave the carpenter shop on its own trucks, so when it leaves the paint shop it is about ready for service.

In the southwest corner of the paint shop is the finishing department, and in the northwest corner the upholstering room. At the center of the west side of the building is the paint stock room, where the paints, varnishes, etc., are mixed and dealt out to the workmen. Fig. 20 shows this room, and the order and system of handling materials, as evidenced by the appearance of the room, is carried out throughout all the different shops. Record is kept of all stock issued to the workmen, and for what shop order and what car, so that the items of car repair expense falling to the paint shop may be accurately determined.

ELECTROPLATING DEPARTMENT

A department not commonly found connected with a street railway shop is that devoted to electroplating and burnishing, shown in Fig. 21. Here are lacquered all car trimmings, while all hand-rails, headlight fittings, trainmen's buttons and other parts are nickeled. It is surprising to see how much material passes through this shop, and the cost of operation is slight compared with the former expense entailed by sending the work out. The plating equipment consists of a cyanide of copper tank, one for sulphate of nickel, two containing potash for cleaning, and one cold water for washing. Oxidized copper and silver plating can also be done here if desired. An electric

______ 190__

Pacific Electric Railway Company

MECHANICAL DEPARTMENT

REPORT OF WRECKED CARS

Car No. ______ *Initial* ______ *Class* ______

Wrecked at ______

Estimated damage to Body ______

Estimated Damage to Trucks ______

Estimated Damage to Elec. Equip. ______

Description of damage: ______

Disposition of Car: ______

Remarks: ______

FOREMAN

Report to Office Superintendent Mechanical Department as soon as possible.

FIG. 26.—ESTIMATE BLANK FOR WRECKED CARS

PACIFIC ELECTRIC RAILWAY COMPANY

______ 190__

To Supt. Mechanical Dept

Please construct for ______ Dept

Charge labor and material to acc't ______ S. O. ______

Completed ______

Foreman

PACIFIC ELECTRIC RAILWAY COMPANY

OFFICE SUPERINTENDENT MECHANICAL DEPARTMENT

Foreman ______ *Dept* ______ 190__

Charge to S. O.

Return this Order to office when completed

Date ______

FOREMAN

FIGS. 27 AND 28.—ORDERS ON FOREMAN FOR REPAIR WORK AND CONSTRUCTION WORK

Pacific Electric Railway Company

Mechanical Department, ______ 1903

DAILY WORK REPORT OF CARS

Car No ______ Initial ______ put in Shops for the following Repairs: ______

Condition of Air Brakes ______

Condition of Hand Brakes ______

Condition of Controllers and Wiring ______

Condition of Motors ______

Remarks: ______

Completed ______ 1903.

Foreman.

FIG. 29.—DAILY REPORT FOR FOREMAN OF CAR REPAIRS

Either shavings or oil can be used for fuel, and if desired both can be fed to the furnace at the same time. This boiler supplies steam for the hammers in the blacksmith shop, for driving an air compressor with a capacity of 250 cu. ft. a minute, and for other purposes as desired.

At the north end of the carpenter shop are three tracks, with 2-ft. cement pits. Under the mill end of the building is a deeper pit, in which all the motors used in driving the machines are located.

PAINT SHOP

The paint shop, a portion of which is shown in Fig. 19, is the largest single room in the shops, and with its present force of forty men ten cars can be turned out in a week. As a rule,

buffing machine, whose wheels are made in the shop, is located in a room by itself.

STORE-ROOM AND OIL HOUSE

The store room of the shops, a portion of which is shown in Fig. 22, resembles the stock room of a large Eastern supply house, a great variety of supplies being kept on hand in good-sized quantities. The stock in the oil house also comes under the supervision of the storekeeper as well as the lumber, of which about 1,500,000 ft. is carried. Part of the lumber stored is shown in Fig. 23. The combined stores under the supervision of the storekeeper have an aggregate value of between $600,000 and $700,000. All track supplies for both construction and maintenance, such as rails, ties, bridge

material, etc., which at present have a value of about $750,000, are disbursed by order of the chief engineer.

As the construction of the oil house is somewhat unusual a description of its arrangement will interest shop men. The building has an iron grating floor, and on one side are 100-gal. steel tanks for the storage of turpentine, benzine, grain alcohol, Atlantic red oil, dynamo oil, lard oil and signal oil. In 244½-gal. tanks are stored coal oil and gasoline distillate. A block and tackle, running on an I-beam supported near the ceiling, is used to raise the carboys for filling the tanks. In smaller

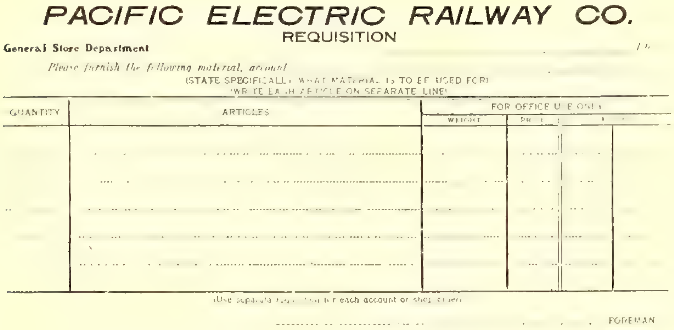


FIG. 30.—REQUISITION BLANK ON STOREKEEPER

tanks, barrels and casks, are stored motor grease, Albany grease, drilling oil, graphite and other lubricants and oils.

In the basement of the building are two 7000-gal cylindrical tanks for the storage of fuel oil, and two 4250-gal. tanks for Galena car oil. These tanks are below the level of the street outside, and are filled by gravity from tanks on wagons or cars. The special tank cars are run through the store room from the transfer table, and can thus be checked up by the storekeeper. Both oils are pumped under pressure from the basement, the arrangement being as shown diagrammatically in Fig. 14. The two tanks of each set are connected together by a short pipe at the bottom, from which a pipe leads to a "T" connecting with two 1800-gal. pressure tanks. In each branch of the "T" is a valve, which opens with the flow of oil, and automatically closes one tank while the other is filling. The oil flows by gravity from the storage tanks to these pressure tanks, from which it is forced by 30 lbs. air pressure to the floor above, where it is drawn off in any desired quantity. The fuel oil is also piped to the blacksmith shop for use in the furnaces, and to the boiler room for the boiler fuel.

GENERAL FEATURES OF SHOPS

The shops are well lighted from the roof by side windows, and artificial illumination is supplied by enclosed arcs for general lighting, and incandescents for individual machine lighting. In Los Angeles the days are so generally bright throughout the year that electric lighting is seldom neede l except at night. The motors used are of the induction 210-volt type, or 500-volt direct-current motors. Compressed air is piped to the repair shop with a connection at the wall between every other track, and is used for hoists and other purposes in the machine and blacksmith shops and for operating the rail saws in the special work yard, as already mentioned. All pits in the shops, as well as the transfer pit, drain into the sewer. In one corner of each shop are lavatories for the men. The wash basins are of heavy tin, and are pivoted so that when thrown back in the position shown at the right in Fig. 12, they drain off.

SHOP METHODS AND RECORDS

The shops are under the immediate direction of the superintendent of the mechanical department, and all orders for shop work are issued by him. When a car is sent to the shops for repairs the general order form, Fig. 25, is made, giving the authority, the mechanical superintendent furnishing a shop number for the work. This shop number, together with the car number, follows the car and its parts throughout all the shops, and in most of the shops cards are posted on the cars giving the shop and car numbers as shown in Fig. 19.

Separate accounts are kept of wrecked cars and of cars undergoing ordinary repairs, they being given separate shop orders. Often when a car has been slightly damaged general repairing is done to other parts while the car is in the shop, and in this case two shop orders apply to the same car. When a wrecked car comes in a report is immediately made by the foreman of car repairs on a blank, Fig. 16, showing the estimated damage to the car body, the trucks and the electrical equipment, with a description of the damage and the disposition of the car. This report is sent to the mechanical superintendent, who reports the main facts of the estimate to the general manager in letter form.

All cars are received at and sent out from the car repair shop. There the car is dismantled and light repairs are completed. For general repairs the parts are sent to the different shops with orders to the foreman made out on blanks, such as shown in Fig. 27. This order follows the work through its different stages, and when completed it is returned to the superintendent's office, signed by the foreman. For new work for the track department, power department, etc., the blank, Fig. 18, is used, and when the job is finished is signed by the foreman in the same way. A daily report is made by the foreman of car repairs on the blank, Fig. 29, showing the work done on each car in his shop for that day. If a car remains in his shop more than one day a daily report is made on it just the same, showing the state of the work at the close of each day, and when finally completed and sent out the last report shows that fact.

Requisitions on the storekeeper for material are made out by the foremen on the blank shown in Fig. 30, which shows what

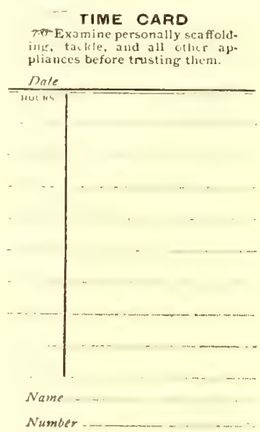


FIG. 31.—TIME CARD FOR EACH EMPLOYEE, SHOWING HOURS SPENT ON EACH SHOP ORDER DURING THE DAY.

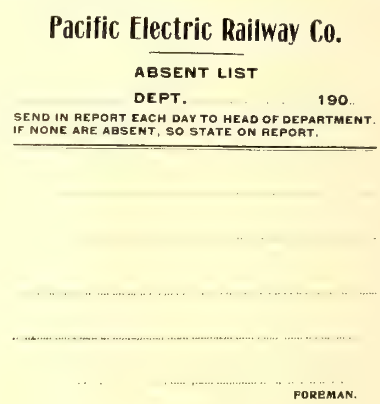


FIG. 32.—DAILY LIST OF ABSENT AND LATE EMPLOYEES, MADE OUT BY EACH FOREMAN.

the material is to be used for and the account or shop order. In the store room the prices are made on the blank, and the goods are then charged to the proper account. General requisitions are made by the storekeeper on the purchasing agent once a month, and emergency requisitions are issued daily when stock is required at once. Standard methods are employed by the purchasing agent in buying materials, in receiving them at the store room, checking against requisitions and approving invoices.

By means of time cards, Fig. 31, made out daily by the workmen, showing the number of hours spent on each piece of work or shop order, accurate data is obtained on the cost of labor for each account. These cards are filed in a large case by the timekeeper, and the proper charges made on the ledger, By the rule of the shops, if a man is late he loses the entire first hour, and is required to report to the timekeeper at the main office as well as the foreman. The latter makes out a daily

absent list (Fig. 32), giving the names of the men who are late or absent in his department. The apprentice system is employed in the shops, and all work is done by day labor, piece-work not being popular with the management, and hardly being practical in most of the shops on account of the great variety of work handled.

NEW POWER PLANT AT CRANFORD

Among the electric railway systems forming part of the consolidated system in Northern New Jersey, represented by the Public Service Corporation, is that of the Elizabeth, Plainfield & Central Jersey Railway Company, one of the sub-companies of the North Jersey Street Railway Company. Before the organization of the Public Service Corporation the North Jersey Railway Company had commenced the erection of a power station at Cranford for the operation of its Elizabeth-Plainfield branch. This station has been completed under the new management, and is particularly interesting owing to a number of novel features which have been introduced into its construction. They include among other departures from standard practice a station built entirely of concrete blocks, and a steam header 81 ft. long without a single valve in it.

The station is designed for a capacity of 3200 kw. The present equipment consists of two 800-kw units, which, with a load averaging 240,000 kw-hours per month, are operating at 3.1 lbs. of coal per kilowatt-hour. Direct-connected vertical compound steam engines, equipped with an interesting system of steam circulation for jacketing and reheating, are employed, operated condensing, and horizontal tubular boilers are installed in the boiler room. Jet condensers are used, with water from the Cranford River, and the feed for the boilers is taken from the condenser discharge. The auxiliary steam machinery exhausts in the usual way to a feed-water heater. The plant was designed by Warner W. McKee, who is chief engineer of the Elizabeth division of the Public Service Corporation.

The plant occupies a site alongside the Central Railroad of New Jersey, so that facilities are afforded for coal delivery, and it is practically on the bank of the Cranford River, which ensures an adequate supply of condensing water throughout the year. The building, which is 127 ft. x 73 ft. in plan, stands some 69 ft. back from South Avenue, in Cranford, and with a lawn in front, cut by cement walks leading to the building, obtains a setting which enhances greatly the general effect of its architecture.

The site was formerly more or less of a wooded marsh, apparently undesirable for its present occupation, but in boring for the foundations hard pan was found underlying the muck at a depth of comparatively few feet, so that concrete footings for the walls and machinery foundations were found possible without the use of piling. For the walls concrete blocks were determined on, planned originally to be hollow, largely to secure a reduction in the first cost of the building. The design of the block or the methods employed in its manufacture did not succeed, however, in producing a hollow block that was proof against cracks, and the pattern finally used was the solid. They were made generally with cinders, in the proportion of 1:3:5, with Vulcanite Portland cement, but whenever cinders were not immediately available crushed stone, 1½ ins. and less in size, was substituted, and the resultant cost of the structure, it is estimated, is about what good brick work would have cost.

The blocks, which are largely of a 2-ft. x 4-ft. face and 6 ins. thick, were placed in the walls as soon as the initial set had occurred, and allowed to harden in position. The blocks on their horizontal mating faces were dovetailed together, one block having a tongue parallel with the outside surfaces and the other a groove into which the tongue is fitted. On their vertical jointing faces each block had a groove, and the two grooves formed a vertical hole, which was filled with cement grout. The joints on all sides was ¼ in. thick, made with cement mortar. The partition wall between engine and boiler rooms is likewise of concrete blocks, and the wall thickness throughout is but 6 ins., except where there are ornamental pilasters or extra thickness blocks around doors and windows.

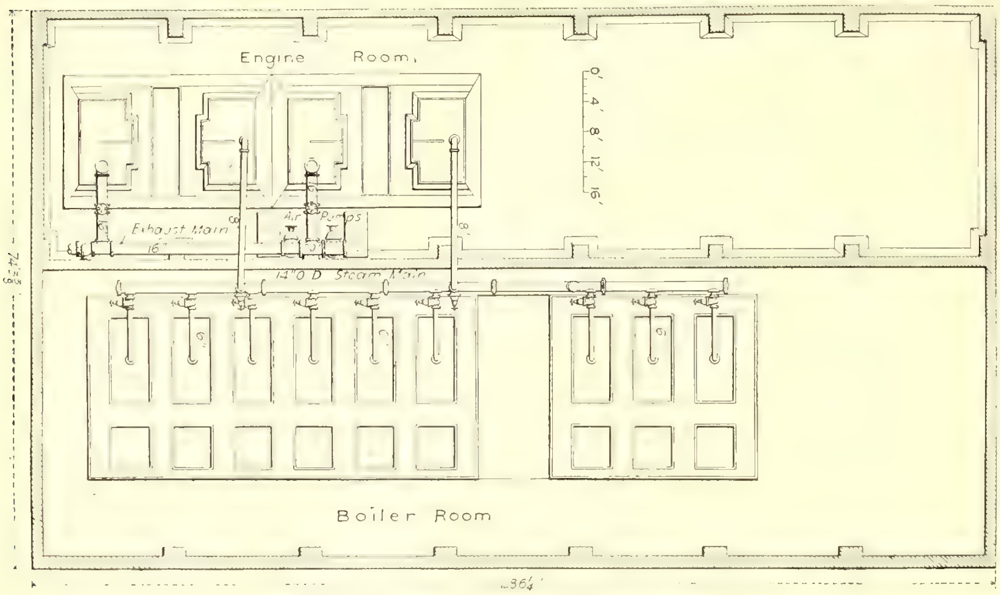
EXTERIOR OF CRANFORD POWER STATION

The walls are continued above the roof level, in a cornice or parapet, so that the roof itself is not visible from the street.

The engine room floor is about 4 ft. above the boiler room floor, and under the former the space around the machinery foundations has been excavated, forming a basement about 7 ft. in clear height, which is lighted by windows and utilized for storage and for electrical apparatus. The engine room floor is of expanded-metal concrete construction, suspended between transverse I-beams, and it has a cement surface marked off in large squares. The roof trusses, which are of light steel construction, are carried by three rows of light, steel columns, two of the rows on opposite sides of the engine room supporting also the girders for a traveling crane. The roof is of gravel, as furnished by the Commonwealth Roofing Company, laid on planks. The walls and under side of the roofs are painted white, except the bottom 5 ft. of the walls, which are black, and the roof trusses and crane are a dark red. The columns in their rise through the building are enclosed in concrete, as a sort of pilaster. There is a clear height of 25 ft. to the under side of the crane, which is a 15-ton hand-power traveling hoist, built by the Reading Crane & Hoist Works. There are practically two rows of windows in the outside walls and also a row of clere-story windows in the partition wall above the

boiler room, so that the engine room presents a lofty, well-lighted and pleasing interior.

Between the boiler room and the railroad coal siding, which is run on a trestle, there is space for some 3000 tons of coal; and in the outside wall there are six pairs of large double doors through which coal is carried by a short haul from coal pile to firing space. At each end of the boiler room there is also a large opening, closed by a Kinnear rolling door. The floor, which is paved with brick, is at grade level, and to the under side of the roof trusses there is a clear height of 22 ft. In the roof there are seven 24-in. ventilators. Fire hose is provided in both rooms, attached to piping extending from the city water supply.

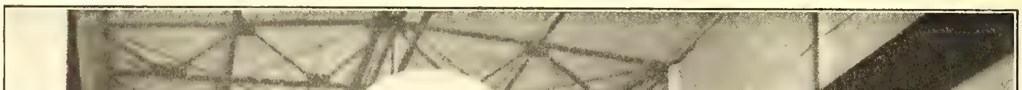


PLAN OF POWER STATION AT CRANFORD

The boiler plant consists, as stated, of horizontal tubular boilers, each of 72-in. shells, with 3½-in. tubes. The room is planned for twelve all told, arranged in two groups on opposite sides of a central cross gangway, where the feed pumps and feed-water heater are located and where communication is had with the engine room. Three of the boilers are yet to be installed. Those now in place were built by the Stewart Boiler Works, of Worcester, Mass., and have a shell 20 ft. long, with 86 tubes, so that the heating surface is 1800 sq. ft. per boiler. Allowing 12 sq. ft. per boiler horse-power, each boiler has a capacity of 150 hp, or 1800 for the whole plant. The floor space taken up by each group of six is 1 2-3 sq. ft. per horse-power, and in the whole room there are about 2.8 sq. ft. per horse-power, with 12 ft. firing space and 5 ft. between the boilers and the partition wall.

The boilers have 9-16-in. shell and ⅝-in. heads, and were designed for 175 lbs. pressure. They are enclosed in a setting built along the lines advocated by the Hartford Steam Boiler Inspection & Insurance Company. The grate area is 33.4 sq. ft., showing a ratio of heating to grate surface of 53.8 to 1, and a ratio of tube area to grate surface of 1 to 5.7, as bituminous coal is burned. The boilers are hand fired, and a record of the coal consumption is kept by means of a street railway fare register, which is rung up every time a barrowful of coal is weighed and brought into the boiler room, the barrow being carefully balanced on platform scales with 300 lbs. net each time. The reading of the register is noted at every change of shift. The boilers have the usual overhanging fronts, and each smoke up-take has an area of 5.4 sq. ft. The breeching is circular, in cross-section, and at its largest point 6 ft. in diameter, or 80 per cent of the total tube area of the six boilers served by it. The smokestack rises outside the building in the position indicated, and is of the Custodis radial perforated brick construction, with square base and ornamental top, 8 ft. in inside diameter at the top and 150 ft. high. A damper in the connection between breeching and stack is arranged for automatic control by means of a Spencer draft regulator.

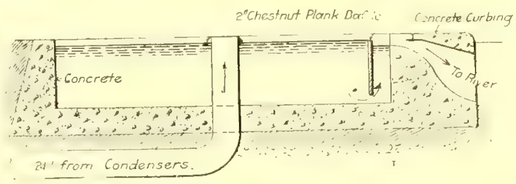
The steam piping is quite unusual, particularly in the use of a steam header without valves. The arrangement of the piping is shown in the accompanying illustrations. The boiler connections into the header, and the engine supply pipes from it are formed on long radius bends, in accordance with modern practice of allowing in that way for expansion and contraction changes, with an elimination of sharp angles and bends, and with a reduction in the number of joints and fittings. The height of the engines with respect to the roof of the boiler room necessitated an unusual amount of bending in the pipe



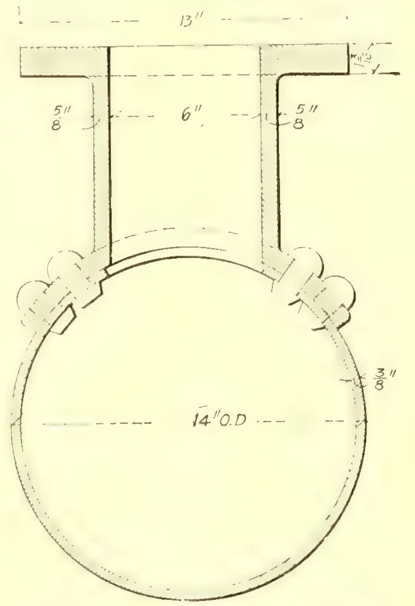
GENERAL VIEW OF INTERIOR OF STATION

in the engine room. One valve only is fitted in the pipes to and from the header and these near to it, and accessible from an elevated platform behind the boilers. The boiler leads enter the side of the header, so that condensation within them can flow back into the boilers, while the other connections rise from the top and drainage of the header is effected by a system of drip pipes. These are 2 ins. in diameter, and one is taken from the header below the inlet from each boiler, with a valve near the header. These pipes drop along the rear of each boiler, and hence into the water space of the boiler, but each connects en route into a 4-in. header, which is carried across the rear of the boilers as an auxiliary steam main and drip line. It will thus be seen that the main steam pipe drainage system provides for returning the water of condensation to the boilers by gravity, while at the same time furnishes a supply of steam for the auxiliary steam apparatus.

The present steam header is formed of five lengths of 14-in. outside-diameter steel piping, ½ in thick, the lengths ranging from 14½ ft. to 19 ft. 4 ins. The steam pipes are connected to it by flanged necks of cast-steel, ⅞ in. thick, riveted to the header by ⅞-in. rivets. The sections of the header are joined by the recessed lap joint, made by W. K. Mitchell & Company, of Philadelphia. The rest of the piping is of extra strong steel piping, with the Mitchell joint. In all joints a copper-wire gasket, devised by Mr. McKee, is employed. The main valves are of the Chapman gate type, and the piping is wrapped in R. A. Keasbey 85 per cent magnesia pipe covering, 2 ins. thick.

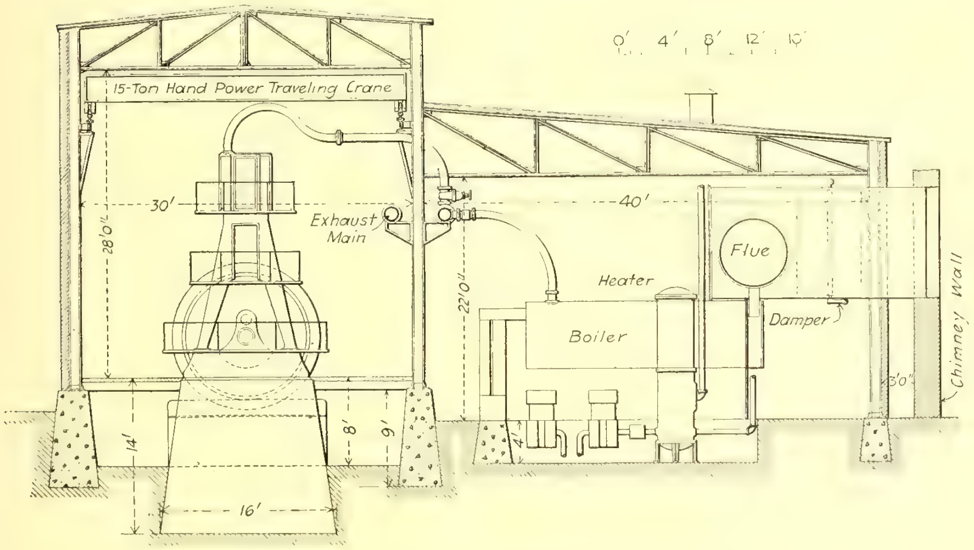


SECTION OF RESERVOIR FOR RECOVERING OIL



SECTION OF BOILER CONNECTION TO MAIN STEAM LEADER

The engine room contains at present two 800-kw, direct-connected direct-current railway units, with space for two more of the same capacity, which, however, may be alternating-current units in case it is desired to provide for long-distance transmission. In that event it is proposed to install rotary converters as a means of connecting the direct and the alternating-current ends of the plant, so that an excessive demand on the one system can be met by the other through the use of the converter. The space occupied in the engine room is 1.18 sq. ft. of floor space per kilowatt of rated output, or 0.88 sq. ft. per horse-power. Taking the whole building into consideration there are, not including the chimney, 2.17 sq. ft. of ground space per horse-power of rated output and 71 cu. ft. of building per horse-power.



SECTION OF POWER STATION AT CRANFORD

The generating sets now in operation consist of Williams vertical compound engines, with 21½-in. and 43-in. cylinders and 36-in. stroke, built by the Quincy Engine Works, and Westinghouse 600-volt railway generators, operated at 120 r. p. m. The engines were furnished under a guaranteed steam consumption of 13½ lbs. of steam per indicated horse-power per hour, with steam at 150 lbs. pressure, a vacuum of 27 ins. and the speed above given. They are equipped with an interesting system of reheating, including a jacket for the high-pressure cylinder and a reheater between cylinders. The live steam in the jacket passes from it through a coil in the reheater, and the outlet of the reheating coil is then connected, after the condensation has been trapped off, to operate the steam cylinders of the condenser air pumps, the pipe thus serving as a convenient method of supplying the condenser units but principally as a means of creating a steady flow of steam through the reheating coils. Such water of condensation as forms later reaches the feed-water heater through the exhaust from the steam pump.

The engines are operated with a fixed cut-off for the low-pressure cylinder, so that with varying load the receiver pressure is variable, and the latter is accordingly equipped with a safety valve of the Crane type, set to blow off at about 60 lbs. The receiver is 36 ins. in diameter and about 4 ft. 9 ins. high inside, and contains sixty 2-in. brass pipes, 3 ft. 8 ins. long, connected at top and bottom by return bends to form a continuous coil. The bearings and guides of the engine are water cooled and lubricated from an oil circulating system, which employs a storage tank on the upper engine gallery. The head under which the oil is circulated is thus not more than a few pounds at the oil spouts, the purpose being to furnish the oil through these outlets in comparatively large globules or streams to avoid the clogging of smaller outlets, which might otherwise have been necessary. The oil from the bearings is caught and drained by a system of piping to a Burt "Cross" oil filter in the engine room basement. Filtered oil from the reservoir is pumped to the elevated tanks by means of a small steam pump, operated a few minutes, as the tanks above become empty.

The condensing system is noteworthy for the directness of the piping system and the location of the air pumps on the engine roof floor, behind the engines readily accessible to the room attendants. The exhaust pipe from each engine, 16 ins. in diameter and of wrought-iron, is 11 ft. long to the 20-in. main exhaust, and each of the two pumps takes from the main

through a pipe 8 ft. long. As indicated in an accompanying drawing, the usual relief connection is provided, with a Blake relief valve discharging through a short horizontal pipe extending through the end wall of the building. The pumps are of the vertical twin pattern, made by the Warren Steam Pump Company, and are 10 ins. x 25 ins. x 18 ins. in size. Each is calculated large enough to serve both engines, and the connections are made so that either one or both may be operated. They deliver into a concrete reservoir outside the building, the chief purpose of which is to afford means for the oil or grease to separate from the water before its final discharge into the river. As shown in a sketch on page 441 the water flows out of the reservoir over a weir in one side, reaching the weir under a baffle, so as not to disturb the surface water where the grease may rise and collect. As little cylinder oil as possible is used in the engines, and thus far no systematic skimming has been necessary.

Water for the boilers is taken from a pocket in the condenser discharge main within the power house, the pocket being located in the bottom of the pipe to minimize the chances of getting oil in the water; and this water, without treatment, except in the feed heater, is pumped into the boilers. The boilers are cleaned in turn after being in use four weeks, and the sediment is a soft mud, easily washed out. There are two 10-in. x 6-in. x 12-in. Warren feed pumps, installed in duplicate and placed on one end, taking a vertical position with minimum floor space. They deliver first through a Union meter, by means of which the record of the boiler evaporation is kept, and then through the feed heater, which is a Wainwright water-tube heater with corrugated tubes. Under normal conditions the feed to and from the heater is 100 degs. F. to 110 degs. F. and 200 degs. F. to 210 degs. F., measured by standard thermometers with dial faces. The heater is rated at 3000 hp, and contains 144 1½-in. tubes, 124 ins. long. The exhaust from the various pumps is led to it, and the condensation is drained to an open barrel near the feed pumps, this barrel serving the same purpose as the concrete reservoir. Considerable oil is recovered in this case, and is skimmed off for utilization over again in the pump cylinders.

The station is entirely a street railway one, subject to the variations of demand peculiar to this class of service. It is at present an adjunct of a 1300-kw street railway plant at Elizabeth, and while located centrally for the suburban lines to Plainfield, to Elizabeth and to Boynton Beach, is frequently called on to send current to the Elizabeth system, a distance of 5½ miles, over a 1,000,000-circ. mil feeder. The station is 9½ miles from the center of Plainfield and 10 miles from Boynton Beach, and furnishes the current necessary to operate all the cars along the line, and at Plainfield as well as Elizabeth.

For the control of the electric system there is a standard switchboard with two panels for the generators, a totalizing panel and the remainder, feeder panels, two feeders per panel, each feeder protected, as usual, with a circuit braker. The totalizing panel carries a recording wattmeter, which is one of the instruments read with changes of shift in the power house, in connection with the records kept of the plant performance.

The plant is run daily except between 2 o'clock and 5 o'clock in the morning. The average load throughout the day is 800 amps., but at the peak, between 5:30 p. m. and 6:30 p. m., the current demand averages 1200 amps., fluctuating between 800 and 1600. Steam, however, is kept up at all times, and the steam pressure is varied proportionately to the load, the idea being that more economical steam distribution is secured in the steam engines at the light loads with reduced steam pressure. The pressure ranges from 60 lbs. during the early hours of the morning to 150 lbs. at heavy-load times, or 160 lbs. in the case of an unusual demand. In the accompanying table is given the record of the coal consumption in seven months' running. The evaporation of the boiler plant, on the basis of the water meter and for the actual continuous performance, day after day, is 9½ lbs. of steam per pound of coal.

RECORD OF SEVEN MONTHS' OPERATION

Month	Kw-hours	Coal Per Kw-hour Pounds
June	......	3.97
July	......	3.4
August	......	3.37
September	......	3.4
October	......	3.44
November	210,000	3.4
December	240,000	3.1

On the basis of the December output, it will be found that 29½ lbs. of steam were consumed per kilowatt-hour, including the engines, condensers and feed pumps.

STREET CAR LUBRICATION

BY GEORGE L. FOWLER

To the layman who is not bearing the burden of the responsibility of street railway management but who happens to be somewhat familiar with the practices of the steam roads, and who has seen the great economies resulting from the adoption of the various standards promulgated by the Master Car Builders' Association, it seems passing strange that with all of the excellent work done by the American Street Railway Association, there should be such variations of practice among the roads represented.

Probably in no one detail is this variation of practice greater than in that of methods in use for the lubrication of axle journals. In the days of the horse car the almost universal practice was to use a felt wicking and oil. The speed was slow and the weight light, so that little or no trouble was experienced. But, with the introduction of electricity and the construction of heavy cars intended to be run at comparatively high speeds, the wicking and oil did not seem to be quite satisfactory, and it was dropped here and there, until very few instance of its persistence in electric work can be found.

As the wicking was found wanting, each master mechanic set about, in his own way, to find something that would do the work. And to do the work meant to find a lubricant that would make it possible to avoid hot boxes and cut journals, and thus avoid the resulting delay to traffic. This end once attained all investigations came to an end, and inquiry almost leads one to believe that there is hardly a road in the country whose officials know whether they are using an economical system of lubrication or not.

It is all very well to declare a freedom from hot boxes and an absence of all delay to traffic, but there are other things to be taken into consideration in the matter of lubrication than hot boxes and blockades.

It does not seem to have occurred to most managers that there is such a thing as a coefficient of friction, and, if it has, it has been discarded as of no moment. It is taken to matter little whether that coefficient is .07 or .15. But it is.

This statement may be best illustrated by the experience of a certain railroad that is now almost ancient history. A contract was made with an individual to keep a line of coal cars supplied with oil, waste and brass for a term of years. The individual proceeded upon the plan that the best way to make money out of the job was to use the best materials that he could buy. At the time of the signing of the contract the trainload for the standard engines was fourteen cars. In six months time the improved lubrication made it possible to increase the train to eighteen cars, and this held throughout that whole life of the contract. Owing to the fact that the contractor made money out of the work, the contract was not renewed, and the purchasing agent started in to save what the contractor had made, and a little more. Accordingly, he commenced to buy on

price and not on quality, with the result that in six months time the trainload was once more fourteen cars.

Practically the same thing is being done in street railway service. It may not be that poor materials are bought, but I am well within bounds in saying that improper materials are used.

In some recent tests two cars were used. With the first a speed of 25 m. p. h. was attained and maintained with ease. When work was started with the second it was found to be impossible to reach this speed. Attributing the failure to the motors, those on the first car were put upon the second, and still the speed lagged at 20 m. p. h. The first car was lubricated with oil and felt, the second with grease. This grease was then removed, and the boxes packed with a dope of oil and waste. At first no difference could be detected, then at the end of a day's work, when the oil had been well drawn in between the brass and journal, a speed of 25 m. p. h. was readily attained.

Again, the records of one of the great roads of the country show that there is a wide variation in the amount of power required to propel cars in January and July. In cold winter weather it takes about 28 per cent more power than in the heat of July. Yet what do we find to be the practice of a great majority of the urban electric railroads?

No attention whatever is paid to this important element of coefficient of friction, though the results must be patent to all. Something is put into the journal boxes that keeps them cool, and no note is made as to whether car resistances are 1.25-kw or 2.00-kw hours per car mile. And, worse than all, is the continued use of the same lubricant for both summer and winter service. This is so diametrically opposed to the almost universal practice of the steam railroads that it is inconceivable that the importance of the subject should be so grossly neglected. On one important trunk line it is claimed that if the summer oil is allowed to remain in the boxes too late in the fall, there is a difference of 30 per cent in train resistance.

Yet what do we find in the practice of street railroads? There is little or no knowledge of the real value of the lubricants used when referred back to that court of final appeal, the coal pile; despite the fact of the realization of the variations in power used under varying conditions of temperature.

Returning now to actual methods of practice we find, first, that the old felt and oil method of the horse car is not entirely unsuited to the requirements of urban electric service, provided suitable materials are used. On at least one important line this method is still in use, but the greatest care is taken in the selection of the wicking. The finest quality of piano felt is used, and it is so cut that it lubricates not only the journal proper but the check-plate groove as well. The purchasing agent buys on specifications and not on price. The result is that the journals on that particular road maintain a phenomenal smoothness and evenness of wear. A cut journal or a hot box is an unknown quantity, and a recent inspection of several hundred old axles showed each to be in first-class condition. The same care that is exercised in the choice of material obtains in the maintenance, and when the felt drops away, as the result of wear and saturation, it is blocked up with felt of the same quality and not with wood. The conclusion naturally reached from this is that felt and oil can be used on urban service, because it is; and the suspicion arises that the reason for discarding it lies in the attempt to use poor and cheap materials that would not do the work under heavy cars at moderately high speeds. There really can be no other reason, since the foreign roads have been using felt and oil as a means of lubrication for years, and with great success.

I am not prepared to say that the felt and oil is the best means of lubrication, either from the standpoint of efficiency or economy; but merely that it will work.

Again, grease is used, and "grease" covers a multiude of compounds. It may be as stiff and hard as a plank in winter, and as soft as melted butter in July. It may be mixed with waste to serve as a binder or have the delicate odor of a perfume. It may masquerade under any one of a score of names, but it is still grease.

Sometimes a road has no accepted method of lubrication, but leaves the matter open to the judgment of the car house foremen, who are held responsible for the cool running of the axles. Such a state of affairs may seem improbable, but it does exist.

Then, of course, comes the more common practice of the use of oil and waste. Rarely is there a difference made in the quality of oil used in summer and winter, though in places this is done.

The variation of practice is almost as great, however, as the number of roads. Every variety of waste and oil is in use. I have seen cotton waste that was lumpy, and would mat like corn husks, put into boxes dry, with a heavy oil poured over it that ran like molasses in January; and I have seen a light elastic waste used that had been soaked in oil until it formed a springy dope that would lubricate anything. Mineral wool, Japanese fibre, jute and other fibrous materials come into play with a wide difference in effect on resistances.

Now, there is really no sense in such a multiude of practices. The services of the ordinary street railroads are near enough alike to make it probable that some one general system will be found to be best for all. What this is, a careful and painstaking investigation alone can tell. That it will be found to be identical with the approved practice of steam roads is hardly probable, but that it will develop that it is a matter of no importance as to what is used provided only that the journals run cool, is an absurdity beyond the realm of consideration.

In order to drive the importance of this subject home let us do a little calculating:

Suppose it requires 1.25-kw hours per car mile, at the car, to move it. If this amounts to 60 per cent of the power developed at the engine, that of the latter will be about 2.8-hp hours. If the engine has an efficiency of 1-hp hour on 14 lbs. of water, and the boilers can evaporate 10 lbs. of water per pound of coal, the coal consumption per car mile will be about 3.9 lbs.

If the road has 500 cars in service that are making 100 miles a day each, the coal consumption directly chargeable to car mileage will be 975 tons. Suppose, now, that owing to defective lubrication the power consumption is increased 20 per cent, and this may easily occur. With coal worth $2 per ton, we have the neat little item of extra expense of $390 per day added for "didn't know," or "don't care." Capitalize this at 4 per cent and you have a paying dividend on pretty close to a million dollars. If there is a disagreement as to the basis of the calculation, though it is not far out, let the reader cut it down to suit himself, and he will still find that lubrication is an item of such magnitude that he cannot afford to ignore it.

And yet, despite the data, small as it is that is available, the wonder to the outsider is that the subject of lubrication is so coolly ignored by men who are bending every nerve to cut down operating expenses and pay dividends. It seems to be the old story of saving at the spigot and wasting at the bung.

While sufficient data is not at hand to lay down a definite law as to what is best, it is respectfully suggested that, owing to the high resistance usually developed with grease, this material is unsuited to the lubrication of car journals, and that investigations had best be made with felt and oil and waste and oil. In the case of the former a fine quality of piano felt will be found to be the best, and the oil must be adapted to the season, at least two, and possibly three grades being used, during the year.

With oil and waste, again, use only the best of materials. Generally speaking, wool will be found to be superior to cotton, and the wool itself may possibly be improved by the addition of a small quantity of Japanese fibre. In the matter of oil it is of importance that at least two grades be used during the year; and, finally, no waste should be put into a box until it

has been soaked submerged in oil for at least twenty-four hours, and forty-eight is better still. It should then be allowed to drain for twenty-four hours, before being used to pack the boxes. With this no oil should be used, and when repacking is required the old waste should be removed and new put in its place. It is not stated that this will give the best results attainable, but merely that it is probable that the best results will be attained by pursuing the investigation along these two lines.

RECONSTRUCTION OF THE ZANESVILLE (OHIO) RAILWAY, LIGHT & POWER COMPANY'S PROPERTY

The property of the Zanesville Railway, Light & Power Company has been undergoing an almost complete reconstruction during the past eighteen months. As many other properties are in a position where such reconstruction is being considered, the present article, telling how this work was accomplished in Zanesville and the results will, no doubt, be of interest. The old power plant of this company consisted mainly of high-speed simple non-condensing engines and a conglomeration of belts and line shafting for transmitting the power to generators, such as is familiar to most of our readers. This plant is to be entirely abandoned. The new plant consists entirely of steam and water turbines. There are no reciprocating engines driving generating machinery in the plant.

LOCATION

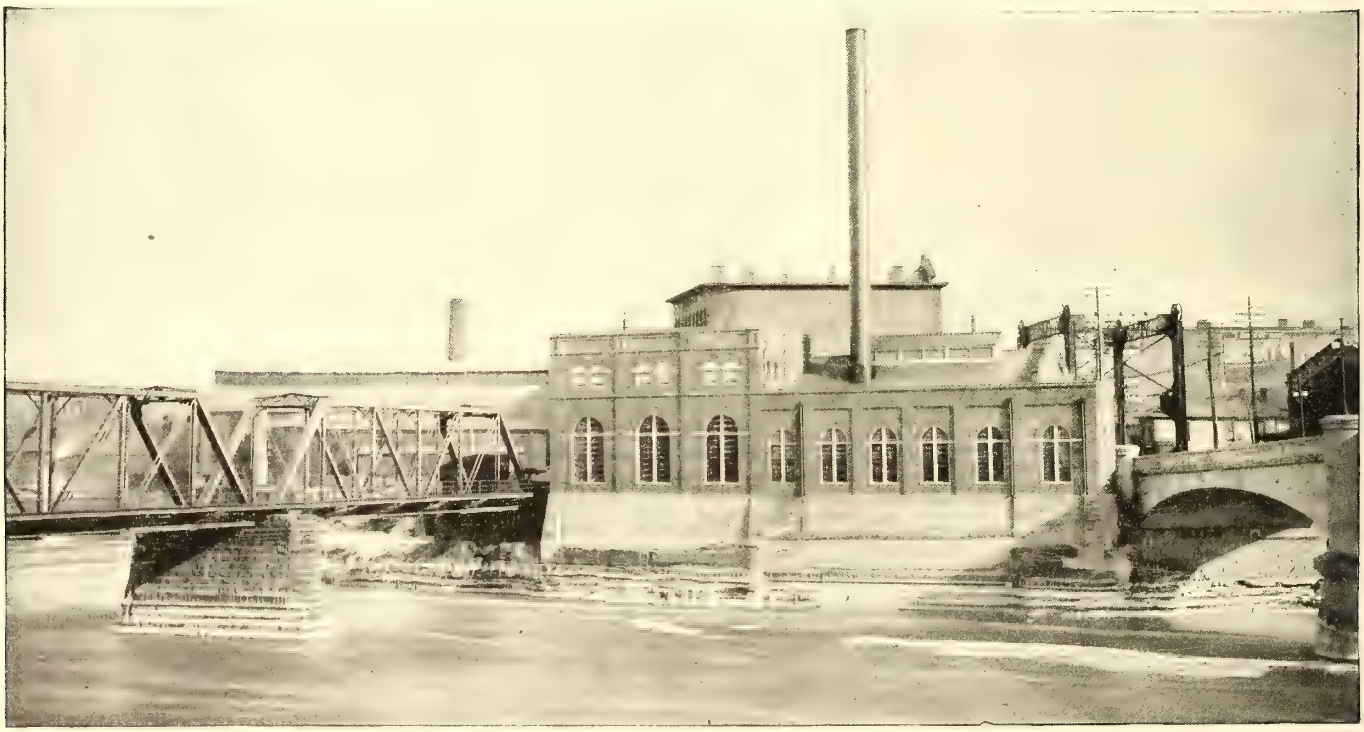
A remarkably fortunate location was selected for the new plant, as shown in Figs. 1 and 8. It is on the bank of the Muskingum River, between the river and a canal maintained by the Government. In order to supply water to this canal the Government maintains a wooden crib dam in the Muskingum River, just above the power plant, as shown in Fig. 8. The water power obtained by this company is therefore secured at no expense for the maintenance or construction of a dam or canal. The only expense connected with the development of the water power has been the building of the water power station itself. In this plant, water power is not depended upon entirely, as there are times when, owing to the great amount of flood water going over the dam, the head water at the power house practically disappears. A steam power plant sufficient to carry the full capacity is therefore placed in the same building, but it is expected that water power will be sufficient during a large portion of the time to operate the plant. Since, in this case, the expense of the hydraulic development was comparatively small, the engineers considered that they could well afford to install a hydraulic plant for the sake of power that could be obtained, even though this power could not be relied on every day in the year.

Just below the power house is a bridge, and from the street railway tracks on this bridge a spur is run to the power house for the purpose of carrying coal and other supplies. A side track of the Baltimore & Ohio Railroad also reaches the plant at one end. A further idea of the location of the plant can be obtained from Fig. 3, which is a photograph taken from across the river, showing the Government dam and railroad bridge at the right with the city bridge at the left. The power house is located on a solid ledge of rock, as can be seen from Fig. 3, which was taken during construction. This shows the ledge of rock on which the power house and the excavation made for the tail race and also the concrete arch construction over the tail race.

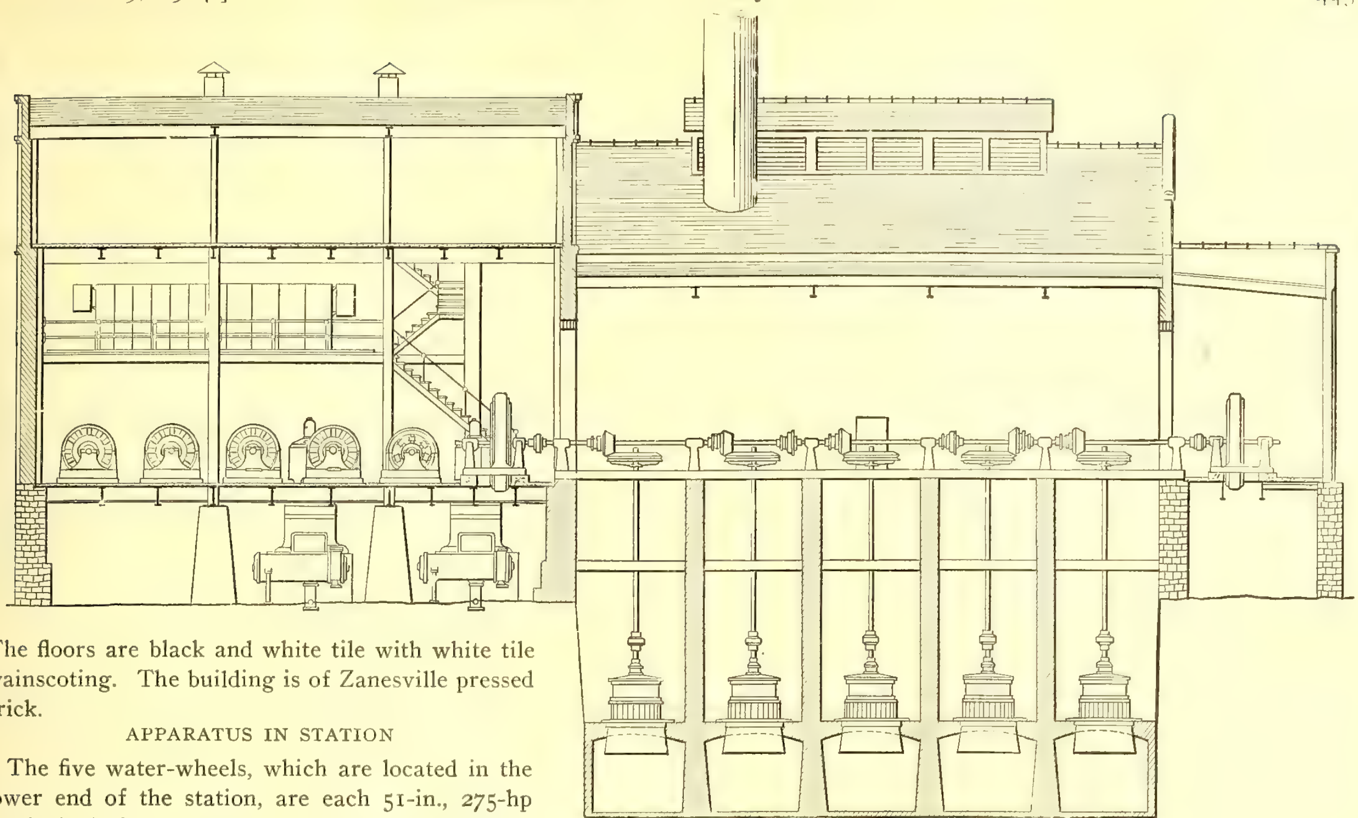
CONSTRUCTION AND ARRANGEMENT OF BUILDING

The arrangement of the machinery is interesting, owing to the dual character of the apparatus employed. Thus the water passes under the down stream end of the building, and the boiler house is located over the head race. Vertical shaft turbines are used and are geared by means of wooden beveled gears to a long horizontal shaft, which is direct connected at its ends to the generators. The ordinary level of the tail water is 13 ft. below that of the head water, giving a 13-ft. head on the wheels. This head disappears in times of freshets, as maximum high water comes very nearly to the top of the concrete foundation wall, which is carried up to the level of the engine and boiler room floors.

The up-stream end of the station contains the steam turbine units. The basement floor is 13 ft. below the engine room floor; the basement containing the turbines and condensers, while the generators on the vertical turbine shaft are above the level of the main floor. All the foundations of the building are concrete, laid on solid rock. The roof is slate with copper gutters.



NEW ELECTRIC POWER STATION AT ZANESVILLE, OHIO



The floors are black and white tile with white tile wainscoting. The building is of Zanesville pressed brick.

APPARATUS IN STATION

The five water-wheels, which are located in the lower end of the station, are each 51-in., 275-hp vertical shaft turbines, of the open flume type, made by the Stilwell-Bierce & Smith-Vaile Company. These turbines run 80 r. p. m., and are

FIG. 3.—VIEW OF STATION DURING CONSTRUCTION

geared through bevel gears to a line shaft running 200 r. p. m. On each end of this line shaft is a 375-kw General Electric, 60-cycle, 2300-volt generator. Fig. 5 is a view in the shaft house, showing the shaft, bevel gears and Lombard water-wheel governors. The shaft house is partitioned off from the generators at either end.

In the steam turbine room, Fig. 6, are two 500-kw Curtis steam turbines, designed to operate at 180 lbs. steam pressure, in connection with Stilwell-Bierce surface condensers. Fig. 7 shows one of these turbine units with its condenser piping. The centrifugal circulating pump is motor driven. Provision has been made in the generator room for two more steam turbine units of this size. The rotary converters mentioned later are also in this room.

In the boiler room resting on a concrete floor over the head race are two 380-hp Heine water-tube boilers, with two Stilwell-Bierce feed pumps. The boilers are hand fired. Coal is shoveled directly from the cars on the siding into the space in front of the boilers. Provision has been made for doubling this boiler capacity.

About 25 per cent of the load of the station is supplied to

FIG. 2.—LONGITUDINAL SECTION OF POWER STATION

alternating-current lighting circuits. The remainder is used in rotary converters to give 550-volt current for railway use and 110 volts for the three-wire direct-current network.

For railway purposes one three-phase transformer takes the 2300-volt current and reduces the voltage for use in a six-phase, 60-cycle rotary converter for supplying the street railway.

To supply the direct-current lighting network to three-phase transformers step down the 2300-volt three-phase current for use in two 240-volt rotary converters. The balancing is done by a connection of the neutral of the star connected rotary converters.

Both the railway and lighting rotary converters are supplied from the same generators. This has been made possible by connecting in multiple with the railway bus-bars 256 cells of chloride accumulator. This storage battery is connected in series with a differential booster, which causes the battery to take the fluctuations of railway load and leave a practically

FIG. 4.—STORAGE-BATTERY ROOM

steady load on the generators. The cells of this battery are type G, with seventeen plates per cell. The tanks are large enough to allow 50 per cent increase in plate surface. The differential booster is large enough for the ultimate capacity of the cells. This battery is rated at 640 amps. at the 1-hour

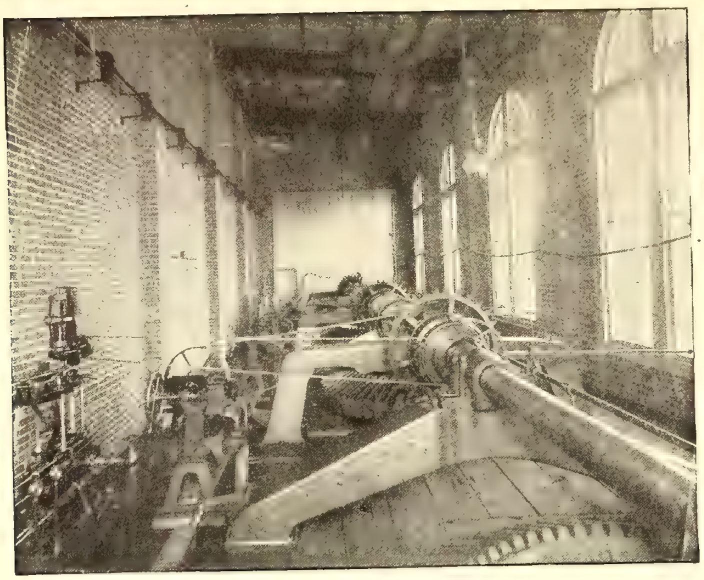


FIG. 5.—SHAFT HOUSE OF WATER-TURBINE EQUIPMENT, SHOWING SHAFT AND GOVERNORS

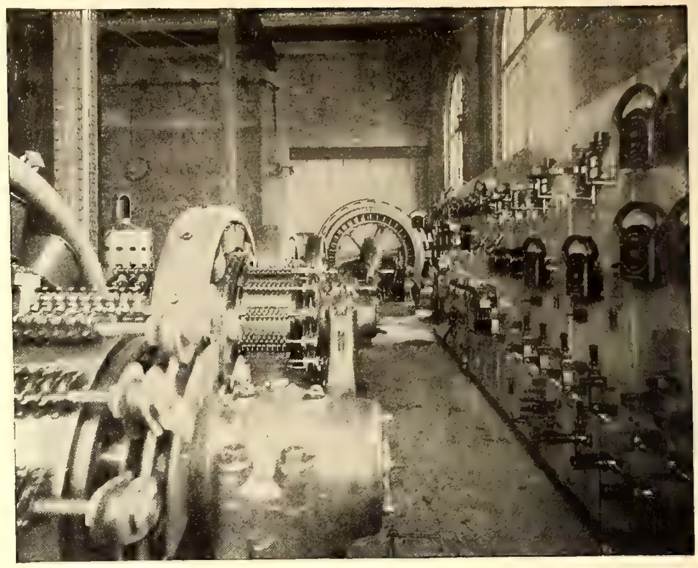


FIG. 6.—VIEW OF STEAM TURBINE ROOM, SHOWING STEAM TURBINES, ROTARIES, ETC.

rate of discharge. Provision has also been made in the battery room for a battery to operate in connection with the three-wire direct-current lighting system. The battery room is shown in Fig. 4.

The value of a battery was forcibly demonstrated last winter during the holidays. The maximum railway load amounted to 660 kw. If there had been no battery this would have been beyond the capacity of the water supply which was then available for use. The average load was only 220 kw. The battery took the fluctuations so that the plant was operated with one wheel at full gate and one wheel at sixteenths full gate. No exciters have been provided for this station for the present, as the engineers considered that in case all the direct-current machinery should be shut down, current for excitation can be obtained from the battery.

The battery room is on a floor above the generator room. It has the regular floor now commonly employed in storage battery rooms, consisting of tile laid in asphaltum, and is drained with lead-lined iron pipes.

The high-tension switchboard in the gallery was furnished

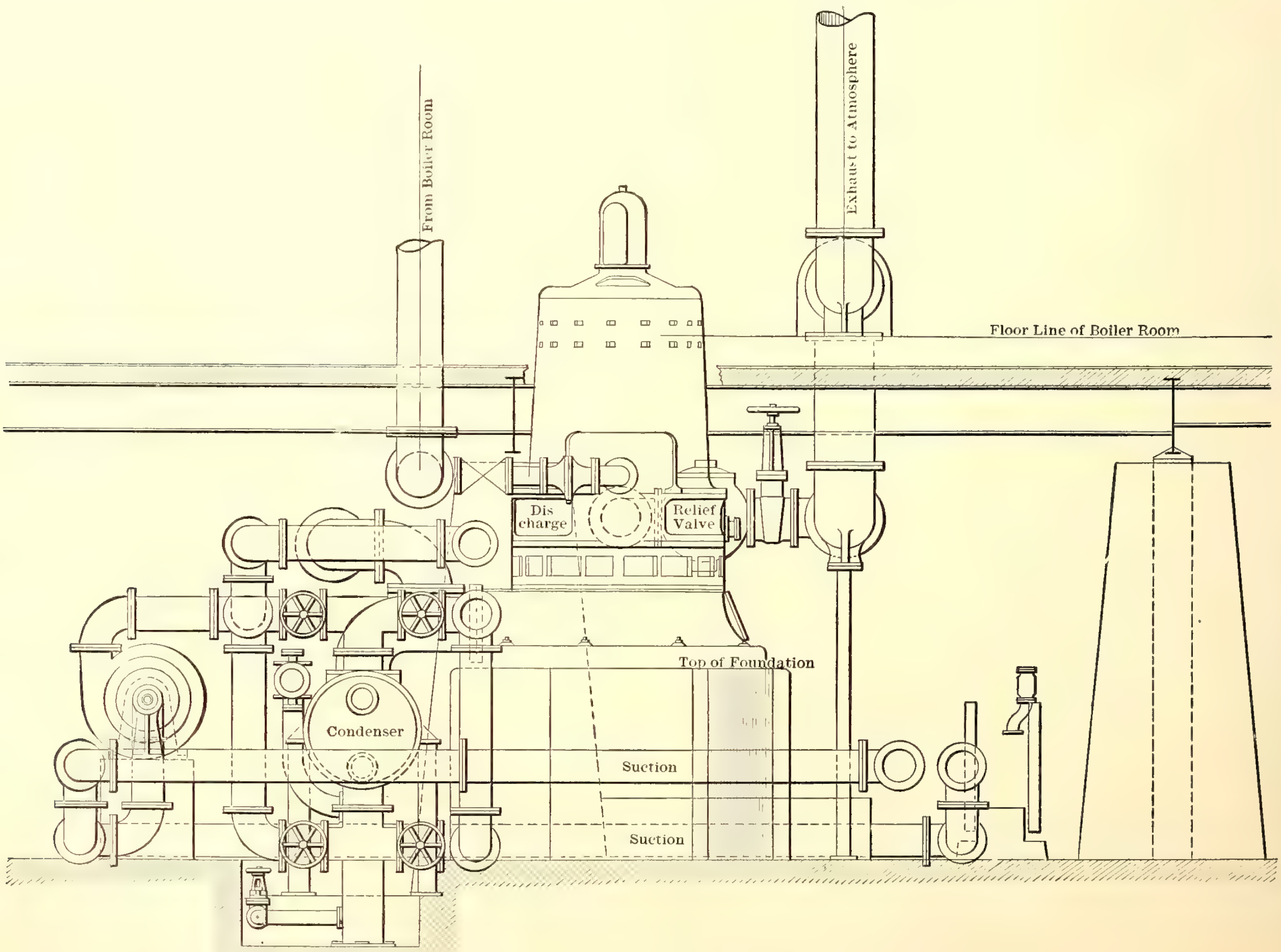


FIG. 7.—ELEVATION OF ONE OF THE STEAM TURBINE UNITS, SHOWING CONDENSER PIPING

by the General Incandescent Arc Light Company, and has "G. I." hand-operated oil switches. Two General Electric potential regulators will be employed on the alternating-current lighting feeders. These regulators will be operated to raise and lower the voltage by means of small alternate-current motors. All the transformers are ail cooled.

As stated before, the water-wheels are governed by Lombard governors. The speed of the wheels can be varied from the switchboard by means of a direct-current motor at the governor for shifting the governor weight.

Street lighting for the city, which has been done formerly by direct-current arcs will be done hereafter with 6.6-amp.

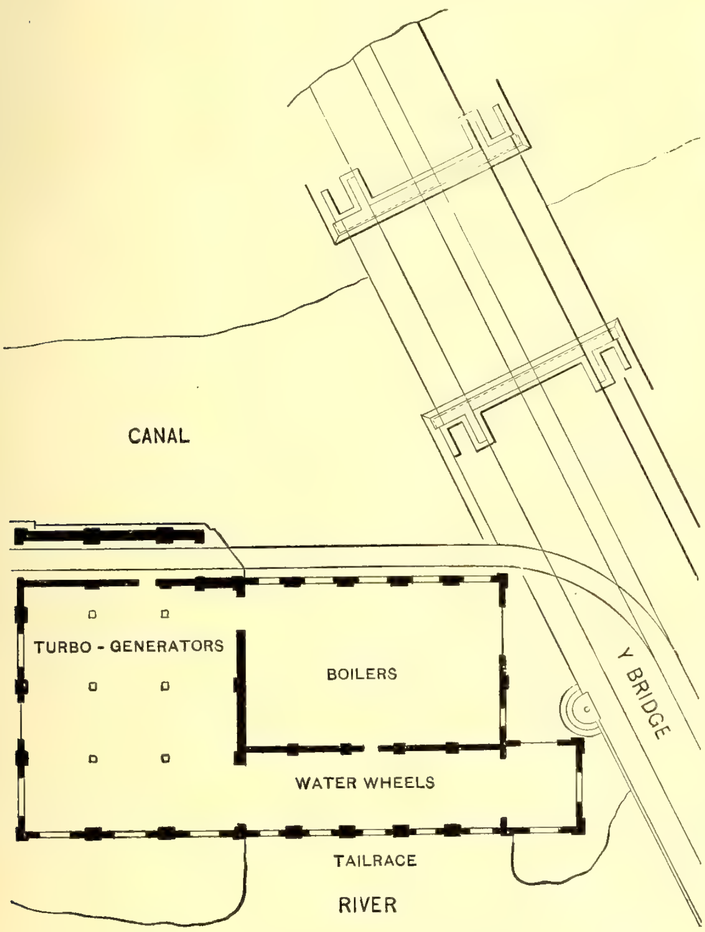


FIG. 8.—GENERAL PLAN OF STATION

"G. I." differential enclosed arcs, 250 in number, twenty-five on a circuit.

ECONOMIES BY THE RECONSTRUCTION

Of course, a great economy in operation is anticipated as a result of the abandonment of the old power station. As said before, much of the total output in a year will be generated by water-power, and, therefore, at no fuel expense. That portion of the power supplied by steam should certainly be generated with much greater economy than in the old plant. The old plant used 12 lbs. of coal per kilowatt-hour. The new 500-kw Curtis turbine units are guaranteed to operate with 20 lbs. of steam per kilowatt-hour. If 8 lbs. of water can be evaporated per pound of coal in the boiler plant (which the engineers assume is a reasonable figure), the turbines would give a kilowatt-hour for 2½ lbs. of coal. The repairs in the old plant were enormous. In the new plant it is believed that they will be very low, as there are so few moving parts, as compared with the old, and the electrical apparatus is confined to large units of modern construction. In the old plant seventeen men were required for its operation. In the new plant six men are required.

FIG. 9.—OLD SINGLE-TRUCK CAR

Making allowance for interest and depreciation, the engineers estimate that there will be a yearly saving of $18,000, as compared with the operation of the old plant. The cost of reconstruction, which includes also rebuilding of much of the street railway track and the purchase of entirely new rolling stock, so as to bring the street railway system to a standard gage, was $400,000. The present connected load is the equivalent of about 14,000 16-cp lamps. Excluding the small sized motors, there is a motor load of 300 kw distributed among thirty-five motors.

Since the present management took charge the earnings have increased about 20 per cent. Last year railway earnings were about $110,000, and light $65,000. The operating expenses are about 55 per cent of the gross earnings. The base rate for power and light is 10 cents per kilowatt-hour. About 350 kw additional power load is soon to be taken on, and it is further anticipated to transmit power to nearby pottery towns, which, as is well known, are good power consumers. Coal costs the company $1.40, delivered. The company now has outstanding $1,000,000 in bonds and $1,000,000 in stock.

Rudolph Kleybolte & Company, bankers of Cincinnati, New

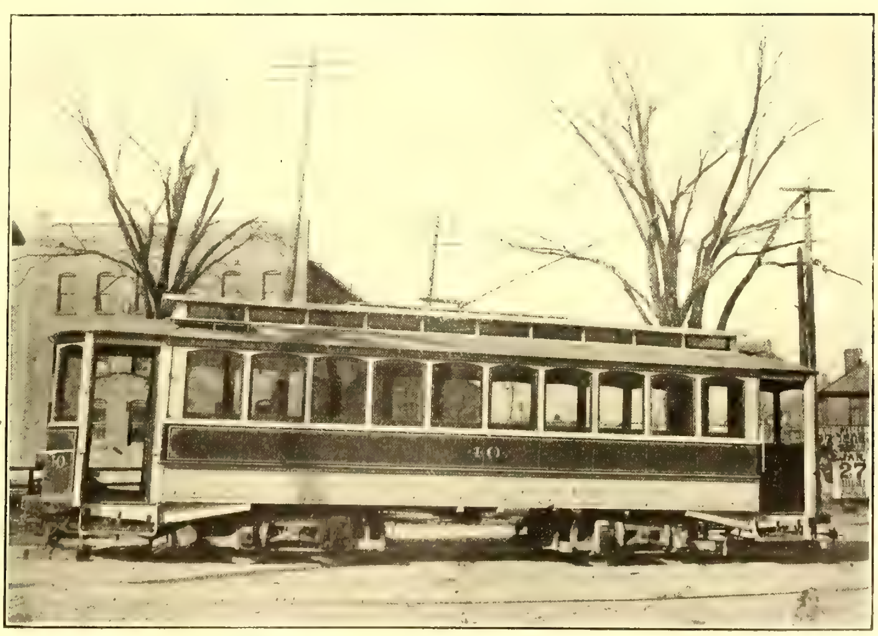


FIG. 10.—STANDARD DOUBLE-TRUCK CAR

York and Chicago, undertook the reorganization of the properties now merged in the Zanesville Railway, Light & Power Company, in September, 1902, their contract providing for, not only the reorganization of the securities of these properties, but also for their complete physical and operating reconstruction. Kleybolte & Company, in turn, contracted with H. M. Byllesby & Company, of Chicago, for all the engineering work connected with the rebuilding of the property, the designing of the new power house and its contents, and H. M. Byllesby & Company, in connection with Messrs. Kleybolte & Company, also had charge of the reorganization of the operation of the porperties.

Under the reorganization all the former operating officials were retained, Hon. F. A. Durban, of Zanesville, being elected president; H. M. Byllesby, vice-president and engineer; W. A. Gibbs, general manager and assistant treasurer; W. D. Breed, of Messrs. Rudolph Kleybolte & Company, secretary and treasurer. Mr. Gibbs had been in charge of the properties under the former management for several years, and under the reorganization his powers and duties were largely increased, and he had a prominent part in the reorganization of the operating conditions and in the reconstruction of the properties in connection with H. M. Byllesby & Company. Mr. Gibbs, together with E. C. Braun, one of the engineers of H. M. Byllesby & Company, had charge on the spot of the reconstruction of the property.

The street railway system, comprising some 14½ miles of track, was of 5-ft. 2-in. gage, laid with rails ranging from 36 lbs. to 70 lbs. per yard. Along with the reconstruction of the power house, the street railway system was reconstructed to bring it to standard gage. This also called for a new rolling stock. The track, as reconstructed, now consists of 70-lb. standard A. S. C. E. T-rail in dirt streets and 70-lb. Shanghai T in paved streets. Eight of the 14½ miles of track is in paved street. Ties are 6 ins. x 8 ft., laid 2 ft. between centers. Atlas rail-joints are used. The trolley is No. 0000 wire. The bonds and overhead material were furnished by the Ohio Brass Company. The cars are equipped with four 25-hp G. E. motors. One of the old and one of the new cars are illustrated in Figs. 9 and 10. Eighteen cars are operated during rush hours and ten upon ordinary schedule.

THE CLEVELAND PASSENGER STATION

The plans of the Cleveland interurban lines for a passenger station on the Public Square, Cleveland, have again been taken up, and the City Council committee on street railways has agreed with the companies on a modification of the plan outlined in the Street Railway Journal some weeks ago. The interurban roads objected to the clause in the agreement which required them to maintain the public toilet rooms in the station. Under the new proposition the city will maintain the toilet rooms. A clause was also inserted providing that in case the Council shall at any time decide to exclude the interurbans from the use of the station, the city shall purchase the station at the cost price, less 5 per cent per year for the time it has been occupied by the interurbans.

The clause permitting the interurbans to have package checking facilities has been cut out. The whole matter will now be thrashed out before the Council.

United States Consul Holoday, at Santiago de Cuba, writes that he thinks an opportunity exists there for the profitable investment of capital in a street railway. The city has a population of 50,000, and the only means of conveyance is by coach, the minimum fare of which is 20 cents for a single trip. "Unquestionably," writes Mr. Holoday, "a company that could secure a franchise for the construction of a light and railway plant combined, would have a very valuable privilege."

CORRESPONDENCE

AIR BLAST FOR CONTROLLERS

New York City, March 11, 1904.

Editors Street Railway Journal:

Referring to the description in your issue of Feb. 27 of the use in the controller of an air blast from the brake system, and the statement that such an application has been patented by H. P. Wellman, I beg to call attention to the fact that there is nothing novel in the method employed. As long ago as in 1898, the same plan was proposed by me for the enclosed reversers used in the multiple-unit installation on the South Side Elevated Railway in Chicago. The object in that case was not only to keep out dirt and copper dust from the controller, but also to accentuate the action of the magnetic blow-out and to keep the contacts cool.

Frank J. Sprague.

OMNIBUSES VS. STREET CARS

New York, March 8, 1904.

Editors Street Railway Journal:

I notice with interest the editorial in your last issue on omnibuses and street cars. It is somewhat of an anomaly that the English laws encourage the establishment of omnibus lines while they act as a deterrent to the construction of tramway lines. Theoretically, anyone can establish an omnibus line on any public thoroughfare in London by posting in the 'bus a schedules of fares to be charged and by paying a small license fee. It is not even necessary to maintain the fares constant, but a change in the posted rates can be made at any time, as is done occasionally at the time of some large public festival, as, for instance, at the time of the coronation. Compare this with the difficulties of getting tramway rights, which are well-nigh insuperable, although the tramcar, as shown in the testimony before the Traffic Commission, improves instead of cumbers the traffic of the street, and subjects the pavement to no wear as does its rival.

While, theoretically, any person may establish an omnibus line in London, practically the business is in the hands of a few large companies, owing to a practice popularly called "nursing." If a small owner attempts to run a 'bus on a line which is considered a monopoly of one of the older companies, it is pursued by two 'buses of one of the older corporations. One of these vehicles of the established line drives directly in front of the newcomer and the other attends him on one side or follows close behind him. Between the two the new 'bus has practically no chance to collect any fares. It is said that the 'bus drivers for the older companies, as a rule, relish the duty of "nursing," not on account of any cruel instincts which they may possess, but from the innate love of sport which exists in most men.

Various attempts have been made to introduce automobile 'buses in London and Paris. Storage batteries have been the favorite motive power, but so far they have been no more successful than similar experiments in New York. The competition in both London and Paris is practically confined to that between the electric car and the horse 'bus, and in both cities the former would easily win if given an opportunity.

R. P. Gorman.

SALE OF THE KUHLMAN CAR CO.

Announcement has been made in Cleveland of the sale of the works of the G. C. Kuhlman Car Company. The purchasers are gentlemen affiliated with the J. G. Brill Company, of Philadelphia, who will undoubtedly reorganize the Kuhlman Company and conduct the works in connection with those owned by them in Philadelphia and St. Louis.

FUSED STEEL-TIRED WHEELS

The growing use of the fused steel-tired wheel for electric railway service makes the publication of additional sections of this wheel used by prominent electric railway companies of interest. For this reason the accompanying engravings, Figs. 1, 2 and 3 are presented, to show some of the various dimensions employed in motor-wheel service to meet the requirements of tracks in cities where the grooved rail is used.

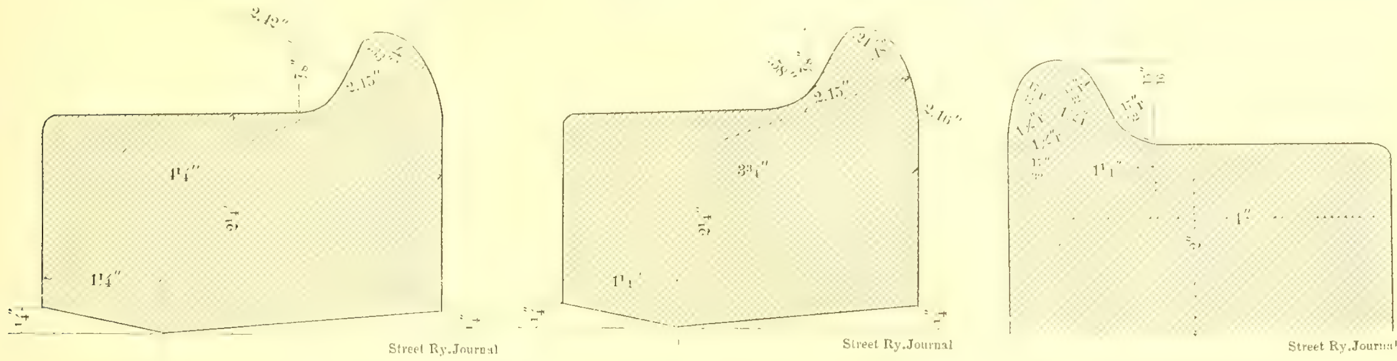
As will be seen, the shape of the flange differs radically in each case, although the maximum height is only 15-16 in. The wheels illustrated were supplied by the Railway Steel Spring Company, of New York.

The flanges shown in the accompanying engravings are somewhat smaller than usually employed on purely interurban work, but were made necessary by the special service in the terminal cities, as in each case the cars equipped with these wheels enter cities over the tracks of the local system. The average size flange for interurban work is about 1⅛ ins. wide by 1 in. deep.

As described in a recent issue the steel-tired wheel, whether provided with a fused tire or a removable tire, is of larger diameter when new than if a chilled-iron wheel were to be used. Thus, in cases where a 30-in. chilled-iron wheel has been employed it is the practice to adopt a 32-in. steel wheel, and where a 33-in. chilled-iron wheel has been the standard a 34-in. steel wheel is employed. The reason of this is that the steel-tired wheel has a greater depth of wear, and if the tire or the flange becomes worn down the wheel can be turned down until it is of the proper section. This is illustrated in Fig. 4, which represents a wheel with removable steel tires, as manufactured by the Railway Steel Spring Company. The same principle, however, applies to the fused wheel, although in that case the tire can be worn down very much thinner than with the steel-tired wheel, say, to ¼ in. at the edge, or ½ in. in the center on the tread instead of ¾ in., as shown with the wheel with removable tires.

In turning down a wheel, such as shown in Fig. 4, the wheel can be put in the lathe six times, taking off ¼ in. from the previous section, as shown in the diagram at the left, or can be put in the lathe four times, and taking off ⅜ in. each time, as shown in the diagram at the right. The center of the wheel is usually made of the best charcoal cast-iron and the tire of open-hearth hammered steel, so as to be homogeneous throughout. It is then hot-rolled. In all cases where steel-tired wheels are used for electric interurban service, the manufacturers should know the service the wheels will be called upon to perform, as they can then furnish special grades of steel tires that will meet the requirements of the railroad; this information, in many instances, would enable them to furnish a tire that would considerably increase the mileage of steel-tired wheels.

In pressing these wheels on to axles manufacturers recommend a difference in diameter between the bore of the hub and the seat of the axle of .01 in. Practice varies as to the amount of pressure used, but experience has shown that about 10 tons to the inch is a desirable one, that is, if the axle is 6 ins. in diameter, 60 tons should be employed. This pressure, of course, could be somewhat lower, provided a key was used on the wheel seats of the axles.



FIGS. 1, 2 AND 3.—SECTIONS OF TIRES OF FUSED WHEELS USED ON ELECTRIC INTERURBAN RAILWAYS

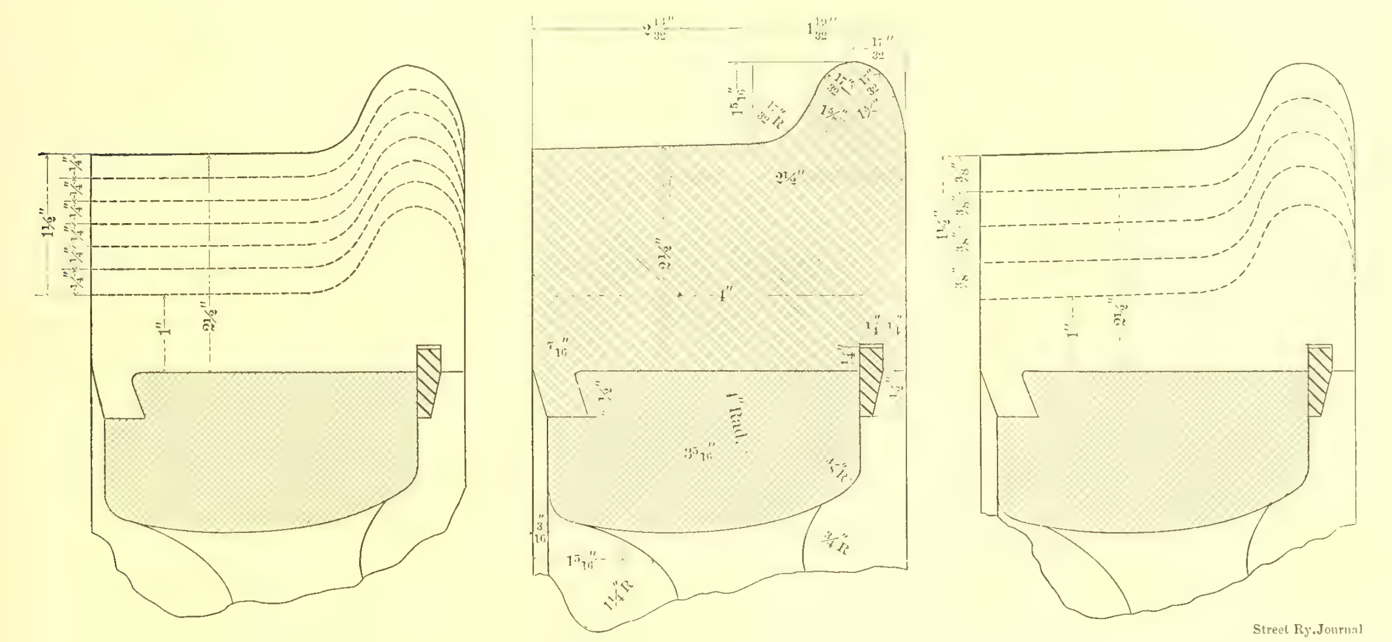


FIG. 4.—DIAGRAM SHOWING SECTION OF TYPICAL NEW TIRE AND SECTIONS AFTER TURNING DOWN

"CALIFORNIA" TYPE OF CARS FOR SANTA BARBARA, CAL.

A week or two ago the J. G. Brill Company shipped two handsome cars of the "California" type to the Santa Barbara Consolidated Railway Company, of Santa Barbara, Cal. Santa Barbara is one of the most popular towns on the southern coast, and has a large transient population at all seasons of the year. The road is 7 miles long, with many points of interest, including an amusement park. It is noted for extensive views of the San Rafael range, and of the sea with the mountains of the Santa Cruz and Santa Rosa Islands on the southern horizon.

CAR USED ON THE LINES OF THE SANTA BARBARA CONSOLIDATED RAILWAY COMPANY, OF SANTA BARBARA, CAL.

This type of car is very popular on the Pacific Coast, because of its comfort and large carrying capacity. The vestibules protect passengers from the rush of air at the front, and those who desire more protection may take seats in the closed compartment. The total seating capacity is forty-four. The lower sashes are arranged to drop into pockets, as are also the sashes in the vestibules. The interiors are finished in cherry of natural color, and the ceilings are decorated in three-ply veneer birch.

The length of the closed compartment is 14 ft. 6 ins., and over crown pieces and vestibules, 38 ft.; from the end panels over vestibules, 11 ft. 9 ins.; from center of corner posts over vestibules, 3 ft. 8⅝ ins.; width over sheathing, 8 ft. 2 ins. The side and end sills are 4¾ ins. x 7 ins.; sill plates, 8 ins. x ⅝ in.; thickness of corner posts, 3⅝ ins.; side posts, 2¼ ins. x 2¾ ins. The cars are furnished with sand-boxes, platform and conductor gongs, angle-iron bumpers, and draw-bars of the builder's manufacture. The trucks are No. 27-G-1, with 30-in. wheels and 4-in. axles, and are equipped with two 42-ft. motors per car. The track gage is 3 ft. 6 ins., but will soon be changed to 4 ft. 8½ ins., and the body bolsters and other parts are arranged so that the change to the wider gage can be made at comparatively small expense.

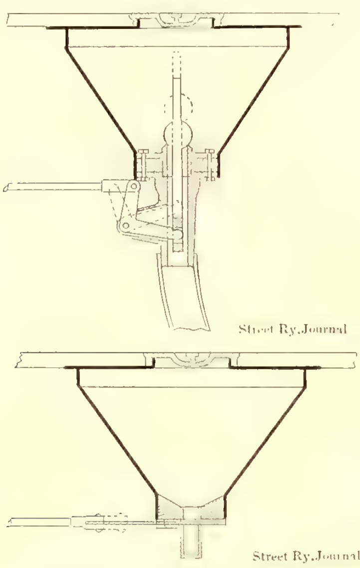
THREE KINDS OF SAND BOXES

The St. Louis Car Company is now making three different types of sand-boxes. Fig. 1 shows the type known as the No. 1 box. This box has a galvanized iron hopper. The feed valve is of the ball and socket type, and is operated by a set of bell-crank levers from an upright staff on the front platform, although a foot lever can be used in the place of the staff. The action of the ball is to crush the sand lumps before they reach the feed pipe.

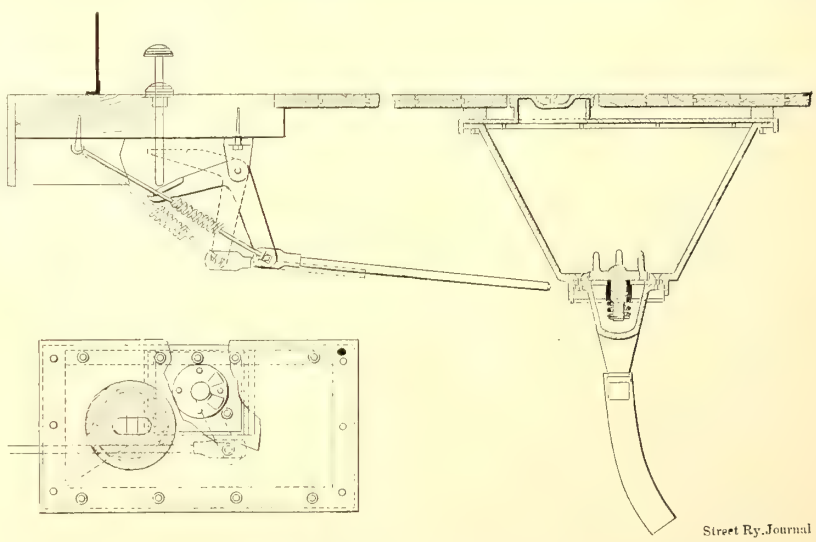
The No. 2 sand-box has a hopper similar to No. 1, but instead of a ball and socket valve and agitator, the plain slide valve at the bottom of the hopper is used. This is intended for use where dry, fine sand is always available.

The No. 3 box is of an entirely different type. The hopper is made of cast-iron, so that it has no seams to become leaky. For feeding sand there is a rotary agitator with a disc slide valve on the same piece. This box is operated either by hand or foot lever. The tube attachment of this box is such that the tube can be set in practically any position desired.

INTERIOR OF SANTA BARBARA CAR, SHOWING OPEN COMPARTMENT IN THE FOREGROUND



DETAILS OF SAND BOXES NOS. 1 AND 2



DETAILS OF SAND BOX NO. 3

The Boston Elevated Railway has had to expend an unusually large amount of money for clearing the tracks of snow. The total cost, $250,000, is $100,000 more than last winter.

FINANCIAL INTELLIGENCE

The Money Market

WALL STREET, March 17, 1904.

There were no important developments in the money market this week, and conditions and rates remain practically unchanged. Further accumulation of funds is reported at this center, and, although the local banks continue to lose cash on operations with the Sub-Treasury, their losses are more than offset by the receipts of currency from nearby interior points and by the constant receipts of gold from Japan and other sources. The continued inactivity in the local stock and bond markets is reflected in a further sharp falling off in the demand for funds for all maturities, and the banks and other lenders experience considerable difficulty in placing their funds at current rates. A fair demand exists for call money, which is generally satisfied at 1¾ to 2 per cent but for time contracts the inquiry is practically at a standstill. Short time funds, which a short while ago commanded 3½ and 3¾, are practically unlendable at materially lower figures, while six months' money appears to be a drug upon the market at 4 per cent. Some loans extending for five months are made at 3¾ per cent, but the character of the collateral, and the standing of the borrower is considered. Lenders as a rule are not disposed to press their funds upon the market or to make concessions in rates in view of the preparations making for the call upon the banks for the initial instalment of Government deposits, due shortly in connection with the Panama Canal payments. Foreign exchange is extremely dull but strong. The supply of commercial bills coming upon the market continues small, while the demand from remitters and from investors, in view of the decided ease in money, is sufficient to maintain prices at about the highest points of the year. There are no important changes in discount rates at the principal European centers. Money on a call at London rules at 2¾, while the open market rate for both short and long time bills is unchanged at 3 per cent. At Paris the rate continues at 2¾ per cent while at Berlin the tendency is easier, with a decline in the rate of 2⅛ per cent to 3½ per cent.

The Stock Market

The record of this week's stock market is little more than a history of the Northern Securities decision and its effects. Previous Monday the Stock Exchange was very much unsettled, with more or less liquidation in evidence and with prices inclined to move downward; in fact, on Saturday many of the leading stocks reached the low figures of the year. From this point there has been a very sharp recovery which, although it started before Monday's announcement from Washington, has made its greatest progress during the last day and a half. This movement is to be explained partly on the ground of bad news thoroughly discounted, and partly on the ground that the decision, while against the railroad companies, has some things about it which are very reassuring for the future. Attention has been directed principally to the closeness of the vote among the Supreme Court judges, not that it in any way impairs the finality of the verdict, but because it seems to afford hope that in any future cases brought under the law, the issue would be extremely doubtful. As to the practical effects of the decision, the community has had nearly a year to prepare for them, prices are very low, stocks have passed into strong hands; the market is in every way situated to consider the situation calmly from the standpoint of the consequences to real security values, and not to be governed by mere sentimental considerations. It is pointed out that the opinion in the present case affirms nothing new or revolutionary, that precisely the same rulings were made in the joint traffic associations' cases seven years ago, and hence, that the business interests of the country are threatened with no danger to which they have not already long been exposed. It seems to be, therefore, the market's sober view that the episode has been closed for the time being at least, and that one of the several causes of uncertainty surrounding the financial situation has been eliminated. Very genuine relief is what the rapid upturn of the last day or two has really indicated. The movement has been brought about chiefly at the expense of the large short interest which had been created on the idea that the bottom would drop out of things when the hostile court opinion was handed down. When these excited covering purchases are over it will doubtless be recognized that there are other incentives more powerful than the Northern Securities matter to induce caution on the part of investment capital.

The feature in the local traction group during the week was the severe break in the Metropolitan Street Railway issues. The real causes of this decline have not been revealed. Undoubtedly there was a good deal of liquidation, much of it of an immediate character. One idea was that the estate of a prominent capitalist who died a short while ago was being settled, the operation involving the sale of a large quantity of Metropolitan stock. It plainly is more reasonable to account for the drop on some such ground as this rather than on any development, real or prospective, affecting the company's earning power. Some rather good buying has recently been observed in Brooklyn Rapid Transit, but no very vigorous efforts have been made to force up the price. Manhattan, selling ex the 2½ per cent dividend, has taken its course from the general market changes, but on the whole has behaved very well.

Philadelphia

In Philadelphia the week has developed no special feature. News concerning the traction properties has been scarce, and the speculative movement has accomplished little. About the only incident of interest was the sudden development of activity in Indianapolis Street Railway shares, 600 of which sold between 85 and 87½. This is an advance of five points over the last previous sales some time ago. The company pays 3 per cent dividends this year, the rate to be increased next year to 4 and the year after to 5. Presumably the execution of an investment order is what caused the present advance. Philadelphia Traction, selling ex-dividend of 2 per cent, gained a half-point to 95½. Philadelphia Electric has been very dull around 5⅞; so has Philadelphia Company common between 38 and 39. The preferred sold as low as 43⅜ and as high as 44. Union Traction was shaded at one time to 47¼ but rallied later to 47½. Two hundred Rapid Transit sold at 14. Pittsburg preferred was dealt in at 49.

Chicago

There are rumors afloat that the Union Traction stockholders will be assessed, possibly 10 per cent, by the reorganization committee, in the event of a favorable ruling in the ninety-nine-year franchise case. These stories checked the efforts of the Eastern speculative clique to put up the stocks. There was a good deal doing in both common and preferred during the week on the New York Exchange, the common going to 6 and the preferred to 31½. In Chicago transactions were confined to 200 of the preferred at 30⅞, and later at 30. It is rather difficult to find a suitable explanation for the decline in Metropoitan Elevated issues which has carried them again to new low records this week. The company has certainly been earning at the rate of 4 per cent on its preferred during the past five months, and the annual statement due in April is expected to show a surplus of $225,000 against only $10,000 last year. Nevertheless the preferred shares have slid down on heavy selling to 41, and the common to 15, the former completing a loss of 10 points from a month ago. A good deal of the recent liquidation has come from New York. No sales of North Chicago have occurred during the week but one hundred West Chicago went at 45. Lake Street sold at 2, Northwestern common at 17, and South Side from 91½ to 92.

Other Traction Securities

In Boston the active issues have been, as usual, the Massachusetts Electric stocks. The common, after selling as high as 18¾ fell to 17¾. The preferred dropped from 73 to 71½ but rallied to 72½. Boston Elevated was steady between 138 and 138¼. An odd lot of West End common sold as high as 92 but the real market did not rise above 91½. The preferred changed hands at 109½. On the Baltimore Exchange the two features of the week were the recovery in the United Railways issues and a sharp advance in the bonds of the Charleston Consolidated Street Railway Company from 79½ to 85. United incomes recovered from 51⅝ to 53¼, or four points above the low level to which they sank after the fire. The general 4 per cents advanced a point to 90¾, and the stock rose from 7 to 7½. Other sales for the week included Atlanta Street Railway 5s at 105 and 104¾, City and Suburban of Washington 5s at 90¼, City & Suburban of Baltimore 5s at 112½ and Baltimore City Passenger 5s at 108. An odd lot at 103 and another at 104¼ were all that were done in Interborough Rapid Transit stock on the New York curb. St. Louis Transit was stronger, 500 shares selling

at 9. Three hundred Washington Traction preferred sold at 45 and ten of the bonds at 74½.

Tractions were comparatively strong in Cincinnati last week, and practically every issue showed an advance. Cincinnati Newport & Covington opened at 28¼, and advanced to 30 on sales of 1253 shares. The preferred sold to the extent of 335 shares advancing from 82½ to 85. Cincinnati Street Railway made a gain of four points from 135½ to 139½, the latter being the highest mark in many months; sales, 702 shares. Detroit United was practically stationary at 63, with two small sales at 63¼; total, 302 shares. Cincinnati, Newport & Covington first 5s sold at 109 on several lots aggregating $8,000. Miami & Erie Canal sold at 8¾ for several lots.

Demands from Cincinnati for Cincinnati, Dayton & Toledo stock made that the most active issues in Cleveland last week. Sales aggregated about 500 shares, all at 20¾. Cleveland Electric was steady at 73⅛, sales, 180 shares. Northern Texas Traction developed strength at the close and several sales were made at 31⅛ to 31¼. The bonds of this company were also in demand, and $15,000 worth sold at 8½. Monday 100 shares of Cincinnati, Dayton & Toledo sold at the price above mentioned. Cleveland Electric sold at 73⅝. A small lot of Northern Ohio Traction & Light sold at 15, a fractional decline.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid March 8	Closing Bid March 15
American Railways	43	43
Aurora, Elgin & Chicago (preferred)	a54	a55
Boston Elevated	138	138¼
Brooklyn Rapid Transit	40¼	41⅜
Chicago City	156	157
Chicago Union Traction (common)	5	5
Chicago Union Traction (preferred)	30½	30
Cleveland Electric	73	72
Consolidated Traction of New Jersey	62	62
Consolidated Traction of New Jersey 5s	105½	105¼
Detroit United	61¾	61
Interborough Rapid Transit	102½	105
Lake Shore Electric (preferred)	—	—
Lake Street Elevated	1¾	1¾
Manhattan Railway	143¾	*141¼
Massachusetts Electric Cos. (common)	18½	18
Massachusetts Electric Cos. (preferred)	73	71½
Metropolitan Elevated, Chicago (common)	15¼	14
Metropolitan Elevated, Chicago (prefered)	44	43¼
Metropolitan Street	113½	107½
Metropolitan Securities	82	77¾
New Orleans Railways (common)	8	8
New Orleans Railways (preferred)	29	29
New Orleans Railways 4½s	79	78
North American	80	83¾
Northern Ohio Traction & Light	15	14¾
Philadelphia Company (common)	38	38
Philadelphia Rapid Transit	14	13½
Philadelphia Traction	97	*95¼
St. Louis Transit (common)	9	12¼
South Side Elevated (Chicago)	91	90
Third Avenue	120	114
Twin City, Minneapolis (common)	87½	88½
Union Traction (Philadelphia)	47⅛	47½
United Railways, St. Louis (preferred)	51	51
West End (common)	91	91½
West End (preferred)	109	109½

a Asked. * Ex-dividend.

Iron and Steel

The fact is now confirmed that a most surprising change for the better has come over the iron trade during the last six weeks. Authority for this statement is found chiefly in the statistics furnished by the "Iron Age" for the month of February. They showed that while the weekly pig iron production had increased from 185,636 tons on Jan. 1, to 309,926 tons on March 1, stocks on hand during February actually decreased 47,078 tons. In other words, despite a very rapid expansion in output, consumption has increased more rapidly still. What this means, of course, is greatly accelerated activity in the higher branches of the industry. That this should have occurred in face of the very moderate purchases by the railroads, is the most surprising part of recent developments. Quotations are as follows: Bessemer pig iron $15.80, Bessemer steel $23; steel rails $28.

Quotations for the leading metals are as follows: Copper 12⅝ cents, tin 28 cents, lead 4⅝ cents, and spelter 5 cents.

BROOKLYN RAPID TRANSIT SUBMITS STATEMENT FOR YEAR

The Brooklyn Rapid Transit Company, in an application to the New York Stock Exchange, to list $5,000,000 bonds, which has been favorably acted upon, submits a statement of earnings as follows for the year ended December 31. Comparative figures from the company's annual report are added, but it should be noted that the years overlap each other, which somewhat impairs the value of the comparisons:

	1903 Year ended Dec. 31	Year ended June 30
Gross receipts	$14,025,825	$13,280,321
Operating expenses	8,392,607	7,931,079
Net earnings	$5,633,218	$5,349,242
Other income	207,522	277,493
Total income	$5,840,740	$5,626,735
Interest and taxes	4,702,514	4,661,857
Balance	$1,138,226	$964,878
Improvements	338,611	*208,481
Surplus	$799,615	$756,397

* Including $40,386 charged off.

The $5,000,000 bonds now listed are a part of the issue of $150,000,000 authorized in 1902. These bonds were sold some time ago. The proceeds already issued have been used to acquire the following stocks and certificates of indebtedness, which have been deposited with the Central Trust Company of New York pursuant to the terms of the mortgage: Brooklyn Union Elevated Railroad Company's 13,103 shares common stock, $37.50 scrip; 1,208 shares preferred stock, $87.30 scrip, $455,963; Nassau Electric Railroad Company's 2,852 shares preferred stock, $25 scrip, $286,588.70; Transit Development Company's 250 shares, $25,222.64; South Brooklyn Railway Company's 1,491 shares, $550,177.43; Brooklyn, Queens County & Suburban Railroad Company's certificates of indebtedness, $625,649; Transit Development Company's certificates of indebtedness (chiefly towards cost of new power house), $1,988,505.64; total, $3,932,106.41; for subsequent expenditures, $67,893.59; total proceeds, $4,000,000. This indicates that the bonds were sold at 80. Additional bonds to the amount of $6,294,000 have been certified by the trustee and delivered to the company, but have not been sold. Of these $3,467,000 were certified prior to Dec. 31, 1903, and appear in the consolidated balance sheet as of that date. Subsequent issues of bonds shall bear such rate of interest as the Transit Company may determine, not exceeding, however, 4 per cent per annum.

Following is a consolidated general balance sheet as of Dec. 31, 1903, of the Brooklyn Rapid Transit Company and constituent companies:

ASSETS.	
Cost of road	$92,817,101
Advances account consolidation for leased companies	11,898,411
Certificates of indebtedness of constituent companies	2,162,450
Guaranty fund for performance of Brooklyn City Railroad Company lease	4,005,755
Treasury bonds, B. R. T. 1st preferred	3,467,000
Other issues	110,000
Treasury stock	146,228
Current assets	5,176,388
Accounts to be adjusted	12,039
Total	$119,795,373
LIABILITIES	
Capital stock B. R. T. Company	$45,000,000
Outstanding capital stock underlying companies	994,955
B. R. T. Company first mortgage	7,000,000
First refunding mortgage	8,467,000
Bonded debt constituent companies	61,328,180
Current liabilities	4,827,690
Long Island Traction trust fund	9,650
Certificates of indebtedness of constituent companies	4,977,171
Surplus	2,657,726
Total	$119,795,373

The Blue Island Avenue car houses of the Chicago Union Traction Company were destroyed by fire Monday morning, March 14. Six hundred cars and the building are said to have been totally destroyed.

THE ANNUAL MEETING AT ST. LOUIS—REPORT OF THE PRESIDENT

At the annual meeting of the St. Louis Transit Company, held March 8, the old directors were re-elected, with the exception of Mr. Wade, who is succeeded by Capt. Robert McCulloch, who is general manager of the Chicago City Railway Company. The directors of the company now are A. D. Brown, Paul Brown, James Campbell, Murray Carleton, Louis A. Cella, Eugene Delano, George L. Edwards, F. E. Marshall, Robert McCulloch, H. S. Priest, C. H. Spencer.

At the organization of the directors on March 11, the projected change in the management of the company was made in the election of Capt. Robert McCulloch as vice-president to succeed A. B. du Pont. Technically, Capt. McCulloch is elected to the place of Corwin H. Spencer, while the office of second vice-president and general manager, the position held by Mr. du Pont, is abolished.

At the meeting of the United Railways Company, the officers were re-elected without change. They are identical with those of the Transit Company with the exception that Corwin H. Spencer's name appears instead of the name of Capt. McCulloch.

It is understood that Capt. McCulloch will go to St. Louis to assume his new duties as soon as he can get away from Chicago, and that he will take with him his son, Richard McCulloch, who is assistant general manager of the Chicago Street Railway Company under his father. Mr. du Pont will acquaint his successor with the details of the management, after which it is stated he will leave the city.

At the meeting of the directors, announcement was made by President Carleton that $8,000,000 of the $20,000,000 improvement and refunding bonds had been placed. The sale of these bonds secured sufficient funds to retire the collateral trust notes of the company and pay for the improvements needed to handle the constantly increasing traffic. It is understood that the $8,000,000 of bonds were sold at 80, and that $4,000,000 was taken by Brown Brothers, of New York, and that the rest was subscribed for by local St. Louis parties. The remaining $12,000,000 of the entire issue will be held for future contingencies.

The report of the company for the year ending Dec. 31, 1903, submitted to the stockholders by President Carleton, follows:

The lease between the St. Louis Transit Company and the United Railways Company, of St. Louis, requires the former (or lessee) to pay as rental interest on the outstanding bonds of the United Railways Company and of its constituent companies, an amount equal to 5 per cent per annum on the outstanding preferred stock of the United Railways Company, of St. Louis, and to provide $1,000 for contingent expenses. The aggregate rental charge was $2,759,781.25, but, deducting $399,935 accruing on the securities of the United Railways Company, of St. Louis, owned by the St. Louis Transit Company, the net rental charge was $2,359,846.25 for the year. The lease also requires the St. Louis Transit Company to make all necessary extensions and improvements to the properties of the United Railways Company, receiving in payment therefor securities of the United Railways Company reserved in the treasury of that company for the purpose. These expenditures have amounted in the aggregate during the year to $1,868,931.45. The principal items embraced in these expenditures are: Seventeenth and Locust Streets sub-station building and equipment, $273,552.66; cars, $362,205.27; motors, $233,108.52; track construction, $561,597.80, of which amount $165,-640.12 was for paving between the rails, between the tracks and 1 foot outside of tracks.

By provision of the city ordinance, and pursuant to the approval of the Board of Public Improvements, the company has equipped all of its cars with the approved type of fenders, and they are also being equipped with air brakes.

During the year contracts were let for 450 new cars and the motor equipment for same. Seventy-one of the cars have been received and the balance are to be delivered and will be in operation in time to take cars of the World's Fair traffic.

During the year the new repair shop at Park and Vanedventer Avenues has been completed and is practically in full working order. It is equipped according to the most modern methods for handling the general repair work, and will undoubtedly prove very economical in the maintenance of the equipment, being arranged so that both steam and electric cars can be brought to the proper places for moving all material with the minimum amount of labor. In the machine shop many new tools have been installed, which materially increases the output at a reduced cost. As for instance, there are multiple spindle drills on which a man handles from four to eight drills at a time, instead of a single one, as by the old method. By thus doing the majority of the work in a single shop a higher grade of direct supervision is provided at less cost, and is conducive to maintaining the apparatus in a much better condition.

The armature department has been equipped according to the most approved practice, both for doing the work and testing the conditions of the parts, and allows only apparatus in first-class condition to go on the road. Such testing apparatus, being, of course, quite expensive, could not be introduced while a large number of shops were being maintained.

The new power stations and equipment have been completed, with the exception of the auxiliary station at Seventeenth and Locust Streets, which will be completed by April 15, 1904.

The number of miles of track owned Dec. 31, 1903, is 358.65; in operation, 345.06; leased, 2.54; not used, 11.05. No additional trackage has been built during the year: 1.44 miles of track no longer needed in the operation of the property have been taken up.

Attention is especially called to the fact that plans have been formulated and material ordered for the construction of proper terminals at the World's Fair grounds. This work is to be completed by April 1 next. The first terminal is located just east of DeBalividere Avenue, at the Lindell or main entrance to the World's Fair grounds. The Olive Street cars will use this terminal. The second terminal is located immediately west of DeBalividere Avenue at the Lindell or main entrance to the World's Fair grounds. The Delmar Avenue cars will use this terminal. The third or "Pike" terminal is located at the Pike entrance to the World's Fair grounds. The Easton Avenue cars will use this terminal. The fourth or "Administration" terminal is located at the Administration or Skinker entrance to the World's Fair grounds. The Page Avenue cars will use this terminal.

All of the above-mentioned terminals will be connected by a double track, thereby enabling the company to concentrate as many cars as necessary from any of the above-named routes at any of the above-named terminals to fully meet the demands of any of these entrances.

On the south side of the World's Fair grounds terminals will be located at the southeast entrance of the Fair grounds and at the Skinker Road entrance. To these terminals will be run the Laclede, Market and Taylor Avenue lines, the cars of which can be concentrated at any one of the terminals, thus meeting the requirements of the south side of the Fair. The company has provided for sufficient car equipment to handle 60,000 passengers per hour to the World's Fair grounds, and an equal number per hour from the same.

Since the Transit Company took charge of the property of the United Railways Company, of St. Louis, under the lease of the latter company to it dated Sept. 30, 1899, it has made additions, acquisitions, improvements and betterments during each year as follows:

1899	$662,989
1900	3,836,803
1901	2,593,428
1902	1,378,839
1903	1,868,931
Making the aggregate amount of	$10,340,990

For the improvements thus made, by the terms of the lease, the Transit Company was paid in United Railways 4 per cent bonds and in preferred stock of the United Railways Company, both at par. It was unable to realize upon the securities which it thus received for improvements without suffering a very heavy loss, because the market prices of the bonds and stock which it received were far below par. Anticipating that the earnings of the property would ultimately bring these securities to a higher value upon the market, it has been borrowing from time to time upon them as collateral money with which to make the further improvements required of it by the lease. The improvements necessary to the successful management and operation of the property and to meet the public demands have been nearly accomplished, except such as are yet necessary to be made to equip it to take care of the increased business incident to the World's Fair.

In order to fund the indebtedness thus accumulated and to provide for all future improvements required of it under the lease, the board of directors thought it wise to ask the shareholders to authorize an issue of $20,000,000 5 per cent twenty-year gold bonds secured by a mortgage upon the leasehold of the Transit Company under the lease of the United Railways Company, and the securities which it had received and would receive from the United Railways Company for improvements made and to be made. On May 23, 1903, the shareholders authorized the issue of these bonds upon the security aforementioned. The Transit Company also secured, in order to make them a better and more substantial investment security, the guaranty of the United Railways Company as to the payment of both principal and interest.

Accordingly, the officers of the company, by the direction of the board of directors, made the mortgage and executed the bonds.

Of the amount authorized, the mortgage provides that $6,056,000 be reserved to refund the outstanding 5 per cent collateral trust notes dated Nov. 1, 1901, and due Nov. 1, 1904, amounting to $5,776,000 ($224,000 of the collateral trust notes unissued were canceled during the year), $8,000,000 to be certified and delivered by the trustee immediately for refunding the floating debt and provide for the construction and equipment expenditures for the years 1903, 1904 and 1905, and the balance to be reserved for future acquisitions, construction and equipment expenditures, provided, however, that the amount to be issued for construction and equipment expenditures during any one year after 1905 shall not exceed $500,000 per annum.

The large expenditures made for construction and equipment, betterments and improvements during the year, and the additional outlay necessary for the year 1904 to provide for the World's Fair traffic, are in excess of what would have been required to care for the normal growth of the business, and should relieve the company from any further material expenditures of a capital nature for years to come.

The growth of St. Louis during the last year has been very marked, and it has been due not altogether, nor even primarily, to the World's Fair. The prosperous condition of the State, and, indeed, of the entire Southwest, warrants the belief that there will be a long-continued increase in the population and business of the city, and with this must come a corresponding increase in the business of the company.

For the purpose of showing the growth of the property, a statement is hereto appended showing the gross earnings from operation and other income, operating expenses and taxes, net fixed charges and the resultant surplus or deficit for the last three years.

An examination of the income account will show that during the fiscal year ended Dec. 31, 1903, the earnings from operation and other sources increased $843,628.48 over the preceding year, a gain of 13.07 per cent; operating expenses and taxes, $545,793.25, a gain of 13.75 per cent. The large increase in operating expenses was caused by the increase in the price of coal, rate of wages and a general advance in the cost of supplies. The increase in cost of coal was $99,574.50, and the increase in pay-roll, $251,457.53.

To clean up the accumulation of previous years, accruing from contingent liabilities, and to balance that account, the charges to "damage account" were increased above the actual by the payment of $97,000 out of this year's earnings. The same ratio of charges to this account will be continued during the year 1904 and thereafter until a sufficient surplus has been created to amply provide payment for like contingent liabilities arising in the future.

The increase in taxes of $33,747.38 was caused by an increase in the rate of taxation from $1.95 to $2.15 per hundred.

The sum of $2,423,091.77 was paid in wages to employees in the operating department, and $424,644.43 was paid in wages in the construction department.

On Nov. 1, 1902, a bonus of 1 cent per hour was offered to conductors and motormen who operated their cars for a period of twelve months without an accident. During the year this bonus has amounted to $14,216.45. On May 1, 1903, the rate of pay for conductors and motormen was raised 1 cent per hour. This increase amounted to about $45,000 for the year.

A summary of the business for the years 1903, 1902 and 1901 is as follows:

	1903	1902	1901
Earnings from operation and other income	$7,295,847	$6,452,219	$5,783,912
Operating expenses and taxes	4,513,514	3,967,721	3,692,400
Income	$2,782,333	$2,484,498	$2,091,512
Interest and rental	2,845,119	2,752,581	2,617,142
Deficit in operation	$62,786	$268,083	$525,630
VOLUME OF BUSINESS			
Revenue passengers	147,141,429	130,830,722	117,546,811
Transfers and passes	63,096,679	54,247,218	46,449,131
Total passengers	210,238,108	185,077,940	163,995,942
Mileage	32,535,626	31,074,581	29,340,361
Percentage of passengers using transfers	40.25	38.68	36.76

The above summary would indicate that the percentage of increase is as follows:

	1903 over 1902	1902 over 1901
Earnings from all sources	13.07	11.55
Operating expenses and taxes	13.75	7.45
Interest and rental	3.36	5.17
Revenue passengers	12.46	11.30
Mileage	4.70	5.91

NEW DEVELOPMENTS IN NEW YORK SUBWAY EXTENSION—TUNNEL TO CONNECT BRIDGES

General plans for the extension of the New York Rapid Transit Subway were considered by the Rapid Transit Commission at a public hearing, held Friday, March 11. The rival applications of the Metropolitan and Belmont interests for subway franchises occupied the bulk of the time. On the main proposition for a new subway line in Manhattan, the only opposition came from the Bronx, the residents there objecting to the Manhattan plan because it contemplates a terminal at 138th Street, while the Bronx residents desire to have any new extension continue right through the Bronx Borough. The hearing did not result in anything definite, and was closed after the several factions had their say.

On the same day a hearing was given by the plan and scope committee of the Rapid Transit Commission on the question of connecting the Manhattan terminals of the Brooklyn, Williamsburg and Manhattan Bridges. The Parsons plan for a four-track subway for the connection was favored, principally because of its comparatively low cost. The Best plan, which provided for an elevated connection, was practically rejected.

A letter of Chief Engineer O. F. Nichols, of the Bridge Department, presented the arguments of the plan outlined by Commissioner Best, and also gave the cost of the enterprise, figured at $12,500,000 for the entire proposition, including the connection through Delancey Street. Mr. Parsons presented his estimate of the subway connection, which he declared could be built for $4,500,000, and be completed in two and a half years. August Belmont, in behalf of the Interborough Rapid Transit Company, then presented an offer in writing to carry out a large proportion of the Best plan to good advantage to the city. In short, this offer was to carry out the Best plan slightly modified, provision being made for a fare of 5 cents, with free transfers at all elevated and subway connections. Further, Mr. Belmont offered to operate a special service for bridge travel alone for the same fare as now charged on the Brooklyn Bridge, viz., 3 cents for one ticket and 5 cents for two.

Soon after the meeting of the plan and scope committee on Friday, March 11, President Winter, of the Brooklyn Rapid Transit Company, announced that his company would not operate cars through the tunnel. He also expressed himself as not being very enthusiastic over the proposed elevated connection between the bridges. His objection to the subway was based on the fact that the present equipment of the company would have to be remodeled to insure passengers against fire risks.

At the solicitation of Mayor McClellan, President Winter, President Vreeland, of the New York Railway Company, and the Mayor held a conference on the bridge situation in the Mayor's office on Tuesday, March 15. At this meeting both Mr. Winter and Mr. Vreeland submitted plans under which their companies could operate cars on the new bridge structure. The plan is for the Brooklyn Company to operate cars over to the Manhattan side, turning there and returning to Brooklyn, while the New York City Company's cars are to run to the Brooklyn side and make their loop at the plaza there. No extra fare is to be charged. In addition, both companies are to operate shuttle cars over the bridge, with 3-cent fares, or two tickets for 5 cents, for the bridge trip. All these plans, however, relate solely to the operation of surface cars over the structure. President Winter and President Vreeland say that the new service can be put in operation by July 1, provided the work in charge of the Commissioner of Bridges is completed in time. At the meeting Mr. Vreeland said that his company would have its Fourteenth Street line, from Second Avenue to Avenue B and down Avenue A to the Williamsburg Bridge, equipped with electricity by July 1. He also said that the Eighth Street and East Broadway lines would be equipped with electricity by that time, and that the conversion of the Grand Street line from horse power to electricity will be completed by fall.

The conference was adjourned without any decision being reached as to bridge connections.

The Lake Shore Electric Railway will erect two steel towers at the Black River at Lorain with which to carry its high-tension lines over the river, which is a navigable stream. One of the towers will be 125 feet high, the other will be 140 feet high. Both will be similar in construction to wind-mill towers, and on top of each will be a vertical arm 10 ins. x 10 ins. x 20 ft. high, upon which the high-tension insulators will be placed, one above the other. Contract for the towers has been placed with the Aermotor Company, of Chicago.

AN IMPORTANT DECISION AS TO THE HOLDING OF FRANCHISE RIGHTS TO THE EXCLUSION OF OTHERS

In the decision of Ceylon H. Lewis, of Syracuse, N. Y., as referee, in the case of the Oneida Lake Electric Railway Company against the Syracuse Rapid Transit Railway Company, a blow is struck at electric railway promoters who secure franchises and rights of way merely for speculative purposes.

For a number of years the Oneida Lake Company has professed the intention of building an electric railway between Syracuse and Lower South Bay, on the shore of Oneida Lake, but has done nothing beyond securing property owners' consents and franchises. In the meantime the Syracuse Rapid Transit Company has covered a portion of the route by construction of an extension of its Syracuse system, over the Liverpool plank road to Liverpool. In the litigation just decided, the Oneida Lake corporation sought to oust its rival, claiming its territory had been invaded by the latter and its franchise rights violated. In an exhaustive report Referee Lewis holds that the Rapid Transit Company can not be excluded from the Liverpool route, and that, by failing to build, the Oneida Lake Company has forfeited all its rights under several franchises.

"The plaintiff has acquired no vested rights of property in the highway," declares the referee. "Having acquired no possession or the use of the highway, giving it the right to exclude another and rival company, and having never commenced construction, its right in the highway never became vested. It received from the local authorities and from the abutting property owners a right to build, which was simply inchoate and contingent; such grant or right does not become a contract or a vested right until the grantee has begun to construct its line in the highway. The franchises and consents of the plaintiff were contingent upon construction. They have never become a contract or a vested right, so far as to be protected by the constitutional provisions against impairing the obligation of contracts until the company has begun to do the thing required by such franchises and consents; and the plaintiff has acquired no vested rights of property in the Liverpool plank road which are protected by the constitutional provisions against the impairing of the obligation of contracts."

CHICAGO CITY RAILWAY GETS ANOTHER EXTENSION OF FRANCHISE

The City Council, of Chicago, on March 14 again temporized with the question of extending the franchises of the Chicago City Railway Company by granting an extension until Jan. 1, 1905. The company is to be allowed to install the overhead trolley on Wabash Avenue, north of Eighteenth Street, so as to make it possible to bring more electric cars downtown over Indiana and Wabash Avenues. This will be a material help in handling the traffic. An annual car license fee of $100 per car is to be paid, instead of $50 as heretofore.

It is understood that the company will begin the construction of its contemplated $4,000,000 power station at Thirty-Ninth and Halsted Streets.

ATTEMPTS TO WRECK PACIFIC COAST CARS

Officials of the Pacific Electric Railway and Los Angeles Railway Company have been aroused to vigorous action by attempts within the last six weeks to wreck street cars. A reward of $500 is offered for the apprehension of whoever is responsible for placing obstructions on the rails of the suburban roads. General Manager Randolph thinks the attempts have been made from wantonness. As to the theory that robbery is the motive, he scouts that utterly.

Here is the schedule of dastardly attempts at wrecking cars:

Jan. 26.—First attempt to wreck street cars on Long Beach line; obstructions.

Jan. 29.—Second attempt on same line; same method.

Feb. 1.—Third attempt to wreck Long Beach cars; same method.

Feb. 9.—Attempt to derail car carrying sight-seeing Oaklanders; railroad spike driven into a switch.

Feb. 21.—Attempt to wreck Whittier car; huge stumps on track.

March 3.—Fourth attempt to wreck Long Beach car; heavy obstructions at three different places along the track.

Detectives and secret service men are at work trying to catch the fiend, while the company's tracks are being patrolled to prevent serious accidents

ELECTRIC TRACTION FOR INVERCARGILL, N. Z.

The prosperous seaport town of Invercargill, situated in the most southerly part of New Zealand, about 120 miles distant from Dunedin, is to have an up-to-date American electric traction system. The Australasian engineering and contracting firm of Noyes' Brothers has secured the contract. The generating equipment will be of Westinghouse manufacture. The trucks will be of Brill build.

SOME PAPERS TO BE READ AT THE INTERNATIONAL ENGINEERING CONGRESS

Among the American papers promised for the International Engineering Congress, to be held at St. Louis, Mo., Oct. 3, 1904, to Oct. 8, 1904, under the auspices of the American Society of Civil Engineers, are the following: "Turbines and Water-Wheels," by Professor Gardner S. Williams; "Railroad Terminals," by Elmer L. Corthell; "Underground Railways," by William Barclay Parsons; "Locomotives and Other Rolling Stock," by George Gibbs; "The Substitution of Electricity for Steam as a Motive Power," by James G. White; "Ventilation of Tunnels," by Charles S. Churchill; "Electrical Power Generating Stations and Transmission," by L. B. Stillwell.

In addition to the foregoing, several other important papers are expected from foreign countries.

UNION ENGINEERING BUILDING IN NEW YORK

Some time ago Andrew Carnegie offered to give about $1,000,000 for the erection of a union engineering building in New York, suitable to house the American Society of Mechanical Engineers, American Society of Civil Engineers, American Institute of Electrical Engineers, American Institute of Mining Engineers and the Engineers' Club. It was feared that the refusal of the Civil Engineers to join in accepting Mr. Carnegie's offer would result in its withdrawal. The following letter shows, however, that Mr. Carnegie has increased his donation by half a million dollars.

Andrew Carnegie, 2 East Ninety-First Street, New York.

March 14, 1904.

Gentlemen of the Mechanical Engineers, Institute of Mining Engineers, Institute of Electrical Engineers, Engineers' Club of New York:

It will give me great pleasure to devote, say, one and a half million of dollars for the erection of a suitable Union Home for you all in New York City. With best wishes, truly yours,

(Signed) ANDREW CARNEGIE.

The three national engineering organizations named and the Engineers' Club, have, with the unanimous approval of all the memberships, already taken active steps to put into being the splendid trust for engineering thus created by a man whose own career has illustrated the upgrowth of the engineering and industrial arts in America. The total amount involved is not less than $2,500,000, for, in addition to the amount given by Mr. Carnegie, a sum of over $500,000, represents the investment in land for the three societies on West Thirty-Ninth Street, between Fifth and Sixth Avenues; while the Engineers' Club has also acquired valuable land for its own purposes on West Fortieth Street, immediately facing the New York Public Library. The Union Engineering Building will probably be twelve stories in height, and will be laid out expressly with an eye to the services required of it. The three national engineering societies made trustees by Mr. Carnegie will have large headquarters there; and already several kindred bodies have made urgent requests for accommodation. There will be four or five auditoriums of different size, notably one to seat 1200 to 1500 persons; and all will be appropriately equipped for scientific meetings, lectures and demonstrations. Above all, there will be an engineering museum and a noble library hall, where all the libraries concerned will be grouped and consolidated, yet each section administered by its respective Society librarian and each adding to its own specific literature, so as to avoid duplication of outlay for books or periodicals. It is propsed, moreover, to co-operate intimately with the New York Public Library, nearby.

The three societies have a total membership to-day of over 9000, and are growing at a rate of between 10 and 15 per cent annually. The sister technical societies asking for quarters and facilities represent also another great body of over 5000 members. Large, therefore, as the Union Engineering Building, with its frontage of 125 ft. on five lots may seem, it bids fair from the start to find every inch put to fructifying use. The Engineers' Club Building, a separate entity, will immediately flank the Union Building. The club, with a long waiting list, has just increased its membership to 1,200

The land is provided by the three societies, but in the meantime

Mr. Carnegie has promptly acquired it for them. The leases run out about July 1, and work will then begin and be pushed to completion.

PENNSYLVANIA AWARDS TUNNEL CONTRACTS

On Friday, March 11, the announcement was made in Philadelphia that the Pennsylvania Railroad Company had awarded the contracts for the tunnels to connect Long Island, New York and New Jersey. The tunnel to connect New York and Long Island will extend under the East River, and the contract was given to S. Pearson & Son, Ltd., of London, England. The tunnel to connect New York and New Jersey will extend under the Hudson River, and the contract was given to the O'Rourke Engineering & Construction Company, of New York. Both of these companies are well known in the engineering field, this being particularly true of the Pearson concern, which now has under way some of the largest construction contracts ever awarded. On this side of the Atlantic the Pearson people have work in progress, principally in Mexico, where they are building the National Teuhantepec Railway, which will permit of transit between Coalzocolas, on the Mexican Gulf, and Salina Cruz, on the Pacific Coast. Sir Weetman D. Pearson, Bart., M. P., chairman of S. Pearson & Son, Ltd., left New York for London Tuesday, March 15.

COMPLETION OF NORTH BORE OF HUDSON RIVER TUNNEL

The north tube of the trolley tunnel under the Hudson River, connecting New York and New Jersey, has been completed, so that it is possible to walk through it. To be exact, the tunnel extends from Fourteenth Street, Jersey City, to Morton Street, New York, and the first persons to pass through it from end to end were President McAdoo, of the company which owns the tunnel, and a party of friends, who made the trip Friday, March 11.

From the nearest New Jersey station to the West Street Station in New York the distance is 1 7-10 miles, and the bore under the river, though often mentioned as the entire enterprise, is not the whole of the New York & Jersey Company's underground road. On the Jersey side there is a spur northward to the Lackawanna station in Hoboken. On the New York side there is a stretch of tunnel much greater than all the river section and the Jersey spur combined, and the company has recently applied for an extension to Herald Square.

The history of the first North River tunnel goes back to 1874. In that year a company sought and obtained a franchise, and work was begun. The scheme was to use compressed air, but no shield. The air pressure was to support the silt soil and keep out the water. The result was a cave-in. Fourteen men were killed, and the project was abandoned.

In 1890 a syndicate of English capitalists was formed. There was more boring. But when they struck a ledge of rock they gave up in despair, although they had completed 1500 linear ft. in the north tube and 570 ft. in the south one.

Then came William G. McAdoo, the president of the New York & New Jersey Railroad Company. He organized his company with a directorate of men, prominent in the finanical world. The old franchise, rights and property were bought in for a little more than $4,000,000 from the old Hudson River Tunnel Company, which the Englishmen had launched.

The "sister tunnel" of this one is to be built by the Manhattan & Hudson Tunnel Company between Cortlandt Street, New York, and the Pennsylvania Railroad terminal in Jersey City. Mr. McAdoo is also the head of that enterprise, which is designed to benefit those of the Pennsylvania's passengers who prefer to reach down-town New York through a trolley tunnel rather than up-town New York through the railroad's own tunnel.

Among those who made the trip with Mr. McAdoo were: Vice-President W. G. Oakman, Chief Engineer C. M. Jacobs, Directors John Skelton Williams and G. Tracy Rogers, William Barclay Parsons, chief engineer of the Rapid Transit Commission; President Thomas N. McCarter, of the Public Service Corporation of New Jersey; W. H. Moir, of S. Pearson & Sons of London, the contracting firm awarded the contract for the Pennsylvania East River tunnel.

After the trip Mr. McAdoo announced that the south bore is not now far from completion, and that he felt confident trolley cars would be in regular operation through the tunnels by July, 1905.

NEW CLEVELAND ENGINEERING FIRM

E. P. Roberts and W. H. Abbott have formed the Roberts & Abbott Company to succeed E. P. Roberts & Company. Both of these gentlemen are well known in the engineering field and a list of the installations with which they have been connected would include ninety-eight railways, seventy-one central stations for light, heat, power and water; thirty-six isolated plants, public buildings, manufacturing plants, etc.

E. P. Roberts, M. E., graduated from the Stevens Institute of Technology in 1877. In 1880 he became assistant engineer to Hiram S. Maxim, of the United States Electric Company, and afterward occupied the same position under Edward Weston. Later he was shop superintendent of the American Electric Company, assistant engineer to William Stanley, of the Swan Lamp Company, and erecting engineer for the Rocky Mountain Brush-Swan Company. After leaving that company he acted as manager and consulting engineer for several Western corporations. He left this work to become associate professor of electrical engineering in Cornell University. Later he returned to commercial work, and became manager of the Swan Lamp Manufacturing Company, Cleveland, Ohio. In 1893 he formed the engineering firm of E. P. Roberts & Company, which has had a long and successful career. Some of the work of this firm includes the installation of the Northern Texas Traction Company, the Dayton & Northern Traction Company, the Dayton & Western Traction Company, the Indianapolis & Greenfield Rapid Transit Company, and the Findlay & Fostoria Electric Railway Company.

W. H. Abbott, E. E., began his career in the works of the Fort Wayne Electric Company. After spending two years there as an apprentice he entered the University of Chicago, from which he graduated with the degree of Bachelor of Science. He then took a post graduate course in the Ecole Internationale des Electriciens, Paris, France. Returning to America he was appointed superintendent of the Ocean City Street Railway & Electric Light Company, Ocean City, N. J. Later he entered the service of the Ft. Wayne Electric Company as construction engineer. When the Siemens & Halske Electric Company, of America, passed into the hands of the former Ft. Wayne people, he was given charge of all outside construction and erection work. Later he became sales agent for the Stanley Electric Manufacturing Company of Pittsfield, Mass. He was then employed by the Pomeroy syndicate to construct the Cleveland & Southwestern Railway, an extension of the Cleveland, Elyria & Western Railway. Following this he became consulting engineer for the Pomeroy-Mandelbaum syndicate. Mr. Abbott is also known as the pioneer in the United States in the introduction of the steam turbine in electric railway power stations.

IMPORTANT MEXICAN PROJECTS

It has been decided to construct an electric railway between Morelia, capital of the State of Michoacan, and Guadalajara, the principal city of the State of Palisco, Mexico. The distance between these two places is about 120 miles. Archbishop Silva, of Morelia, is primarily interested in the project. Carlos F. de Candero, a Morelia engineer, has been commissioned to obtain the usual government concessions.

An electric traction system is to be installed in Pachuca, a mining city of some 50,000 inhabitants, located in the State of Hidalgo, Mexico. The Hidalgo Railroad, which connects Mexico City with Pachuca, is completing the purchase of the mule tramways, about 12 miles long, and they are to be converted into electric motive power.

ACTION IN THE BRONX FRANCHISE CASE

The railroad committee of the Board of Aldermen of New York, through its chairman, has reported favorably on the application of the New York, Westchester & Boston Company for the right to cross certain streets in Bronx Borough, for which the New York & Port Chester Company also has applied. The New York, Westchester & Boston Company's application will now go to the Board of Estimate and Apportionment, where it will encounter an investigation by the Law Department. Under the terms of the charter it will require a three-fourths vote of the Aldermen to pass the permit.

PUBLIC SERVICE COMPANY BUYS THE MIDDLESEX & SOMERSET COMPANY

On Wednesday, March 16, announcement was made that the Public Service Corporation of New Jersey had just completed the deal for the purchase of the Middlesex & Somerset Traction Company, which has 50 miles of line in Middlesex and Somerset Counties. The purchase price was $2,250,000. The purchase is of special significance because it gives the Public Service Corporation control of a through electric railway route between New York and Philadelphia about 90 miles long. The line is composed of the Camden & Trenton Company, operating between Camden and Trenton, a distance of 35 miles; the Trenton & New Brunswick Railroad Company, a distance of 25 miles, and the Public Service Corporation, between New Brunswick and Jersey City, about 24 miles.

ENGINEERING SOCIETIES

AMERICAN INSTITUTE OF ELECRICAL ENGINEERING.—The 185th meeting of the Institute will be held at the Chemists' Club, 108 West Fifty-Fifth Street, New York. Friday, March 25, at 8.15 p. m. The following papers will be presented for discussion: "The Relative Fire Risk of Oil and Air-blast Transformers," by E. W. Rice, Jr., technical director of the General Electric Company, Schenectady, N. Y.; "Use of Group Switches in Large Power Plants," by L. B. Stillwell, electrical director of the Interborough Rapid Transit Railway Company; "Oil Switches for High Pressures," by E. M. Hewlett, engineer of the General Electric Company, Schenectady, N. Y.; "Terminals and Bushings for High-pressure Transformers," by Walter S. Moody, electrical engineer with General Electric Company, Schenectady, N. Y.

THE ENGINEERS' CLUB, OF PHILADELPHIA.—A business meeting of the club will be held Saturday evening, March 19, at 8 o'clock. W. L. R. Emmet will read a paper on "Recent Steam Turbine Developments," which will describe some of the most recent apparatus of the General Electric Company, and give data concerning results obtained in tests. The economic significance of these results will be touched upon and the paper will review briefly the history of the company's turbine work and practical experiences with machines in operation.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED MARCH 8, 1904

753,839. Trolley Wire Finder; William Barnhurst, Dallas, Tex. App. filed June 1, 1903. A pulley mounted beneath the trolley wheel carries a guiding fork which is thrown to operative position by rotating the pulley by means of a cord.

753,937. Railway Switch; Frederick Uhtbrock, New York, N. Y. App. filed April 18, 1903. Means mounted upon a car adapted to engage either side of an angularly formed plate, which is pivoted at its apex and has a slotted arm connected with a switch point, whereby the latter is actuated.

754,169. Device for the Opening or Shifting of Track Switches; William D. Simpson, Columbia, S. C. App. filed July 23, 1903. Details of construction of a switch-operating shoe adapted to be suspended from a car.

754,181. Emergency Car Brake; Michael Woltz, Wilkins Township, Allegheny County, Pa. App. filed Dec. 3, 1903. The flanges of the car wheels are provided with notches or teeth and adapted to be engaged by toothed shoes, to thereby lock the wheels against revolution.

754,193. Car Brake; Henry T. Brown, Wilkinsburg, Pa. App. filed July 22, 1903. A brake shaft, rail brake-shoes, rods connecting the rail brake-shoes with the shaft with compression and adjustment means between the shaft and the shoes, wheel-engaging shoes, and means connected to the wheel-engaging shoes for operating the latter simultaneously with the rail-engaging shoes.

754,331. Wheel Fender; Manuel E. De Los Monteros, Mexico, Mex. App. filed Dec. 4, 1903. Comprises a frame provided with closed sides, a tilting collector within the frame formed of two sections pivoted together and means in the sides for movable supporting each of the collector sections.

CAPTAIN McCULLOCH GOES TO ST. LOUIS

Captain Robert McCulloch has resigned as general manager of the Chicago City Railway Company to become vice-president and general manager of the St. Louis Transit Company. He will assume his new duties as soon as he can conveniently leave the affairs of the Chicago City Railway Company. Captain McCulloch has had the management of the Chicago City Railway since the death of M. K. Bowen in 1899, and is one of the well-known managers of the country, having been general manager of the National Railway Company's lines in St. Louis previous to the consolidation of the St. Louis lines.

ROBERT McCULLOCH

Captain McCulloch has managed the affairs of the Chicago City Railway through an especially trying period of its existence, as, during his administration, franchise matters with the city have been hanging fire, so that many permanent improvements have been delayed. Nevertheless, he has made a large number of important improvements in the property. He introduced, for instance, the long double-truck car in Chicago city railway practice, and demonstrated its practicability on the heaviest traffic lines of the company, where before it had been thought that the advisability of such cars was questionable, because of delay in unloading. These cars of his design proved so successful that they have practically set the standard for Chicago street railway rolling stock of the immediate future. Captain McCulloch is known as a manager who has the conservatism born of age and experience, together with the progressiveness which is ready to adopt anything new of sound merit. He was the first street railway manager to adopt the cast-welding of rail-joints, and among the first to perceive the value of the double-truck car in city service. He goes to the St. Louis Transit Company at an important juncture in the life of that company, from an operating standpoint, as the World's Fair traffic this summer will be a heavy tax on both the operating force and the equipment. That at this juncture the directors should have selected Captain McCulloch as the operating chief of the company is the highest testimonial to their appreciation of his ability and judgment.

SALE OF THE FONDA, JOHNSTOWN & GLOVERSVILLE DENIED

It is officially denied that the Fonda, Johnstown & Gloversville Railway has been purchased by the Andrews-Stanley syndicate, of Cleveland. A statement in regard to some of the purchases of this syndicate was published in the last issue of this paper, but as yet the Fonda, Johnstown & Gloversville Railway, which has been mentioned in connection with these negotiations, remains an independent property.

PERSONAL MENTION

MR. FRANK S. DRAKE, now general sales agent for the Philadelphia Air Brake Company, of Philadelphia, was for years general manager of the railroad properties controlled by the late Albert L. Johnson.

MR. A. M. MATTICE has resigned as chief engineer of the Westinghouse Machine Company to accept the position of chief engineer and technical director of the Allis-Chalmers Company. Mr. Mattice will have his headquarters at Milwaukee, Wis.

MR. WILLIAM ROBERTS, master mechanic of the Northern Ohio Light & Traction Company, of Akron, Ohio, has been promoted to the position of superintendent of motive power, vice Mr. T. W. Shelton, resigned. Mr. R. Turnbull has been promoted to the position of chief engineer and assistant to Mr. Roberts.

MR. GEORGE THOMAS, superintendent of the Columbus, London & Springfield Railway Company, has been appointed to an important operating position with the Scioto Valley Traction Company, the new third-rail line which is to be placed in operation early in the spring. Mr. Thomas assumed his new position March 1.

MR. ALFRED GREEN has resigned as chief electrician and master mechanic of the Rochester Railway Company after thirteen years' service with that company. He will also resign at the end of the current month as master mechanic of the Rochester & Sodus Bay Railway Company. In 1890 Mr. Green went to Rochester for the Brush Electric Company, of Cleveland, to install the Short electric railway system. It was upon completing this work that he entered the employ of the Rochester Railway Company. He was superintendent of the testing department of the Brush Electric Company for twelve years, and previous to that superintendent of the Memphis Light & Power Company. Mr. Green is well known in electric railway circles through his many valuable papers on shop practice, and his active interest in the affairs of the American Railway, Mechanical and Electrical Association, of which he is first vice-president. Mr. Green does not contemplate taking up new work immediately, as he desires to take a much-needed vacation.


ALFRED GREEN

MESSRS. C. B. VOYNOW AND H. B. NICHOLS, engineers of the track construction department of the Philadelphia Rapid Transit Company, were awarded this month the John Scott legacy medal and premium for their zinc joint for rail bonding. This prize is held in trust by the city of Philadelphia, and is awarded by a committee of the Franklin Institute of that city for especially meritorious inventions.

CHIEF ENGINEER ENDO, of the Nanki Railway, Japan, was in Brooklyn recently, and went over a part of the Brooklyn Rapid Transit system in company with Assistant Manager George R. Folds. The visitor is a steam railway man, and has been away from his native country since last May, traveling in various parts of the world, and getting ideas on the operation of both steam and electric roads. The company with which Mr. Endo is connected operates by steam, but it is proposed to adopt electricity over a part of the line at least. Mr. Endo came to this country from England, and will visit all of the larger cities here. He has already been over the street railway system in New York. Mr. Endo will return to Japan next May.

MR. CARL SCHWARTS has resigned from the engineering force of the Commonwealth Electric Company, of Chicago, to enter the electrical department of the New York Central & Hudson River Railroad Company as assistant engineer in charge of the department for the electrical equipment of the power stations for the traction system. Mr. Schwarts, while in Chicago, had charge of the design of the electrical part of the new Fisk Street station, with its fourteen 5000-kw Curtis steam turbines. He is a graduate of the Royal Technical College in Hanover, and was conected with the Allgemeine Elektricitäts Gesellschaft in Germany as designing engineer. He was afterward connected with the Siemens & Halske Company as chief engineer of the company's light and power department in St. Petersburg, and later as its general representative in the South of Russia.

MR. E. P. SHAW, JR., has been appointed general superintendent of the Boston & Worcester Street Railway, of Worcester, Mass., to succeed Mr. Arthur C. Ralph, who recently resigned. Mr. Shaw is a member of the Shaw family, so prominently identified with street railway interests in New England, his father having long been known as a builder of street cars, and his brother, James F. Shaw, being a well-known street railway builder. Mr. E. P. Shaw, Jr., was superintendent of the Worcester & Marboro Street Railway when it was first built, and since then has occupied similar positions with the Norwich & New London Street Railway, of Norwich, Conn.; the Manchester Street Railway, of Manchester, N. H., and lately has been superintendent of the Citizens' Street Railway Company, of Newburyport, Mass., and of the Haverhill & Amesbury Street Railway.

PRESIDENT H. J. PIERCE, of the Netherlands Traction Company, which is a Connecticut corporation and is the holding company of the Haärlem Street Railway Company, and which also owns the new electric railway extension between Amsterdam and the North Sea seaside resort, Zandt-voord, together with Mr. Thomas E. Mitten, general manager of the International Traction Company's lines, Buffalo, who is also a director in the Netherlands Traction Company, returned from Europe last week. Both gentlemen had visited Holland on a tour of inspection of the new work, which has been undertaken by the company, and which is being rapidly brought to completion by the contractors, the J. G. White Company (Limited), of London. It is thought the line will be ready for operation July 1. While abroad at the meeting of the directors of the two corporations, Mr. Chas. Julius, lately of the Westinghouse Electric Works at Havre, was selected as general manager of the new line. Between Haärlem and Amsterdam thirty-five large, double-truck passenger coaches will be run on five-minute headway. Express and freight will later be made a feature. The coaches are divided into first and second-class compartments, the round trip being first class, 35 cents, United States money, 16 cents one way; second class, 12 cents one way, 22 cents round trip. It is expected in time that the new line will secure the government mail contract. A large tract of land along the tracks of the new line from Amsterdam City limits to the government road will be improved with boulevards and parkways, and the property put on the market for suburban residences, as an added enterprise of the present owners and projectors of the new trolley line. This promises not only to be profitable as an investment in improved property for speculative purposes, but also to furnish a large and thickly-settled constituency of daily patrons to the line.

MR. JOHN B. O'HARA, associate editor of the STREET RAILWAY JOURNAL, died at the residence of his brother-in-law, J. G. Hickey, in Rochester, March 13.

Mr. O'Hara joined the editorial department of the STREET RAILWAY JOURNAL just two years ago, and brought with him to the editorial force of this paper an accumulated experience in newspaper work and technical journalism which was of the greatest value. He was born in Rochester on Dec. 10, 1865. After graduating from the public schools in that city he became connected with the Rochester "Herald," and was afterwards appointed associate city editor of the "Post-Express." Fifteen years ago he went to Chicago to join the editorial staff of the "Western Electrician," and was later appointed editor-in-chief of that paper. This position he occupied for a number of years with marked success. Later he was offered a proprietary interest and business management, with editorial control, of "Modern Machinery," a monthly paper published in Chicago and devoted to the machine tool business. He was soon obliged to resign this position on account of failing health and take a long vacation, part of which he spent in Rochester and part in the South. Partially recovering, and being of a disposition which would never permit unnecessary idleness, Mr. O'Hara joined the publication department of the Westinghouse Companies, with headquarters in New York, but after a few months' connection with this company was offered and accepted the position on the editorial staff of the STREET RAILWAY JOURNAL, which he occupied at the time of his death.


J. B. O'HARA

Ten years ago Mr. O'Hara was married to Miss Margaret Hickey, of Rochester. After her death he attended the body to Rochester, where the interment took place, but serious illness followed so soon in his own case that he was unable to attend the funeral in that city. His death occurred just four weeks after that of his wife, to whom he was devotedly attached, and was caused by valvular heart trouble. He is survived by an only son, aged eight years, his father, mother and two sisters.

John B. O'Hara possessed the high respect and esteem of all with whom he was acquainted, and especially of his immediate associates, who had an exceptional opportunity of learning and appreciating his high character and exceptional qualities of mind and heart. To know him was to love him. He had many friends in the city in which he was born, and in those in which he had lived, who will regard his death in the light of a personal bereavement, and as removing one of their most intimate and highly respected friends.

As a writer, Mr. O'Hara had a very clear style of expression, with an excellent quality of going to the foundation of the topic under discussion, and a keen perception of the news feature of every item which he was considering.

FINANCIAL REPORTS OF THE OPERATING STREET RAILWAYS OF THE STATE OF MASSACHUSETTS FOR THE YEAR ENDING SEPT. 30, 1903

Name	On September 30, 1903		Year Ending September 30, 1903					
	Capital Stock	Funded Debt	Total Receipts All Sources	Operating Expenses	Charges on Earnings	Dividends Paid Amount	Dividends Paid PerCent	Surplus for Year
	$	$	$	$	$	$		$
Boston Elevated Ry. Co.	13,300,000	......	12,019,371	8,259,860	2,932,556	798,000	6	28,955
Boston & Northern St. Ry. Co.	10,060,000	8,443,500	3,662,377	2,324,840	849,204	483,000	5	5,334
Old Colony St. Ry. Co.	6,812,600	4,667,000	2,483,156	1,606,846	531,011	339,983	5	5,316
Worcester Consolidated St. Ry. Co.	3,550,000	1,060,000	1,324,495	797,832	313,576	213,000	6	86
Springfield St. Ry. Co.	1,958,400	600,000	915,876	674,426	130,643	156,672	8	def. 45,865
Holyoke St. Ry. Co.	700,000	600,000	369,337	252,707	68,112	56,000	8	def. 7,482
Union St. Ry. Co. (New Bedford)	900,000	400,000	366,158	258,758	55,237	48,000	8	4,163
Fitchburg & Leominster St. Ry. Co.	350,000	300,000	218,968	130,135	66,988	21,000	6	846
Berkshire St. Ry. Co.	800,000	800,000	183,091	104,873	43,130	......	..	35,087
Lexington & Boston St. Ry. Co.	525,000	350,000	164,690	125,153	31,633	19,688	3.56	def. 11,783
Interstate Consolidated St. Ry. Co.	275,000	......	152,611	117,791	7,246	......	..	27,573
Northampton St. Ry. Co.	300,000	225,000	151,031	100,413	29,964	24,000	8	def. 3,346
Milford & Uxbridge St. Ry. Co.	440,000	384,000	149,966	111,979	34,458	......	..	3,529
Hoosac Valley St. Ry. Co.	400,000	100,000	148,828	101,977	18,503	24,000	6	4,348
Dartmouth & Westport St. Ry. Co.	150,000	90,000	145,656	102,945	14,880	12,000	8	15,831
Newton St. Ry. Co.	315,000	280,000	135,623	98,450	31,955	18,900	6	def. 13,683
Pittsfield Electric St. Ry. Co.	200,000	200,000	134,952	99,194	23,172	12,000	6	586
Haverhill & Amesbury St. Ry. Co.	150,000	490,000	109,389	73,490	38,225	......	..	def. 2,326
Springfield & Eastern St. Ry. Co.	370,000	330,000	107,509	73,130	24,305	......	..	10,074
Boston & Worcester St. Ry. Co.	1,250,000	1,250,000	103,726	41,657	19,490	......	..	42,580
Worcester & Southbridge St. Ry. Co.	500,000	500,000	102,388	53,102	19,923	15,000	3	14,362
Brockton & Plymonth St. Ry. Co.	295,000	270,000	99,600	67,363	35,394	......	..	def. 3,156
Citizens Electric St. Ry. Co. (Newburyport)	240,000	210,000	97,586	61,309	19,253	......	.	17,025
Commonwealth Avenue St. Ry. Co.	292,000	......	91,930	68,442	11,949	13,140	4½	def. 1,601
New Bedford & Onset St. Ry. Co.	500,000	280,000	91,721	58,904	24,635	......	..	8,183
Natick & Cochituate St. Ry. Co.	100,000	......	88,923	71,958	8,858	......	..	8,108
Woronoco St. Ry. Co.	250,000	75,000	77,220	51,588	6,706	12,000	6	6,926
Milford, Attleboro & Woonsocket Ry. Co.	315,000	250,000	76,849	62,083	16,362	......	..	def. 1,596
South Middlesex St. Ry. Co.	100,000	100,000	72,217	58,110	14,936	......	..	def. 828
Worcester & Blackstone Valley St. Ry. Co	60,000	......	67,910	41,710	19,225	......	..	6,975
Newton & Boston St. Ry. Co.	200,000	200,000	67,151	98,608	25,434	......	..	def. 56,891
Warren Brookfield & Spencer St. Ry. Co.	150,000	125,000	66,415	45,481	17,791	......	..	3,144
Greenfield & Turner's Falls St. Ry. Co.	130,000	86,000	62,785	35,336	8,227	6,138	5	13,085
Gardner, Westminster & Fitchburg St. Ry. Co	185,000	150,000	59,237	37,742	15,118	......	..	6,377
Concord, Maynard & Hudson St. Ry. Co.	175,000	165,000	58,877	39,506	14,172	......	..	5,199
Bristol County St. Ry. Co.	200,000	200,000	57,639	36,026	20,310	.....	..	1,303
Middleborough, Wareham & Buzzard Bay St. Ry. Co.	150,000	150,000	56,881	44,851	9,747	......	..	2,282
Northampton & Amherst St. Ry. Co.	180,000	180,000	56,746	44,042	12,561	......	..	143
Norfolk & Bristol St. Ry. Co.	200,000	......	54,703	51,747	12,186	......	..	def. 9,230
Wellesley & Boston St. Ry. Co.	115,000	......	53,812	43,861	4,213	6,900	6	def. 1,163
Lawrence & Methuen St. Ry. Co.	125,000	......	52,268	53,255	2,605	......	..	def. 3,592
Norton & Taunton St. Ry. Co.	297,000	296,000	48,180	41,664	17,719	......	..	def. 11,204
Templeton St. Ry. Co	75,000	.....	47,532	36,268	21,370	......	..	def. 10,106
Providence & Fall River St. Ry.	165,000	165,000	44,460	31,486	12,581	......	..	392
Southbridge & Sturbridge St. Ry. Co.	60,000	60,000	43,675	27,377	7,475	1,800	3	7,024
Georgetown, Rowley & Ipswich St. Ry. Co.	180,000	180,000	41,221	34,923	12,629	......	..	def. 6,331
Athol & Orange St. Ry. Co.	74,500	60,000	40,385	27,123	5,285	5,960	8	2,016
Framingham Union St. Ry. Co.	30,000	47,000	38,274	27,363	6,406	1,500	3	3,005
Marlborough & Framingham St. Ry. Co	105,000	......	38,272	36,203	5,842	.....	..	3,773
Blue Hill St. Ry. Co.	300,000	......	37,232	31,379	5,768	.....	..	85
Marlborough & Westborough St. Ry. Co.	160,000	160,000	36,239	23,803	15,306	......	..	def. 2,870
Haverhill & Southern New Hampshire St. Ry. Co.	80,000	......	35,652	43,366	1,788	.....	..	def. 9,502
East Taunton St. Ry. Co.	110,000	45,000	35,257	20,229	4,441	5,500	5	5,087
Haverhill, Georgetown & Danvers St. Ry. Co.	60,000	35,000	31,581	20,634	6,531	3,600	6	816
Amherst & Sunderland St. Ry. Co.	97,100	51,500	29,413	25,917	5,796	1,860	2	def. 4,160
Hampshire & Worcester St. Ry. Co.	155,000	135,000	28,654	18,891	9,426	......	..	337
Framingham, Southbridge & Marlborough St. Ry. Co.	80,000	60,000	24,730	14,319	5,599	......	..	4,811
Uxbridge & Blackstone St. Ry. Co.	80,000	80,000	24,275	12,977	4,136	......	..	7,162
Norfolk & Western St. Ry. Co.	100,000	100,000	24,078	30,249	9,361	......	..	def. 15,532
Medfield & Medway St. Ry. Co.	100,000	100,000	23,233	15,810	7,330	......	..	92
Lowell & Pelham St. Ry. Co.	40,000	......	21,813	22,765	716	.....	..	def. 1,668
Shelburne Falls & Colrain St. Ry. Co.	50,000	50,000	15,160	10,015	3,606	......	..	1,539
Westborough & Hopkinton St. Ry. Co.	40,000	40,000	14,138	12,098	2,215	......	..	def. 177
Lowell & Boston St. Ry. Co.	90,000	90,000	13,659	15,320	15,013	......	..	def. 16,674
Linwood St. Ry. Co.	12,000	......	12,553	9,552	484	720	6	1,797
Hampshire St. Ry. Co.	67,300	.....	10,131	6,080	3,665	......	..	385
Conway Electric St. Ry. Co.	35,950	......	9,001	5,373	3,498	.....	..	129
Norwood, Canton & Sharon St. Ry. Co.	62,500	......	8,549	11,647	9,799	......	..	def. 12,896
Plymouth & Sandwich St. Ry. Co.	36,800	......	7,077	5,235	1,116	......	..	726
College City & Edgartown Traction Co.	60,000	......	4,500	4,039	236	......	..	225

NEWS OF THE WEEK

CONSTRUCTION NOTES

BIRMINGHAM, ALA.—The City Council of Wylam has granted the Birmingham Railway, Light & Power Company the right to extend its line down Bank Street.

BIRMINGHAM, ALA.—The new line of the Birmingham Railway, Light & Power Company, between Powderly and Bessemer, 7 miles, has been opened. This gives the company two direct lines to Bessemer, which is 12 miles from Birmingham.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company has bought a piece of property 41½ ft. by 150 ft., near its power house, so as to enlarge the plant. Several new boilers, a large 60-cycle, three-phase, 2300-volt alternator and a new direct-current, 1600-kw, 575-volt generator will be installed.

IVANPAH, CAL.—The unique electric motor carriage roadway from Ivanpah to the Lila C. mine of the Pacific Coast Borax Company, just across the Nevada line, has been completely graded the entire 100 miles, and it is expected motor trains designed especially for ore hauling will soon be in operation. While designed primarily to haul the product of the borax company, a large quantity of freight will be handled for the mines of the various districts in San Bernardino and Inyr counties, in California, and the southeastern part of Nevada. The electric road will connect at Ivanpah with the Salt Lake and Santa Fe lines and form an outlet for a vast mining territory without railway transportation.

LOS ANGELES, CAL.—The City Council has voted to advertise for sale a franchise on East Twelfth Street. The proposed line will serve a considerable portion of the district left without car facilities by changing the East Ninth Street line from a street railway into a trunk line railroad.

LOS ANGELES, CAL.—Major H. M. Russell has returned from New York, whither he went to finance the Ventura & Bakersfield Electric Railway project. He believes the bonds have been placed as a result of his trip, and promises that work shall be rushed at once.

LOS ANGELES, CAL.—July 1 is given as the date for opening the Huntington interurban depot for business. About half the mammoth building has been rented, and, as soon as it can be done, the several Huntington railway headquarters will be removed to the new structure.

LOS ANGELES, CAL.—The City Council has expressed its willingness to offer for sale two more franchises from the Southern Pacific shops, beginning at Main and Lamar Streets and running southward on Lamar Street to Alhambra Avenue; also beginning at Main Street and Avenue Twenty and proceeding north on Avenue Twenty to Pasadena Avenue.

LOS ANGELES, CAL.—The Pacific Electric Railway Company is getting 16,000 tons of steel rails from Belgium. There are now 10,000 tons on the water, and three cargoes have been unloaded at San Pedro within the past month. Officials of the company will not admit that there is any significance in the fact that some of the rails are unloaded at San Diego, but the amount unloading there is more than enough to build a single-track system with sidings between this city and San Diego. It is thought the rails will not be brought to Los Angeles "just yet."

LOS ANGELES, CAL.—The Los Angeles-Pacific Railroad Company is enlarging its power plant at Vineyard Station, and is dismantling the main station at Ocean Park. Preparations are being made for handling an unusually large traffic during the coming summer. Other improvements contemplated by the road are the renewing of track on Bellevue Avenue and the reconstruction of the Sixteenth Street line from Hill Street and Pico Street to Georgia Street. Several new cars have been ordered by President Clark.

LOS ANGELES, CAL.—The Pacific Electric Railway's new line to Lamanda Park has been opened, and, like all the roads of the system, is standard gage, double tracked, constructed according to the most approved railway standards. From Los Angeles to San Diego the line uses the tracks of the Monrovia branch, and in Pasadena connection is made with the local street railway system of that city. The new line traverses a section of the Southland rich in scenic attractions.

SAN FRANCISCO, CAL.—The North Shore Railroad Company is building eight electric cars at its shops in Sausalito, Cal., under the superintendence of Chief Electrician Vanatta. The new cars will be similar to the large vestibule cars built in St. Louis for this company last year, which are in successful operation on the third-rail system between Sausalito, Mill Valley and San Rafael.

SAN FRANCISCO, CAL.—The United Railroads of San Francisco has filed a petition with the Board of Public Works for permission to reconstruct the steam road which extends to the Cliff House from California Street via Lake Street and the Bay Shore as an electric road. A standard-gage electric road of substantial construction will be built along this scenic route as soon as possible, after permission is granted. This will give the company an opportunity to relieve the pressure on the present roundabout route to the cliff south of Golden Gate Park. If proper connections are made with the downtown districts several transfers may be done away with, and the time from city to ocean reduced.

DENVER, COL.—General Manager C. W. Sells, of the Manitou & Pike's Peak Cog Road, announces that after this year the road will be operated by electricity. The work of changing the motive power from steam to electricity will cost approximately $200,000. Mr. Sells recently made a visit to the East for the purpose of securing bids from large electrical companies on the various machinery and apparatus needed in the new method of operation.

DENVER, COL.—The electric railway between Denver and Greeley will be in operation by next fall if the plans of the company, as now agreed upon, are perfected. D. F. Carmichael and J. J. Cahill are the active spirits of the enterprise, while a number of Eastern people are heavy backers of the road. This road will be built under the name of the company incorporated in 1893—the Platte Valley Railway Company, but a new franchise has been secured. The line follows the Brighton Road. A large power house will be erected at Brighton. The road will do a general freight and passenger business. While it will parallel the Union Pacific road for a large part of the way, it will be several miles shorter. Its length will be 54 miles.

GLENWOOD SPRINGS, COL.—Albert C. Johnson, who says he represents considerable Southern capital, has been here looking into the feasibility of running an electric railway from Glenwood Springs to Mt. Sopris, 12 miles south, and has incidentally looked into the practicability of building a similar line over the mountains to Trapper's Lake, about 25 miles north.

LEADVILLE, COL.—The Leadville-Denver Mining, Tunnel & Tramway Company has voted to issue $500,000 worth of bonds for the purpose of building an electric railway from Leadville 6 miles to a point where a tunnel will pierce the mountains for half a mile. This new electric road will cost, with its equipments, $260,000, and will be a connecting link for the steam railroads between Denver and Leadville. It will cut down the distance between the two points mentioned 175 miles by the Denver & Rio Grande Railroad and 40 miles by the Colorado & Southern Railroad. The new line will be equipped for carrying both freight and passengers. The officers of the company are: James A. Shinn, president; Alfred C. Phelps, vice-president; Byron Tifft, secretary. The company is incorporated for $2,000,000.

HARTFORD, CONN.—The board of directors of the Danbury & Harlem Traction Company has changed its personnel by electing Joseph A. Serre, of Danbury, and W. H. I. Howe, of North Salem, N. Y., to succeed William D. Marks and W. J. Patterson, of New York, resigned. The following officers were also elected by the board: D. E. Loewe, of Danbury, president; Stephen B. Quick, of North Salem, vice-president; J. N. Cronley, of New York, secretary; Philip Simon, of Danbury, treasurer. Technical difficulties arising from a transfer of control of the corporation resulted in a cessation of construction work, but it is expected that operations will be resumed this spring. The roadbed has deteriorated considerably through disuse and lack of care. The proposed line is about 17 miles long.

ATLANTA, GA.—The franchise which was recently granted to the Atlanta & Roswell Electric Railway Company by the County Commissioners has been forfeited by the corporation. The time limit allowed the company by the Commissioners in which to file a $15,000 bond to indemnify the county and to guarantee the construction of the line has expired.

ATLANTA, GA.—The Atlanta Water & Electric Power Company is projecting an eletctric railway from Atlanta to Bull Sluice. This has already been decided upon by the owners of the property. Application for a franchise will be made to the Board of County Commissioners during the next session of that body, and it is believed that the franchise will be granted to the corporation. The electric road will travel over the former proposed route of the Atlanta & Roswell Railway Company. As stated above, the franchise granted that concern has not been used, and it is now valueless to those who secured it, because they failed to give the required bond of $15,000. It is the intention of the owners of the Atlanta Water & Electric Power Company to commence work on the street railway as soon as the franchise has been granted by the Board of County Commissioners. It is believed that the new road will be completed during the early part of 1905.

BOISE, IDAHO.—Equipment for a 5-mile extension of its system has recently been ordered by the Boise Rapid Transit Company, the City Council having granted a franchise which permitted this extension.

EAST ST. LOUIS, ILL.—Articles of incorporation have been filed by the St. Louis, Vandalia & Eastern Electric Railway, with a capital stock of $50,000. The incorporators are: William M. Fogler, Charles G. Sonnerman, George D. Steinhauer, H. C. Doyle, T. N. Lakin, of Vandalia.

EAST ST. LOUIS, ILL.—The surveyors of the Southern Illinois Electric Railway Company have begun a new survey preparatory to commencing actual work. With Okaville as the starting point, the survey passes through New Memphis station, thence along the right of way of the Louisville & Nashville Railway, through Mascoutah, on South Street, to Rentchler, where it passes north to the Mascoutah Road to the Belleville public square, where it will connect with the East St. Louis & Suburban Railroad.

EAST ST. LOUIS, ILL.—Articles of incorporation were filed March 4, by the Eastern Illinois Traction Company, having a capital stock of $5,000 and principal office at Mattoon, Ill. The object of the corporation is to construct a railroad from Mattoon, in Coles County, in a northerly direction through Coles and other counties to Champaign in Champaign County. The incorporators, who also constitute the first board of directors, are: Emery Andrews and James Vause, of Mattoon; Thomas Lyons, of Arcola; Charles G. Eckert, of Tuscola; E. A. Potter, of Chicago.

EAST ST. LOUIS, ILL.—The East Side Railway & Transfer Company, with principal offices in this city, filed articles of incorporation recently. The new concern has a capital stock of $2,500. Its object is to construct a belt railroad around East St. Louis. The incorporators are: Thomas H. Koch, of Mt. Olive; H. C. Begole, of Belleville; W. E. Trautman and John J. McLean, of East St. Louis; F. A. Methan, of St. Louis. The incorporators constitute the first board of directors.

INDEXED

Street Railway Journal

VOL. XXIII. NEW YORK, SATURDAY, MARCH 26, 1904 No. 13

PUBLISHED EVERY SATURDAY BY THE
McGRAW PUBLISHING COMPANY

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.
BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues)........................ $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Temporizing in Chicago

The city of Chicago has again temporized with the surface transportation problem by granting a franchise extension until Jan. 1, 1905, to the Chicago City Railway Company operating the lines on the South Side, thereby putting off nine months the settlement of a twenty-year franchise grant. At any time during the past year a settlement of the franchise question, as regards the Chicago City Railway Company, could easily have been made had the city authorities ceased to discuss non-essentials in the framing of a franchise extension ordinance, and proceeded at once to settle the important points and frame an ordinance to be submitted to the Council. After hours upon hours of consideration of an ordinance, the local transportation committee is no nearer a settlement of the question than it was a year ago. It is remarkable that as honest and capable a set of business men as constitute this committee should be so misled as to what constitutes their duty to the public as to have accomplished nothing definite in the months and years this matter has been considered. The committee for some time has had information before it which should enable it to come promptly to a definite conclusion upon the real question at issue, which is, what is the proper compensation to be paid for the franchise? The difficulty seems to be that the committee knows that the absurd compensation which has been demanded by some of the anti-corporation element of the city is out of the question for a twenty-year franchise, while at the same time it fears to recommend what it knows to be the proper compensation, because of the fear that it will be charged that the committee has not looked after the city's interests properly in not demanding more. As a result, the local transportation committee has most studiously remained on the fence, with the result that nothing has been or is likely to be accomplished soon. The public suffers more than anyone else, because of this delay in transportation improvements, but it is only now that the Chicago press seems to be waking up to that fact.

The Electric Railway Tests at St. Louis

We have already referred to the plan adopted by the managers of the Louisiana Exposition in St. Louis to conduct a series of practical tests on electric railway apparatus at the fair this summer, and it is with great pleasure that we are enabled to present in this issue a fairly complete programme of the trials which have been decided upon. From these it will be seen that the work laid out by the commission is a very important one, and the results which may be anticipated from the tests at St. Louis will not only have a high commercial value to all persons interested in electric railroading but will have great scientific interest and import as well.

These tests will be divided into three classes, those carried on within the building itself, those on the test tracks in the Exposition grounds, and finally some more elaborate trials which may be conducted on an outside line to elucidate certain problems in high-speed railroading, in case it should seem desirable to do so. These tests can also be divided into and will completely cover equipments for city and suburban railroading, for interurban electric roads, heavy traction conditions and new electrical railway systems. Those carried on within the buildings will be in a sense similar to shop tests, except that all apparatus will be subject to one set of inspectors, and will be governed by one set of rules. By this means the results can be co-ordinated and compared in a way not possible otherwise. The outside tests will represent actual operating conditions, and by them it will be possible to determine the ratio between the temperature rise and the watt loss in different parts of the motors, that is, the capacity curves, as found in the shop tests and as obtained in actual practice with different train cycles and conditions. If this relation is determined for a large number of motors and for different conditions of operations, the data secured will be of the greatest value to railway engineers.

We look forward with especial interest to the tests on train resistance as full of promise of information for which there is now even less data available than in the directions which have been previously mentioned. This is an instance, although one only, in which the commission will be able to supply the engineer with data which are essential, if high-speed electric rail-

ways are to be successfully built, and we refer to it simply because it is a glaring example of the way in which railway development has outstripped scientific investigation. One reason for this has been, of course, that no private corporation would care to go to the expense of conducting elaborate tests of this kind, but under the auspices of the commission valuable, as well as authoritative, results ought to be secured.

The Opening of the Season

The season is now here when extensions are in order and the manager is planning his campaign for the summer. June and July will ere long bring their harvest of traffic, but from now until settled weather in our Northern climate is a time of stress in the street railway business. The most serious question is that of adequate car accommodation to suit not all people at all times, for that is a task for omniscience, but a fair proportion of the people most of the time. It will not be long before the first warm days will tempt the open car out of its den, and for a couple of months the railway manager will be kept guessing as to whether he shall let it frisk about or chain it up.

Beloved of the stalwart fresh air fiend, and denounced of testy old gentlemen as a purveyor of pneumonia, the open car is a standing problem. In spite of the undoubted success which the semi-convertible car has had in both city service and on interurban roads, it is not a complete substitute for the open car. The latter may be productive of more accidents than any other design, but there is a freedom of access to it and a pleasure in riding in it at moderate speeds which can never be attained by any car which is partially closed. Of course, the plutocratic corporation that can afford several suits of rolling stock gets along well enough by strenuous exertion, but the mere well-to-do-company that has to look very sharply after the nickels is in no such comfortable case. With it the question of a duplication of rolling stock, one for use during nine months of the year and for a few cold days in summer, and the other for the three months or less remaining, is a very serious one.

Time only will tell whether there is any complete solution to this problem. The semi-convertible car has so far been the most popular mean between the open and the closed types, although there are also several full convertible cars in the market. Some managers will have nothing to do with either attempt to reconcile the two types of car in one structure, and denounce the plan as impossible of application, like "perpetual motion" or "squaring the circle." We are not disposed to take such a gloomy view of the situation. The semi-convertible car has been found to suit many conditions where it was formerly thought the open car was the only substitute for the full closed car, and it is by no means impossible that further improvements may evolve a car which still more closely resembles the open car for summer service. Again, although the view may seem heterodox, we still persist in believing that there are conditions in which an open trailer can be used to advantage to care for peak loads on the road which cannot afford two complete equipments of car bodies. Such a trailer, if used behind a semi-convertible car, would afford those passengers who insist upon an open car a liberty of choice, while giving accommodation to those who prefer to ride in the partially closed semi-convertible. The open trailer could, if considered desirable, be fitted with a center aisle, although if passengers descend from a running board on one side of the car only we hardly consider that this is necessary; and if a center aisle is used it might even have a single exit, either from the front or rear platform, as a further precaution against accidents. The plan is at least worthy of consideration in view of the early approach of the summer season and the difficulties which may be presented in finding accommodation for all passengers who wish to ride.

Electricity on Long Lines

A paper recently read before the Institution of Electrical Engineers, by F. F. Bennett, gives some interesting, even if rather daring, estimates on the possible saving to be made by operating the entire railway system of England and Wales electrically. The proposition strikes one on its face as rash, but upon further examination improves in appearance. The fundamental proposition laid down by Mr. Bennett is, however, one that is well worth thinking about in connection with the interurban networks that are extending so rapidly.

Broadly the proposition is, that while it might be difficult or impossible to show a saving on electrically operating the consecutive sections of a single line, the inclusion of all the lines in a given territory would generally lead to a good economic result. A series of sections, each fed by a single power station, is an arrangement inevitably leading to a bad load factor, unless in the case of very exceptionally heavy traffic. If, however, lines in contiguous territory are taken in so that each station feeds an area instead of a line, the load factors may reasonably be expected greatly to improve. For example, Mr. Bennett figures, there were in England and Wales in 1901, 15,308 miles of railway in service, and if each company undertook to electrify merely its own line in 50-mile sections, there would be needed some 306 power stations to do the work. If, on the other hand, all the roads came into the deal, so that the territory could be cut up into blocks, each of 900 square miles, each block supplied by a central station, the total number of stations required would be only sixty-five. The total output of the stations being the same in either case, the block stations would show four to five times the output requirement of the previous case.

Of course, some gain in economy is obvious, even supposing the load factor to remain unchanged, and taking the change in load factor into account, the case is very much bettered. The argument is certainly specious on first sight, and it evidently has a sound basis of fact, but the attempt to chase it over into the field of numerical computation is somewhat hazardous. To figure out the load curve for even a single block station is little short of appalling in its complication, and until this is done one cannot be at all sure of the gain in the load factor. Mr. Bennett computes an average block station of about 5500-kw output, but the actual load factor attainable and the maximum output required at the peak of the load are matters on which one can scarcely do more than guess. Clearly, cases might occur in which the load factor would be hardly better than that pertaining to any single line, while sometimes the load would be fairly uniform. With one station for every 50 linear miles of track, the theoretical average station would be not much in excess of 1000 kw, and if it were much larger for any reason would still be likely to have increased size, only because of an associated bad load factor. Standing these off against each other it is fair to suppose the 5500-kw station could furnish power, perhaps, 25 per cent cheaper than the smaller station. Further than this we do not care to follow Mr. Bennett's figures, for the simple reason that his data are only roughly approximate, and some of his figures open to severe criticism. In point of fact the sections fed from a single station, in view of the economy of alternating-railway motors, would, for a single line, be considerably more than 50 miles in length, and the

areas per station much greater than 900 square miles. Each increase in practicable radius of distribution means an added advantage in going to a station feeding the corresponding area.

The moral of Mr. Bennett's paper, so far as street railway organization goes, is obvious. It appears if one but takes the trouble to glance at a street railway map of any well-served section. It shows at once that while each individual interurban road may have a well planned system of power transmission and distribution, the power stations, considering the network as a whole, will almost always be badly arranged. If it were possible for a group of roads to pool their interests in the generation of power and to install a proper system for the group as a whole, there is no doubt at all of a very substantial saving in the power bill. Organic consolidation is not at all necessary to this end, since a group of roads could put up its power systems in charge of trustees, and take power by meter, each road paying its share of the running expense and fixed charges. The proposition would generally work out rather simply, and with the present rate of growth of interurban systems would very quickly become a source of very considerable saving. If the speed on electric lines keeps on its present rate of increase, the power bill will grow steadily heavier year by year, and the fuel bills may be counted on for regular increase anyway. The large interests of electric roads, even in contiguous territory, are common interests, and no small spirit of jealousy should be permitted to interfere with harmonious action. There are many ways in which neighboring roads can help each other, but a common supply of power, and distributed for the common account, strikes one as perhaps the most important item in the line of co-operation. Sooner or later there will be much consolidation among electric lines, but, however that may be, co-operation of a very effective kind can be introduced most profitably without any close, formal union in other things. We should certainly like to see the plan tried on a large scale, and feel reasonably sure that the result would turn out to be a happy one.

The Duties of the Repair Inspector

Several articles have appeared in recent issues of this paper on the design of car houses and repair shops, but without proper superintendence and inspection the best arranged and most completely equipped building for the maintenance of the rolling stock of any railway company is of little use. The foreman, or chief inspector, has usually secured his position by promotion from among the car inspectors, and the latter by selection from among the mechanical force. The efficiency of the organization, therefore, depends upon whether these appointments have been made because of the knowledge and ability of the men who hold these positions. The importance of both offices is too often overlooked. The chief inspector and his assistants should not only be able to detect and remedy troubles, but should also have the acumen to foresee and take the necessary steps to prevent it, either by strengthening the equipment or by directing the attention of the management or men to ways in which it is being abused.

On many roads the inspection department is the one through which the motormen are taught as to their manipulation and care of the apparatus under their charge, and where this practice is followed the chief inspector should have the executive ability to instruct the men as to the proper use of the equipment. In this connection there are two points in the operation of electric cars that have often been neglected, as those who have had opportunity to inspect systems in all parts of the country will realize, although both are important features in railway work. One is how to locate defective motors and the method of cutting them out, the other is the method of using the reverse. Very often there are no indications on the controller as to where the motors are connected. There should be a diagram on the inside of the cover of the controller or in the motorman's instruction book, showing the position of each motor on the car, and also indicating what switches should be thrown in order to cut out each motor. It is a lack of knowledge and training in these particulars that often causes blockades in city service and serious accidents in interurban operation.

Familiarity with these matters, especially the perfect use of the reverses, inspires a motorman with confidence, and in cases of emergency where this knowledge is valuable he is not liable to lose his head. It is a matter of record that many damage cases have been won by proving that the reverse was used in attempting to avoid collision. In other cases where only the hand brakes were used the court has held that the motorman did not do all within his power to stop the car, and that consequently the company whose agent he was was responsible for the damages caused. The degree of proficiency that is required of a motorman in remedying defects of minor importance while on the road naturally varies with the different systems, and is governed somewhat by the number of equipments allotted to each inspector. On interurban lines, because of the long runs involved, the motorman should be much more proficient in making repairs and have a much better knowledge of the equipment than is absolutely required on city lines.

Probably one of the most important reforms that has been instituted in the methods of inspection and repair of car equipments is the abolition of the practice of inspecting the equipments in the car house at night. This system is radically wrong, and wherever it has been employed the maintenance of equipment has not reached a high standard on account of the poor light that the men must necessarily work by and other unfavorable conditions, such as dirty and confined quarters. It has been found, moreover, that the best class of labor for this purpose is not attracted by night work. This is now pretty generally recognized, and most roads are gradually coming to day inspection for most of their equipment and confining night inspection of such work as is only absolutely necessary, such as greasing the journals, blowing out the controllers with compressed air and looking after the brushes, or else changing the brushes every night on each equipment as is done on some roads.

Spare Trucks vs. Spare Cars

In connection with the general subject of car inspection, the growing practice of providing spare trucks instead of spare cars is worthy of consideration. The procedure followed in Boston on the elevated railway system, on which this method is in use, is described in this issue, and is simply an elaboration of the growing practice of inspecting motors from above instead of from the pit. The elevated railway systems were naturally among the first to adopt this method, owing to the larger size of their electrical equipments, but many of the surface companies are following the practice, and, as described in recent issues, a number of the largest and most recent car houses are equipped so that all new equipment will be inspected in this way. It is a comparatively simple matter with a double-truck car to take out one truck and substitute another. If this is done, the repairs and inspection of the electrical equipment can be made without the detention of the car body in the repair shop beyond the few minutes required for making the change.

STEEL-TIRED WHEELS ON THE BOSTON ELEVATED RAILWAY SYSTEM

Perhaps no elevated railway company has studied the wheel question so carefully as that in Boston. One reason for this is that the conditions of grades and curves on the Boston Elevated Railway system, owing to the narrow and crooked streets through which the line runs, are undoubtedly more severe than those in any other city, so that the wear caused to both wheels and rails has been serious. In addition, the company has given special attention to the wheel question in an effort to reduce the noise from the cars on its elevated structure. As is well known, the company has made a careful study of the different factors which produce noise in the operation of trains on elevated structures, and as a result has been successful in greatly ameliorating the original conditions. The exact extent to which the attention paid to the wheel question is responsible for this improvement is difficult to determine. Other suggestions have been tried, such as the use of wooden blocks and other cushioning material under the track rails, ballasting the track, etc., but more has undoubtedly been accomplished by strict attention to keeping the wheels absolutely round, and by careful attention to having the other parts of the car equipment, such as brake chains and shoes, kept tight, so they do not clatter, than in any other way.

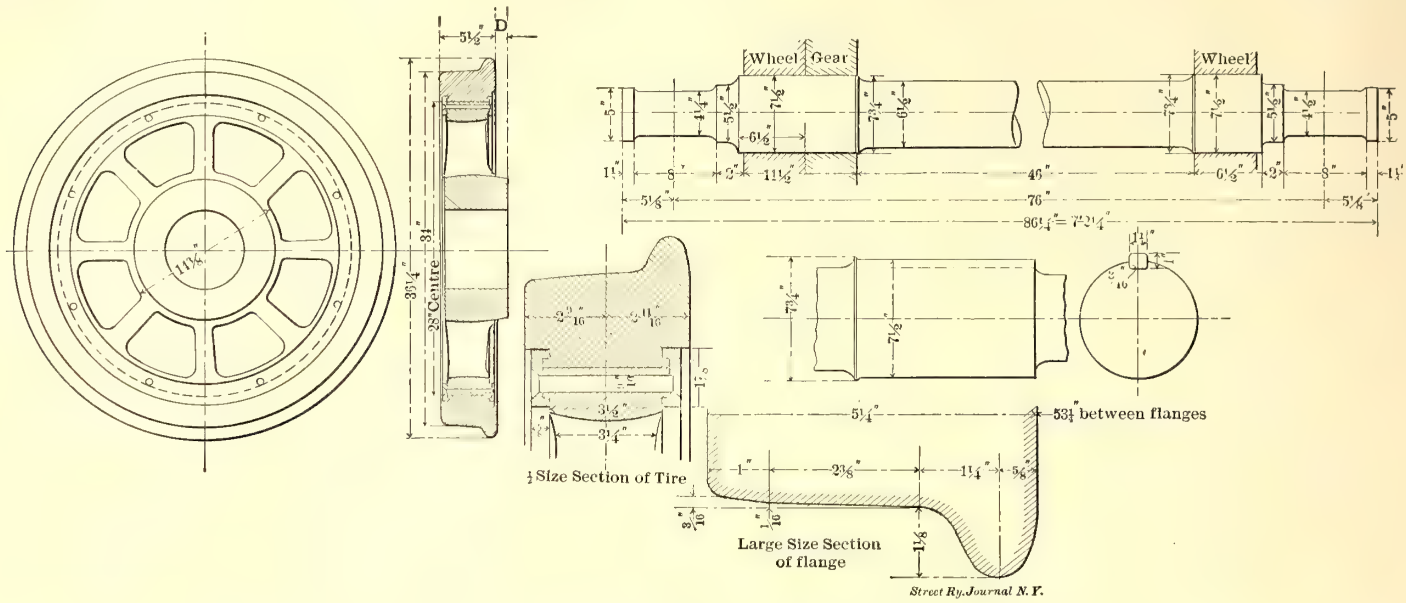


FIG. 1.—DETAIL OF STEEL-TIRED MOTOR WHEEL, BOSTON ELEVATED RAILWAY CARS

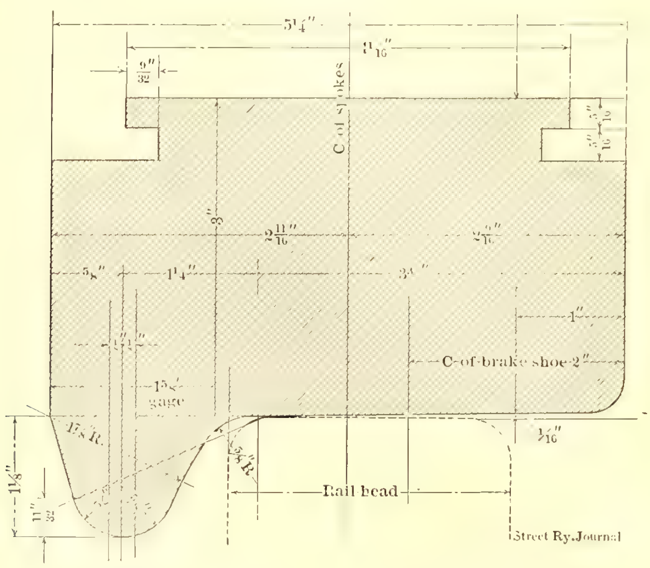


FIG. 2.—SECTION OF MOTOR WHEEL STEEL TIRE

To keep the wheels absolutely round they are ground down regularly every two weeks and are also turned down every three months. Steel-tired wheels, as shown in Fig. 1, are used. An enlarged section of the tire itself is given in Fig. 2. The tires are open hearth and crucible steel from various manufacturers, among them the Midvale and Latrobe Steel Companies, and Krupp, of Essen, Germany.

The work of changing wheels is carried out at the Sullivan Square car house, and the wheels on about twelve cars are changed each day. In doing this the company has adopted the policy of keeping spare trucks and not spare cars, and the pro-

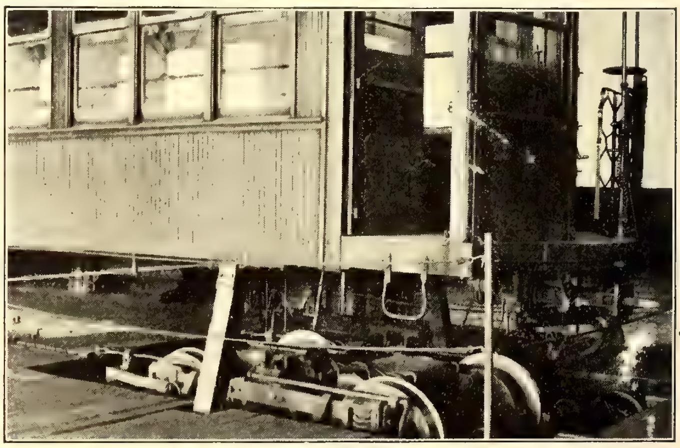


FIG. 3.—ELEVATOR BEING LOWERED WITH TRUCK ON IT, CAR SUPPORTED OVER OPENING

FIG. 4.—CAR SUPPORTED OVER ELEVATOR OPENING, WAITING FOR NEW TRUCK

cess of changing the trucks on a car has been carefully worked out and requires a minimum of time.

The Sullivan Square car house is in two floors. All the storage and repair tracks for the elevated cars are on the upper floor, which is on a level with the elevated structure. The repair shop proper is directly below, on the ground floor. In changing trucks the car is first run in over an elevator in the floor, which is raised slightly after the truck is run upon it, as shown in Fig. 5. Braces are then slipped under the truss plates at the end of the car to support the end of the car in position. The elevator is then lowered to the ground floor, carrying the truck with it, while the car body remains supported over the opening. Views showing the appearance of the car on the car house floor are given in Figs. 3 and 4, while Fig. 6 shows the descending truck as it appears from the ground or repair shop floor.

Upon reaching the repair shop floor the truck is pushed on to the turn-table shown, and taken to any part of the floor desired. A finished truck stands ready on the track at the other side of the elevator, and is moved to position on the latter. The elevator then returns to the car storage floor, the truck is slipped into position, the car body braces are removed and the car, as far as that truck is concerned, is ready for service. The entire change takes less than 5 minutes.

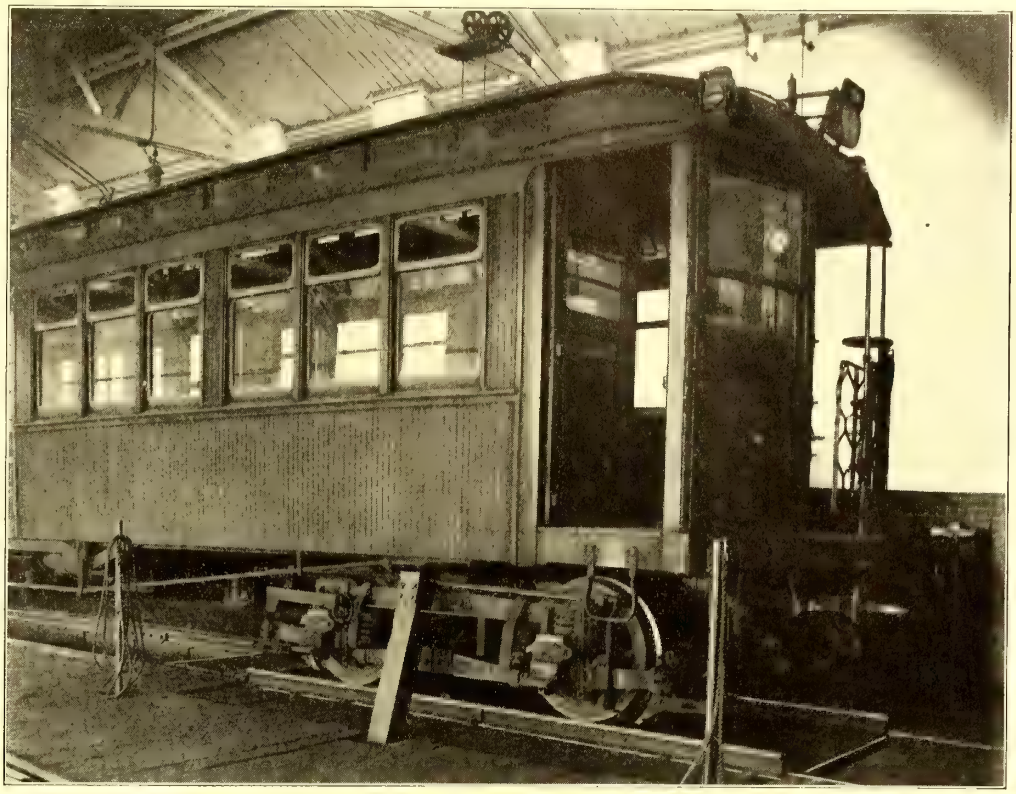


FIG. 5.—CAR, WITH TRUCK ON ELEVATOR, FIRST OPERATION, ELEVATOR RAISED SLIGHTLY TO INSERT BRACES FOR HOLDING BODY

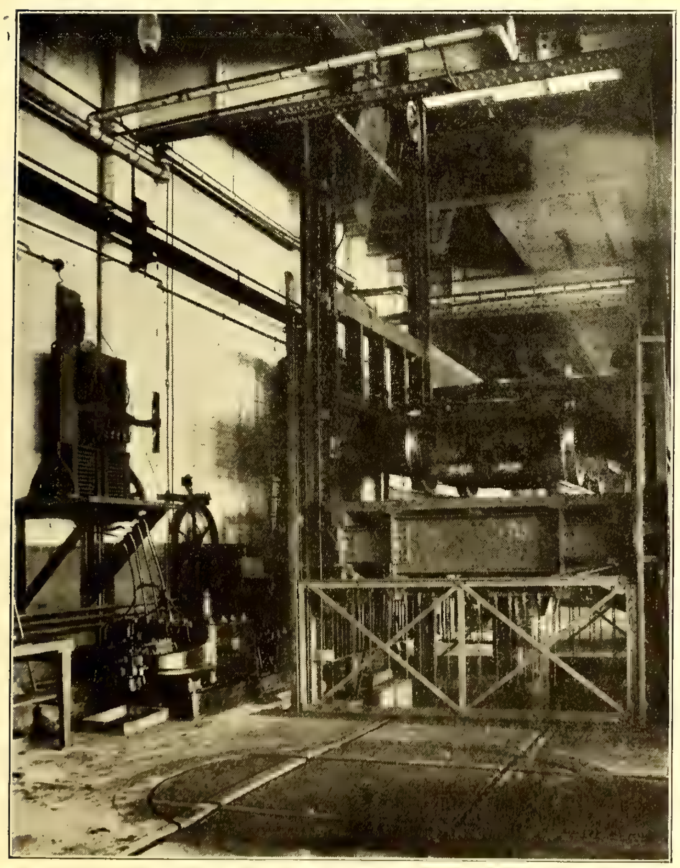


FIG. 6.—TRUCK ELEVATOR FROM REPAIR ROOM FLOOR, WITH TRUCK PART WAY DOWN

The cars in the car house and the trucks on the repair shop floor are moved by means of their electric motors. As it was not considered wise to employ the third-rail system in the car house, an ingenious form of flexible overhead contact has been arranged. It consists of a loose, flexible contact attached to an over-running trolley carried on an overhead conductor. The end of this connection is bare and in the form of a hook, so that it can be placed against the bare shoe support. To protect the workmen from accidental contact with the bare end, or the live end, of the wire, a wooden cylindrical shield, as shown in Fig. 7, is used, which drops down over the bare wire at the end of the contact when not in use, and can be shoved back when desired so as to make the contact accessible. The overhead trolley wire is protected by a 300-amp. fuse, so that any possible short circuit in the car house would not be disastrous. In moving the trucks on the lower floor wall rheostats are used with flexible couplings to be attached to the No. 2 motor leads, so that the speed can be graded to any amount.

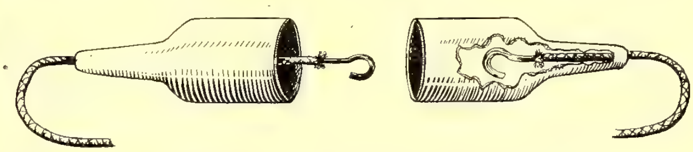


FIG. 7.—SHIELD FOR PROTECTING LIVE WIRE CONTACT USED FOR MOVING CARS IN CAR HOUSE

It will now be in order to describe the repairs to the wheels as they are made in the repair shop, which is on the ground floor of the Sullivan Square car house. When the trucks reach the shop floor, as described above, they are run off the elevator platform to one side or to the other, depending upon whether they are motor or trail trucks. If the former, the truck and motors are raised by a pneumatic hoist and the axle and wheels are run out and replaced with another pair. If the wheels are to be reground, they are taken to a gang of four Springfield grinders, where they are ground down about one-sixteenth of an inch in circumference. The wear on the elevated road is particularly on the tread of the wheel, and for this reason, as

stated, the wheels have to be turned down about once in three months to reduce the flange to the proper section. The lathe used for this purpose is shown in Fig. 8, and is arranged for turning down two tires at once, with two tools on each side. The wheels are brought to the lathe on the special truck shown in the foreground, and as the lathe is driven by gearing the gear is made with a section which can be lifted out and replaced in order to insert the axle and wheels in the lathe. As shown in the engraving the gear case is raised to show the sectional gear and the removable section is shown in the foreground.

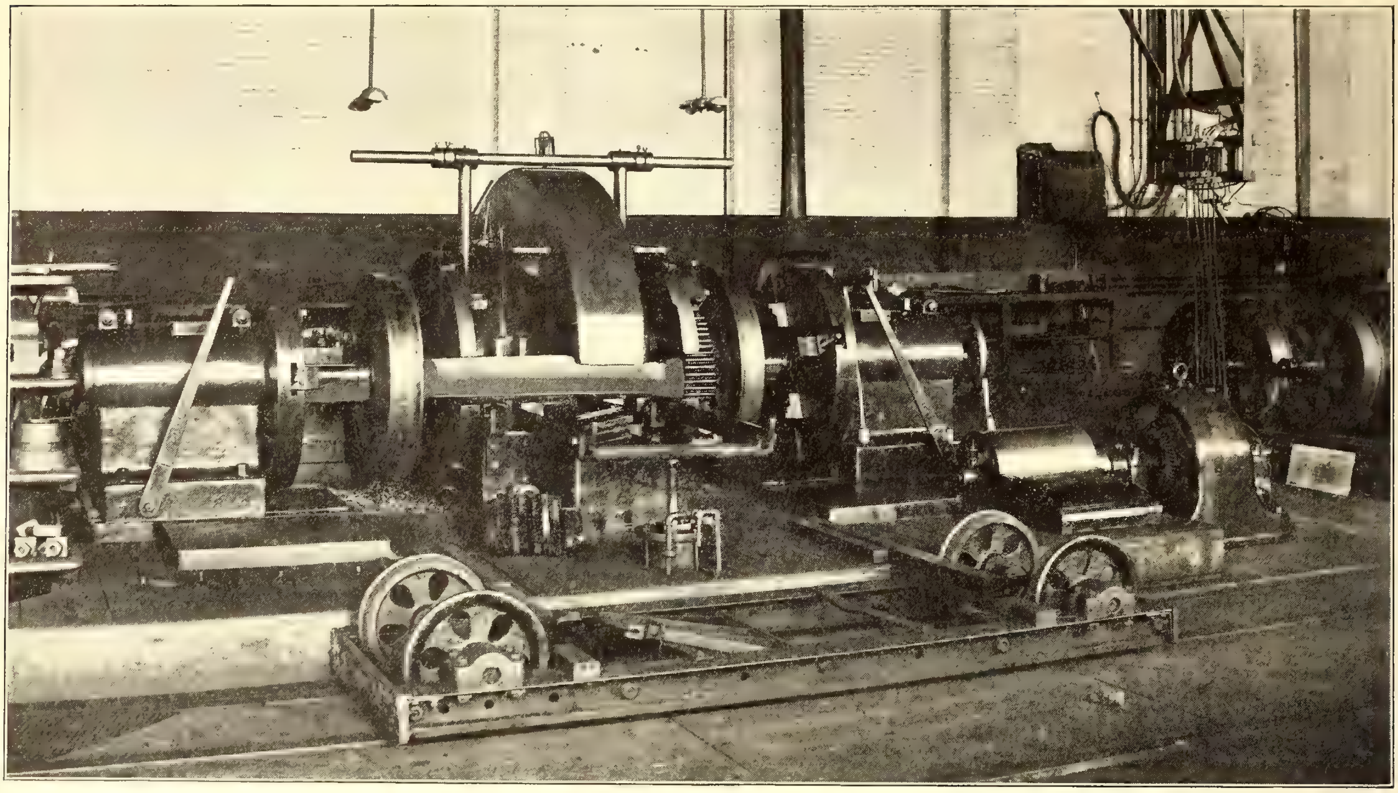


FIG 8.—WHEEL LATHE WITH SECTIONAL GEAR, SHOWN WITH GEAR CASE RAISED

Two sizes of wheels are used, a 33-in. and a 31-in. wheel. The former is allowed to wear down to 30½ ins. in diameter, and the other to 28 ins. in diameter before being re-tired. From two to three years are usually required to wear out a wheel in the tread. Owing to the difference in diameters of partially worn wheels, it is, of course, essential for good electric motor operation to exercise great care in mating the wheels on the same axles, and to a certain extent those on the same motor truck. The maximum difference permitted under ordinary conditions for wheels on the same axle in a motor truck is ⅛ in. in circumference, while the difference between the wheels on two axles may be ½ in. in circumference.

When a wheel is re-tired the usual way of loosening the tire by heating it is employed. After knocking out the rivets which hold the retaining rings together, see Fig. 1, the wheel is swung over the gas burner, shown at the side of the elevator in Fig. 6 and also in Fig. 9. The tire is then knocked off. A new tire, which has been carefully bored out on the tire lathe, shown in Fig. 9, is then heated and slipped on to the old center. The tire is bored to .001 in., and is .031 in. smaller in diameter than the center. A pneumatic hammer is used to knock out the tire rivets.

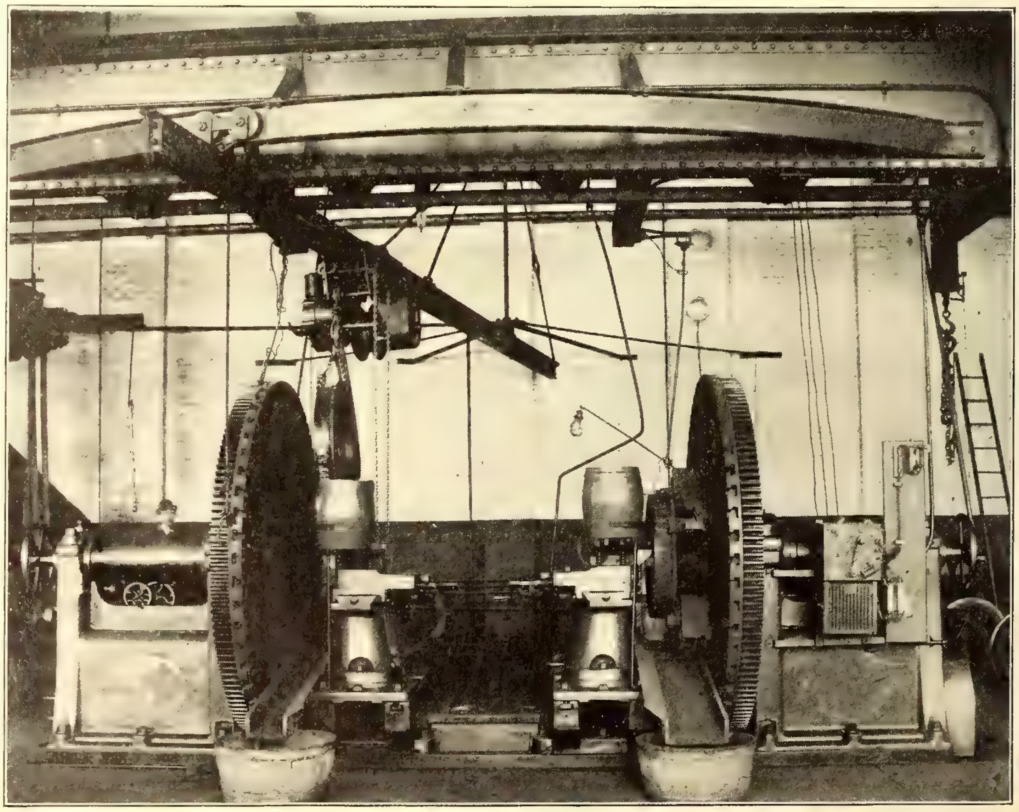


FIG. 9.—RADIAL CRANE TIRE LATHE FOR BORING TIRES, AND GAS HEATER FOR PLACING THEM ON HUBS

Open-hearth cold-rolled steel axles with solid gears pressed

on and keyed to the shaft are used, as shown in Fig. 1. All axles before being used are tested in the machine shown in Fig. 10. The axle is first laid in the straps which extend over each end, and a pressure of 25 tons is applied from below in the center of the axle, and the deflection is recorded by means of the gage illustrated. This pressure should spring the axle about ¼ in. If the axle does not come back to the zero point a permanent deflection is shown, and the axle is rejected. The company not only tests new axles in this way but tests all axles by this process once every two months.

JOURNAL WEAR

On account of the large number of curves on the Boston Elevated lines it is found that the ends of the journal brasses as well as the journals themselves wear very fast, but the company has adopted a plan of renewing the end of the axle.

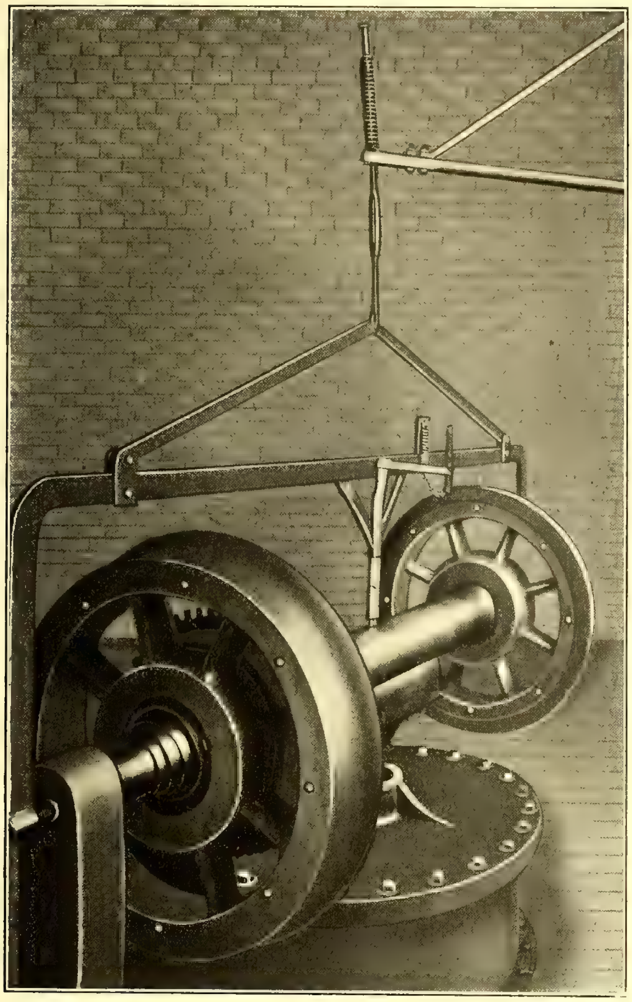


FIG. 10.—AXLE TESTING MACHINE

When the button is sufficiently worn as to require replacing, it is turned off and the journal is turned down. A new button fitted with a thread is then screwed on, being first heated to ensure a perfect fit. A hole is then drilled at the line of division between the new end and the old axle, and a No. 38 screw, 1¼ ins. long, is put into the drilled hole. The top of the screw is then riveted over. This will hold on the new journal button until it is worn out. The wear on the journal, outside of the end wear, is trifling.

A peculiar suit against the Northern Ohio Traction & Light Company for $10,000 damages for alleged electrocution is now pending in the Common Pleas Court at Akron. The suit is brought by the estate of the late O. P. Wheeler. The claim is that Mr. Wheeler, who was connected with the Citizens' Savings Bank, was shocked to death in the bank's vault while turning on an electric light, because of defective wire insulation.

RESULT OF THROUGH SERVICE BETWEEN CLEVELAND AND TOLEDO

In a recent issue of the STREET RAILWAY JOURNAL a table was presented, showing the extent of the through business between Cleveland and Toledo secured by the Lake Shore Electric Railway during the past year. The company has just compiled some additional figures showing the total number of passengers carried for each month of 1903, and the average fare paid by each passenger. It will be noticed that in January, 1903, the number of passengers was 166,467, and that the average fare paid was $0.189, while in August nearly twice as many passengers were carried, and they paid an average of $0.238. The average per passenger increased steadily, due largely to the increased through traffic. Here is the table:

1903	Passengers	Average Fare
January	166,467	$0.189
February	157,880	.186
March	203,843	.187
April	202,613	.190
May	238.622	.200
June	228,986	.214
July	275,007	.223
August	304,701	.238
September	254,027	.236
October	229,123	.230
November	194,105	.229
December	194,469	.228

Average per passenger for 1903, $0.217.

President Bicknell has also prepared a statement showing the earnings of the limited cars on the Lake Shore Electric. For October the westbound limited earned an average of $0.2893 per car mile, while the eastbound limited earned an average of $0.351 per car mile. The average for all limited cars for October was $0.3201 per car mile, while the general average of all cars on the Cleveland & Toledo division, including the limited cars, was $0.2349 per car mile, showing an increase of limited earnings over general average of $0.0852 per car mile, or an increase of 36 per cent.

The showing in November was even better than in October. The average earnings of all limited cars during November was $0.3495 per car mile, while the general average for all cars on the Cleveland & Toledo division was $0.2225, showing an increase of earnings for the limited cars over general average of $0.127, or an increase of 57 per cent.

December made a still better gain, and on some runs the earnings exceeded $1 per car mile. Mr. Bicknell expects the earnings of the limited cars to show still greater car mile earnings during the present year.

PACIFIC ELECTRIC RAILWAY COMPANY TENDERS RECEPTION TO ITS EMPLOYEES

Employees of the Pacific Electric Railway Company, of Los Angeles, were tendered a most enjoyable reception, Wednesday evening, March 9, by the management of the company. The employees took the occasion to present the retiring superintendent of the Northern division, W. H. Smith, a gift of a complete cabinet of sterling silver. An elaborate collation was served in the Dutch dining room.

When the Grand Rapids, Grand Haven & Muskegon Railway was built the prediction was made that a 40-mile third-rail line would be a failure in the severe weather to which Michigan is accustomed in winter. However, the road has been operated with less trouble than anticipated, and in several severe storms proved more efficient than some of the trolley lines operating under like conditions.

ORGANIZATION AND OPERATING FEATURES OF THE PACIFIC ELECTRIC RAILWAY COMPANY'S SYSTEM

Many of the operating features of the Pacific Electric Railway Company, of Los Angeles, are of interest and will be treated in detail. For the operation of the city and interurban cars the system is divided into four divisions, each in charge of a superintendent, who reports directly to the general manager of the company. These divisions are respectively the Los Angeles division, handling the four city lines in Los Angeles; the Southern division, operating the Long Beach, Whittier and Ascot Park lines, and the local cars in Long Beach; the Northern division, operating the Pasadena, Monrovia and San Gabriel lines, as well as the local cars in Pasadena; and the Mt. Lowe division, which handles the Mt. Lowe cars to Rubio Canyon and the cable and electric cars above that point. The superintendent of the Mt. Lowe division is also manager of Ye Alpine Tavern on Mt. Lowe. The Northern and Southern are the largest divisions, and together they regularly operate 332 cars out of and 333 cars into Los Angeles daily.

HIRING AND INSTRUCTING MEN

As to operating and handling of the men, the methods of the different superintendents are in general similar, differing only in details. Each superintendent has full charge of the hiring and discharging of the men on his lines.

On the Los Angeles division the men are first sent to the chief surgeon for examination, and, in the case of a motorman, is put a week in the shop to learn about the motors, controllers, air brakes and other equipment of a car. Then he spends a week, or until such time as he is proficient in handling a car, on one of the city lines in charge of an old employee. When he has mastered that line he is given one run on each of the other lines, so as to become acquainted with the route, the location of circuit breakers, etc. He is then given a rigid oral examination by the superintendent, and, if successful, is put on the extra list.

On the Southern division the superintendent, after selecting his men, by their general appearance and his impression of them, puts them on a run in charge of a regular man for instruction. If a motorman, he stays about ten days, or until he becomes familiar with the controller and the method of handling the car, and learns the location of fuses, light switches, etc., as well as how to make repairs to the car on the road, that is, so far as a motorman can make repairs. Then he is sent to the foreman of the car repair shop, with instructions that he educate the applicant in the construction and operation of the motors, controllers, brakes, etc. This shop instruction usually takes two days, after which he is required to pass a severe oral examination, and is then put on the extra list. No printed form is used, as the man would be apt gradually to get acquainted with the questions.

Similar methods are used on the Northern division in hiring men. After a man passes the physical examination he is given a copy of "The Motorman and His Duties," which is quite generally used by all the superintendents, and is then required to spend three days in the car house tracing the wiring and familiarizing himself with the car equipment. He is then put on one of the lines, generally the Pasadena Short Line, for about eight days, and is reported to the trainmaster at the end of that time by the regular man, with a written statement as to his competency. Then he is put on the main Pasadena line for two or three days, and for about the same length of time on the Monrovia, San Gabriel and Pasadena local lines, so that he becomes thoroughly familiar with the entire division. It is usually necessary for the applicant to spend about thirty days in this manner on his own time. He is then thoroughly examined by the trainmaster on the usual points, and also on proper procedure in case of wreck or emergencies, and is put on the extra list.

Until recently all trainmen were required to deposit $25 with the company when they entered its employ as extra or regular men. That system has now been abolished, and in its place one adopted that has been in successful use by the Los Angeles Railway Company. By it all men are required to give a bond with a surety company. This bond is for $500, and costs $5, the employee and the railway company dividing the cost. The surety company, through its staff, looks up the record of the applicant, and, if satisfactory, he is hired. When a man first applies he is put to work, the bond company guaranteeing his record until they have completed their investigation. By this method the company is spared the bookkeeping expense that was necessary to keep account of the deposits, and is also freed from the trouble of investigating the records of the men.

OFFENSES AND PENALTIES

No merit or demerit systems are at present in use on the system, the record of each man being largely a matter of personal judgment on the part of the superintendents. The Brown system was used on one of the divisions for a time, but was abolished, as it was not regarded as satisfactory. For offenses the men are laid off, and this method proves very effective. If the offense is serious enough, or if it is a lesser one committed by a previous offender, the man is generally discharged. In case of small accidents, due to carelessness of the motorman, such as the smashing of the end of the car, one of the superintendents has found it advisable occasionally to give the man the choice of being discharged or of paying the cost of the damage. When such an occasion arises the man invariably pays, thus lessening the cost to the company as well as giving the man a severe lesson.

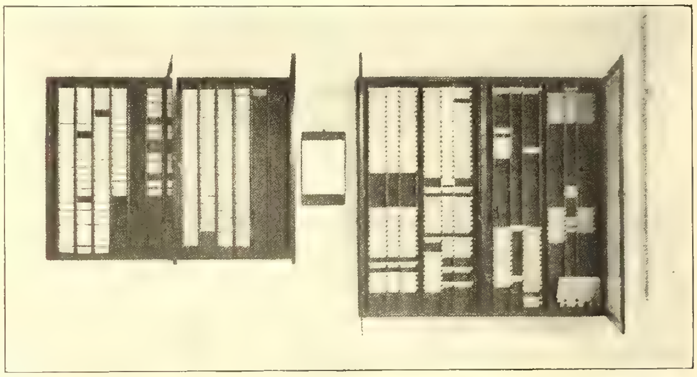


FIG. 1.—RACKS WITH CARDS SHOWING ORDER OF RUNS AND SENIORITY OF EMPLOYEES IN SUPERINTENDENT'S OFFICE

On one of the divisions, for violation of the rules a bulletin is posted giving the particulars without the name of the man. When a man is discharged his name is posted. On the other divisions it is thought that the fact of a man being given a lay off is sufficient notice to his fellow workers that he has committed an offense. The men all have printed books of rules, and they are required to be uniformly polite and courteous to passengers as well as proficient in the handling of the car. The men are closely watched by the superintendents and inspectors for infringements of the rules, and frequently regular trainmen in the employ of the company serve as "spotters" or secret inspectors, unknown to the other employees. Records are kept of all discharged men, and frequently the company is asked to give information to other companies to which the men apply for work. It may be said, to the credit of the Los Angeles railway companies, that their trainmen are generally courteous and above the average of intelligence.

SENIORITY RACKS AND RUNNING BOARDS

In the office of each superintendent are maintained two boards, or frames, one for indicating the seniority of the men, and the other the order of runs. The two boards in the Pasa-

dena car house are shown in Fig. 1, the seniority board being at the left. These racks are very similar to those used in Camden for giving the order of the extras, described in the Street Railway Journal for Dec. 3, 1903. They have vertical wood strips, spaced about 2 ins. or 3 ins. apart, to suit the lengths of the cars used, and have oblique slots in which the cards are inserted. Glass doors, which lock, permit the boards to be viewed by the trainmen. Half of the seniority board shown is devoted to the conductors and the other half to the motormen. A card is filled out for each man and bears his name, number and date of employment. Each space is numbered, so that the relative rank of a man may be instantly determined. On one of the other seniority racks the longest dimension is the vertical one, and two are used for conductors and two for motormen, the former having white cards and the latter blue. As was mentioned in the Street Railway Journal some time ago, the company recently averted the unionizing of the trainmen, and, for their loyalty to the company, the men were advanced two years in seniority. This is shown on the cards by setting back the date of their employment two years from the time of actual employment. Suspensions for offenses do not affect the seniority of the men.

The running board is made up from the seniority rack, the oldest motorman being given the first choice, then oldest conductor, then the next oldest motorman and conductor and so on. This choice of runs, or "shake up," as it is called, occurs every three months on the city division. On the interurban divisions it is made every six months, or when new lines are opened, or runs changed so as to alter their desirability. Desirable special runs, such as trolley parties and observation cars, are always given to the oldest men. This running board is made up every afternoon for the following day, the changes being necessary on account of lay offs, discharges, extras, etc. At the top of the center space is placed a card with the name of the line and below on the small cards are given the number of the run, the time run, the time off and the total time of the run. At the left are placed the cards of the conductors who

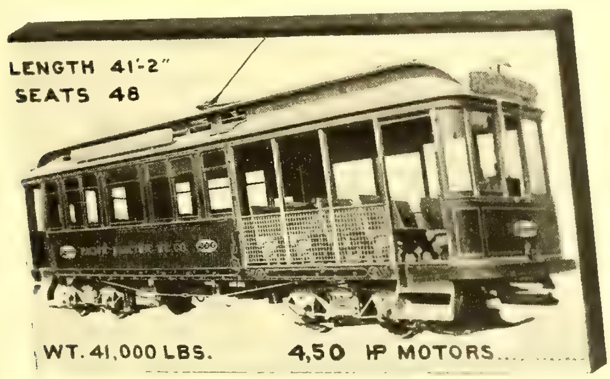


FIG. 3.—CARD RECORD BLOCK

have chosen those runs, and at the right the cards of the motormen. On one of the boards red cards are used to designate extra men.

CREWS AND EXTRAS

On the Southern division there are employed about forty regular men and twenty extras, and on the Northern division there are sixty-nine regular crews and about forty extra men. The extra lists are kept as low as possible, but on account of the frequent excursions the company is required to keep a large proportion of extra men. The extra runs are given to the extra men in rotation, so that they all receive a fair share of the work. When there is a vacancy in the regular list the senior extra man is promoted to the vacancy. Two or three crews are required to report at each of the car houses the first thing every morning, so as to cover all the runs. Arrangements are made so that all extras can be reached by telephone, and certain crews report by telephone during the day.

Bulletins for the trainmen are posted in all the car houses, and copies are sent to the general manager's office. In cases where crews live at terminal points bulletins are also posted there. On the Southern division each man is required to sign every bulletin affecting him, and these signatures are checked up every week.

WAGES

The prevailing wages on all the lines of the Pacific Electric Railway Company are 22 cents an hour for extra men, 22½

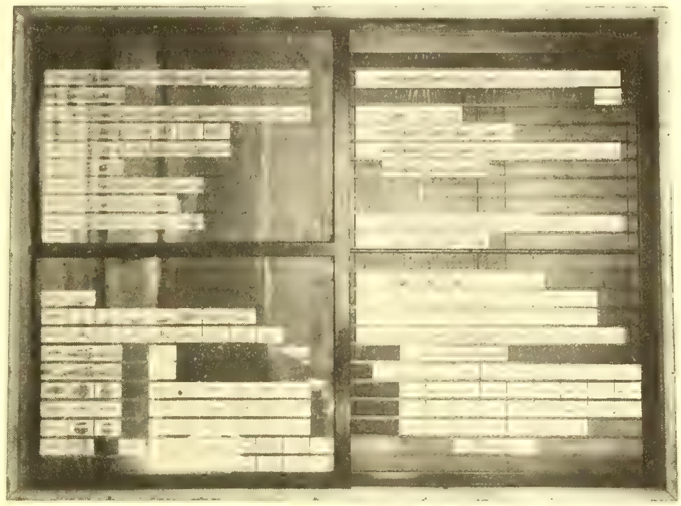


FIG. 2.—CAR EQUIPMENT RECORD CASE IN GENERAL MANAGER'S OFFICE

cents for regular employees, 23½ cents after five years, 24½ cents after ten years, and 25½ cents after fifteen years. The men generally work about 10½ hours a day, that time being preferred. The company gives the men no premiums except in exceptional cases, as has already been cited in the instance of their being advanced in seniority for loyalty during labor troubles. On the Northern division the busiest time of the year comes during the Christmas week and on New Year's Day, when the annual Tournament of Roses occurs at Pasadena. If the men succeed in handling their cars during this period without accident, as they generally do, they are given a large ball at Pasadena, Echo Mountain or other suitable point. The men are required to buy their own clothes, but the company purchases their caps and sells them to the men at cost. These caps are distinguished from those on the other Los Angeles lines by having white duck covers.

SCHEDULES AND TIME-TABLES

Elaborate schedules and time-tables are necessarily required for such a large system. For the Los Angeles division time-tables of each line, with running points, are posted in the car house, and each crew is required to copy down the schedule for its run. The superintendent and inspectors carry cards in their pockets on which are printed the time when cars should pass certain points on the lines, so that the crews may be checked up by the officials as happen to be in different parts of the city.

On the single-track interurban lines time schedules with meeting points are made out and given to the men. On the Whittier line the schedule is so arranged that, although the cars operate at nearly 60 m. p. h. they seldom have to wait over a minute at terminals. It is the intention of the company to have all its lines double-tracked, but they are sometimes opened up as single-track roads, and so operated until the construction work is completed. The Long Beach cars operate at a maximum speed of 60 m. p. h., and make the trip of 21 miles in the schedule time of 40 minutes. Morning and evening flyers cover the distance in 30 minutes, and make two railroad crossing stops and three street stops in Long Beach. The regular service to Long Beach is every 15 minutes, and to Whittier from 30 minutes to an hour.

For the lines of the Northern division the time-table shows the running time of 609 regular daily trains and contains upwards of 20,000 figures. Copies are posted at the car houses, despatcher's office and terminals. This time-table shows a service of from 7 minutes to 13 minutes on the Pasadena Short Line, a 15-minute service on the main Pasadena line, and half-

FIG. 4.—SCENE AT SHAM BATTLE

hourly service on the Monrovia and Alhambra lines. On the sheet are also printed several general instructions to the trainmen.

The company is well prepared to handle large crowds. On Sundays and holidays cars are put on to meet the demand, the Long Beach line frequently requiring cars 4 minutes apart. On such days from 16,000 to 18,000 people are often handled on that line, the record being 40,000 people for Long Beach. For

been devised by Joseph McMillan, chief clerk to the general manager, and is in use in his office. It consists of a wooden case, 71 ins. x 52 ins. in size, mounted on the wall, with sliding glass doors, as shown in Fig. 2. The case is divided into twenty-four horizontal rows or slots, in which are placed movable blocks to designate the different types of cars. These blocks are of wood, 3 ins. long, 1¾ ins. wide and ¼ in. thick. On each block is mounted an outline photograph of a car, as shown in Fig. 3, actual photographs of the different classes of rolling stock being used. On the margin of the block are printed the length of the car, the number of seats, weight, motor equipment, and any other descriptive information that is desired. For example, the block shown in Fig. 3 represents car No. 200 of the "200" type, such as runs on the Pasadena lines, and its description is as follows: Length, 41 ft. 2 ins.; seats forty-eight; weight, 41,000 lbs.; four 50-hp motors. For other cars of the same type the various car numbers are inserted by pen in the number spaces on front and sides of the car, which are purposely left blank.

One of these blocks is made up for every piece of rolling stock owned by the company, and they are arranged in the case after name blocks to represent on what lines they are used, whether they are "special" cars, such as maintenance of way and line tower cars, whether they are in the shops for repair, or "extras," "not in service," "freight," etc. The case is changed from day to day, in conformity with the information which is sent into the general manager's office by the division superintendents, mechanical superintendent and other officials. When the photograph, Fig. 2, was taken the case showed that twelve cars were in service on the Pasadena Short Line, thirteen standard cars, one combination mail and passenger car and two express cars on the Pasadena Main Line, and so on for all the lines; also that eight cars were in the shops, etc.

TRAFFIC DEPARTMENT

The company has a very well organized traffic and passenger department, the work of which embraces the regulation of fares, designing and issuing of tickets and transfers, handling

FIG. 5.—A CROWD OF 10,000 PEOPLE GATHERED NEAR LONG BEACH TO WITNESS A SHAM BATTLE—ALL RESULTS OF GOOD ADVERTISING

the Tournament of Roses at Pasadena last New Year's Day the company carried 57,000 people over its two Pasadena lines. As many as 80,000 passengers have been carried by the company on all its lines in one day.

CAR EQUIPMENT RECORDS

A novel and comprehensive method of keeping an accurate and up-to-date record of the car equipment of the company has

excursions, tourist parties and holiday crowds, the operation of the observation cars, and the necessary advertising for all these features. Los Angeles is a very popular tourist city, and one of the features that helps to give the traveling public a good impression of the city, as well as a comprehensive idea of the neighboring attractions, is the facilities which the electric railways offer to reach the different points. The traffic manager

of the Pacific Electric Railway Company is especially energetic in getting up excursions and special features. When a delegation from another city, or a party of any nature, visits Los Angeles, the leaders of the party are looked up or communicated with beforehand, and arrangements made for whatever trips they may desire—whether it be a trip to Pasadena and Mt. Lowe, a ride to the ocean on the Long Beach line, or a visit to San Gabriel Mission. The party is then taken in private cars, which are in charge of competent guides, to explain the scenic features, and all the time desired is spent at the different points. For these excursion trips the company makes low rates, which are from 10 per cent to 30 per cent lower than the regular fares. It figures, however, that a great many more are induced to go by having the party travel together, and another advantage is that the regular daily traffic is not congested. As examples of such parties which have visited Los Angeles lately and been thus taken care of by the traffic department of the company, may be mentioned the Chamber of Commerce delegations of San Jose and Oakland, with about 200 in each, and the party of Dr. John Alexander Dowie.

When the traffic manager has no special attraction on hand to offer the public, such as dances at Long Beach or snow on Mt. Lowe he endeavors to get up one on his own account, or assists others in arranging for special features at points on the

Distance Table No. 1

Pacific Electric Ry. Company

WHITTIER DIVISION, NOV. 1, 1903

FOR USE OF EMPLOYEES ONLY

EPES RANDOLPH
GEN'L MANAGER

STATIONS	Los Angeles	City Limits	Slauson	Dozier	Santa Fe Avenue	Pacific Boulevard	Miles	Fruitland	Bell's	Greening	Baker	Walker	Laguna	Gage	Rio Hondo	McCampbell	Rivera	Burke	Cuirado	Los Nietos	King	Eli	Sorensen	State School and City Limits	Whittier
Los Angeles																									
City Limits	4.25																								
Slauson	4.29	0.03																							
Dozier	4.73	0.48	0.45																						
Santa Fe Avenue	5.12	0.87	0.84	0.39																					
Pacific Boulevard	5.42	1.17	1.14	0.69	0.30																				
Miles	5.79	1.54	1.51	1.06	0.67	0.37																			
Fruitland	6.18	1.93	1.90	1.45	1.06	0.76	0.39																		
Bell's	6.73	2.48	2.45	2.00	1.61	1.31	0.94	0.55																	
Greening	7.26	3.01	2.98	2.53	2.14	1.84	1.47	1.08	0.53																
Baker	7.66	3.41	3.38	2.93	2.54	2.24	1.87	1.48	0.93	0.40															
Walker	8.44	4.19	4.16	3.71	3.32	3.02	2.65	2.26	1.71	1.18	0.78														
Laguna	10.07	5.82	5.79	5.34	4.95	4.65	4.28	3.89	3.34	2.81	2.41	1.63													
Gage	11.17	6.92	6.89	6.44	6.05	5.75	5.38	4.99	4.44	3.91	3.51	2.73	1.10												
Rio Hondo	11.40	7.15	7.12	6.67	6.28	5.98	5.61	5.22	4.67	4.14	3.74	2.96	1.33	0.23											
McCampbell	11.90	7.65	7.62	7.17	6.78	6.48	6.11	5.72	5.17	4.64	4.24	3.46	1.83	0.73	0.50										
Rivera	12.39	8.14	8.11	7.66	7.27	6.97	6.60	6.21	5.66	5.13	4.73	3.95	2.32	1.22	0.99	0.49									
Burke	12.86	8.61	8.58	8.13	7.74	7.44	7.07	6.68	6.13	5.60	5.20	4.42	2.79	1.69	1.46	0.96	0.47								
Cuirado	14.22	9.97	9.94	9.49	9.10	8.80	8.43	8.04	7.49	6.96	6.56	5.78	4.15	3.05	2.82	2.32	1.83	1.36							
Los Nietos	14.50	10.25	10.22	9.77	9.38	9.08	8.71	8.32	7.77	7.24	6.84	6.06	4.43	3.33	3.10	2.60	2.11	1.64	0.28						
King	14.79	10.54	10.51	10.06	9.67	9.37	9.00	8.61	8.06	7.53	7.13	6.35	4.72	3.62	3.39	2.89	2.40	1.93	0.57	0.29					
Eli	15.40	11.15	11.12	10.67	10.28	9.98	9.61	9.22	8.67	8.14	7.74	6.96	5.33	4.23	4.00	3.50	3.01	2.54	1.18	0.90	0.61				
Sorensen	15.93	11.68	11.65	11.20	10.81	10.51	10.14	9.75	9.20	8.67	8.27	7.49	5.86	4.76	4.53	4.03	3.54	3.07	1.71	1.43	1.14	0.53			
State School and City Limits	16.71	12.46	12.43	11.98	11.59	11.29	10.92	10.53	9.98	9.45	9.05	8.27	6.64	5.54	5.31	4.81	4.32	3.85	2.49	2.21	1.92	1.31	0.78		
Whittier	17.38	13.13	13.10	12.65	12.26	11.96	11.59	11.20	10.65	10.12	9.72	8.94	7.31	6.21	5.98	5.48	4.99	4.52	3.16	2.88	2.59	1.98	1.45	0.67	

FIG. 7.—DISTANCE TABLE USED ON WHITTIER DIVISION

lines. As one notable instance of what a little energy and judicious advertising will do to help pay dividends, may be mentioned a sham battle, given by the local companies of the California National Guard last January. H. F. Stewart, the traffic manager, personally arranged for this event. A site was selected near the ocean, that could be easily reached by two of the local Long Beach lines, and the land leased for the event. The troops were given their transportation, and the company also paid for the ammunition used and for other expenses. The sham battle was widely advertised in the local papers and by placards and hand bills. The result was, that on a spot where probably no more than thirty people had ever congregated before, there assembled a crowd of 10,000 people to witness the maneuvers, Fig. 5. As each passenger paid 50 cents for the round trip it can easily be realized that the event was a money-maker for the company, the expenses being comparatively small. It was on this occasion that one car was observed carrying 160 people inside and forty-three on the roof.

One successful feature that has recently been introduced by the traffic department is the operation of an observation car over some of the lines of the Northern division. The company's parlor car, "Poppy," is used for the purpose, the leaving time being 9:00 a. m. daily. Opportunity is allowed for visits to the Cawston ostrich farm and San Gabriel Mission, and, at Baldwin's Ranch, time is given for lunch and a drive through that magnificent property. The car returns to the city early in the afternoon, thus giving ample time for it to be rented out to private parties or for special excursions. A competent guide has charge of the car, and for the trip $1 is charged. It is seldom that this car does not net the company $40 or $50 a day.

A "Seeing Los Angeles" car is operated by the Los Angeles Railway Company over its lines, but the city lines of the Pacific Electric Railway in Pasadena do not afford as good an opportunity to see that city, so the Pasadena Board of Trade has made arrangements with the railway company to meet the Los Angeles cars with tally-hos and carriages for drives about

Pacific Electric Railway Company

EFFECTIVE JANUARY 1ST, 1904.

Rate Sheet No. 2--LONG BEACH DIVISION.

The rates named are for Single Trip Tickets, limited to date of sale (when sold by Conductor.)

Round Trip Tickets will be sold but will be limited to return passage 10 days from date of sale, viz.:

Where single trip fare is 10 cents, round trip will be 20 cents
Where single trip fare is 15 cents, round trip will be 25 cents.
Where single trip fare is 20 cents, round trip will be 35 cents.
Where single trip fare is 25 cents, round trip will be 40 cents
Where single trip fare is 30 cents, round trip will be 45 cents
Where single trip fare is 35 cents, round trip will be 50 cents.

Beyond city limits, children over 5 years and under 12 years of age, half regular fare, (but not less than 10 cents.)
Within city limits of Los Angeles and Long Beach, children over 5 years of age should be charged 5 cents.
Children under 5 years of age accompanied by parent or guardian will be carried free.
No single trip fare less than 10 cents (except within city limits) and no round trip less than 20 cents.

Epes Randolph
Gen'l Mgr.

MILES FROM LOS ANGELES	STATIONS	Los Angeles	City Limits	Fleming	Merrill Ave.	Florence Ave.	Nadeau St.	Graham	Latin	Watts	Abila	Hersom	Banning	Walton	Compton	Carson	Dominguez	Delamo	Cota	Los Cerritos	Willow	Earl St.	German	16th St.	14th St.	Anaheim Rd. (City Limits)	Long Beach
	Los Angeles																										
4.25	City Limits	5																									
4.51	Fleming	10	10																								
4.77	Merrill Ave.	10	10	10																							
5.27	Florence Ave.	10	10	10	10																						
5.78	Nadeau St.	10	10	10	10	10																					
6.28	Graham	10	10	10	10	10	10																				
6.75	Latin	15	15	15	10	10	10	10																			
7.45	Watts	20	20	20	20	15	10	10	10																		
8.36	Abila	20	20	20	20	15	15	10	10	10																	
9.10	Hersom	25	25	25	25	20	20	15	10	10	10																
9.39	Banning	25	25	25	25	20	20	15	10	10	10	10															
10.41	Walton	25	25	25	25	25	20	20	15	15	10	10	10														
10.92	Compton	25	25	25	25	25	20	20	15	15	10	10	10	10													
12.85	Carson	30	30	30	30	25	25	25	25	25	15	15	15	10	10												
13.31	Dominguez	30	30	30	30	25	25	25	25	25	15	15	15	10	10	10											
14.43	Delamo	35	35	35	35	35	35	30	30	25	25	20	20	15	15	10	10										
15.08	Cota	35	35	35	35	35	35	30	30	25	25	20	20	15	15	10	10	10									
16.17	Los Cerritos	35	35	35	35	35	35	30	30	25	25	25	25	20	20	10	10	10	10								
17.14	Willow	35	35	35	35	35	35	35	30	30	30	25	25	20	20	15	15	10	10	10							
18.23	Earl St.	35	35	35	35	35	35	35	30	30	30	30	30	25	25	25	20	20	20	10	10						
18.48	German	35	35	35	35	35	35	35	30	30	30	30	30	25	25	25	20	20	20	15	10	10					
18.79	16th St.	35	35	35	35	35	35	35	30	30	30	30	30	25	25	25	20	20	20	15	10	10	10				
19.02	14th St.	35	35	35	35	35	35	35	30	30	30	30	30	25	25	25	20	20	20	15	10	10	10	10			
19.11	Anaheim Rd. (City Limits)	35	35	35	35	35	35	35	30	30	30	30	30	25	25	25	20	20	20	15	10	10	10	10	10		
20.00	Long Beach	35	35	35	35	35	35	35	30	30	30	30	30	25	25	25	20	20	20	15	10	10	10	10	10		

FIG. 6.—RATE SHEET ON LONG BEACH DIVISION

the city, 75 cents being charged for the trip from Los Angeles. Similar observation trips are given, which include admission to the ostrich farm and stop-over in Pasadena.

FARES AND TICKETS

The passenger rates charged are fixed for all stations according to rate sheets supplied to ticket agents and conductors, and at present run up to 35 cents for a 21-mile ride. The rates vary from 1¼ cents to 2 cents a mile, and although they are just as high, or even higher, than the fares on the

ISSUED BY T-119
Pacific Electric Ry. Co.
Good for one Continuous Passage within one day from date stamped on back

FROM ....

TO ....

Epes Randolph
Gen'l Mgr.

ISSUED BY T-119
Pacific Electric Ry. Co.
Good for one Continuous Passage within one day from date stamped on back

FROM ....

TO ....

Epes Randolph
Gen'l Mgr.

FIG. 8.—STANDARD SKELETON TICKET FOR EXCURSIONS, STATIONS TO BE FILLED IN.

Auditor's Stub No.

Conductors must enclose this stub with trip sheet to auditor.

Not Good for Passage.

PACIFIC ELECTRIC RY. CO.

Good for One Continuous Passage
Between points indicated by punch marks, and only in direction indicated, subject to rules of the Company.

Void if sold as a One Way Ticket Epes Randolph
Gen'l Mgr.
T-41

Void after Ten Days from date of sale

Returning Coupon

DESTINATION				Fare Paid
Los Angeles	JAN.		1	10
City Limits	FEB.		2	15
So. Pasadena	MAR.		3	20
Pasadena	APR.		4	25
No. Pasadena	MAY		5	30
Altadena	JUNE		6	35
Dolgeville	JULY		7	40
Alhambra	AUG.		8	45
San Gabriel	SEPT.		9	50
Wilson Ave.	OCT.		10	55
El Molino	NOV.		11	60
San Marino	DEC.		12	65
Rose Ave.	25	17	13	70
Sunny Slope	26	18	14	
Santa Anita	27	19	15	
Arcadia	28	20	16	
Monrovia	29	21	North	South
	30	22		
	31	23		
		24		

No. ½ fare

FIG. 9.—CONDUCTORS' RETURN TICKET TOTAL AMOUNT IS REGISTERED, AND THIS IS GIVEN FOR RETURN TRIP

steam roads, the electric railway gets practically all the local business. The round-trip fares average about 1¼ cents a mile, the highest being 50 cents where a single fare is 35 cents. Rate sheets, such as shown in Fig. 6, are made out for each line, and conductors collect for single or round-trip fares according to these rates.

Mileage books of 500 miles are sold for $6.25, good on all lines except the Mt. Lowe division. These mileage books may also be used for the transportation of persons accompany-

ing the purchaser. For conductors' use in determining the distances between points for mileage, or for any form of ticket, distance tables are made up for each line, such as shown in Fig. 7. When a conductor collects for a round-trip fare on a

PACIFIC ELECTRIC RAILWAY COMPANY

______________190____

TO MEDICAL DEPARTMENT,
311-312 DOUGLAS BUILDING,
LOS ANGELES

The bearer______________is in the service of this Company and is entitled to medical and surgical treatment, except for sickness or injury resulting from vicious habits or contracted prior to entering the service.

DR. E. A. BRYANT, CHIEF SURGEON — Signature______________

DR. E. F. DILLON,
DR. H. G. CATES,
DR. G. L. HUTCHINSON,
ASSISTANT SURGEONS — Title______________

OFFICE HOURS: 10 TO 12 A. M. 2 TO 4 AND 7 TO 8 P. M.
SUNDAYS: 10 TO 12 A. M. ONLY

Form M-D3-1M. 8-03

FIG. 10.—ORDER BLANK USED IN HOSPITAL DEPARTMENT

car he rings up the total amount on the Ohmer recording fare register, and gives the passenger a return ticket, such as shown in Fig. 9, on which are punched the date, the fare paid, the direction of return trip and the destination. An auditor's stub, containing the same number as the ticket, is returned to the auditor by the conductor with his trip sheet.

The standard round-trip ticket sold is similar to that used on steam roads, and consists of two coupons. There are about ten varieties of this ticket, and the same ticket is used for half-fares with a large "½" printed on the face of the ticket in red. Fig. 8 is the standard skeleton ticket used for excursions and for passage to any way point from any ticket station.

CERTIFICATE OF EXAMINATION

______________190____

*Examination of*______________

AGE	NATIVITY	EMPLOYED AS	Applicant for Position as

VISION	HEARING
Right Eye = 20	Right Ear 60
Left Eye = 20	Left Ear 60

COLOR-SENSE

For Green	For Red
For Pink	For Blue

GENERAL CONDITION

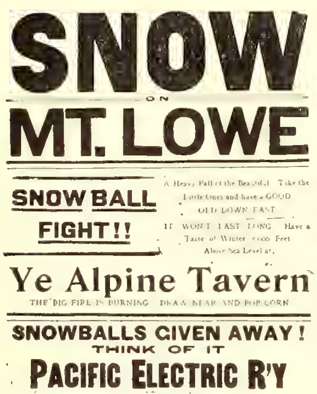
____

*Applicant is*______________*up to standard.*

THIS IS TO CERTIFY, That the above named party has this day presented himself for examination, under properly signed permit; that I have made such examination in a careful and thorough manner, and in accordance with Company's instructions; and that the information herein contained, so far as I have been able to discover from my examination and his replies to me, is correct.

______________*M. D., Examiner.*

FIG. 12.—CERTIFICATE OF EXAMINATION



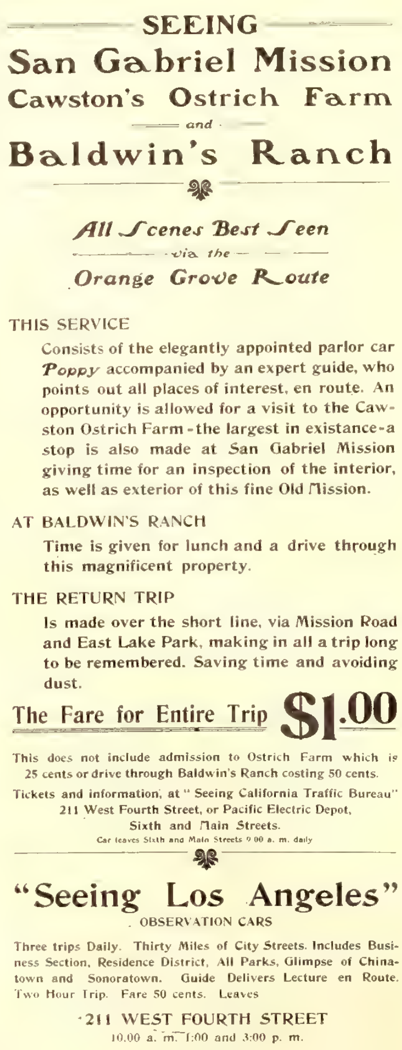


FIG. 11.—TYPICAL POSTERS FOR ADVERTISING SPECIAL TRIPS.

The traffic department believes in the value of advertising, and regular spaces are carried in the local papers and many of the Western magazines and guides. It also issues folders, descriptive of each line, a general guide to all its lines and several special booklets, time-tables, etc. Fig. 11 shows a collection of some of the large posters issued by the company. There are several tourist guides and pocket time-tables published by private parties, and the company's schedules are always published in these.

HOSPITAL DEPARTMENT

The company maintains a very well organized hospital department, which has under its supervision the medical attendance of all injured or ill employees, including hospital cases, examining all applicants for train service and the maintenance of "first aid" boxes in all power stations and sub-stations. The department is under the direction of a chief surgeon and three assistant surgeons. The same physicians have charge of the hospital departments of the other electric railway companies in Los Angeles, and there is a total of about 4000 men who have a right to their services. About 2100 of these men are employed by the Pacific Electric Railway Company.

When a man is entitled to medical and surgical treatment a surgeon's order blank, Fig. 10, is made out and signed by the foreman, superintendent or other official to whom he reports. This blank is delivered to the surgeon. The surgeon in charge of a case makes out an accident report for every case, and this is sent to the general manager's office, the surgeon keeping a duplicate. The surgeons also make a physical examination of all applicants for train service, examining the men especially as to their vision, hearing, color sense and general condition. A certificate of examination for each man is made out in duplicate on the blank, Fig. 12, the original being sent to the division superintendent.

FIG. 13.—HOSPITAL OR FIRST AID CASE INSTALLED IN STATIONS AND SUB-STATIONS OF PACIFIC ELECTRIC RAILWAY COMPANY

For the support of the hospital department the men are each required to pay to the company 50 cents a month, that sum being taken from their salaries. For this sum a man is entitled to medical and surgical treatment for all cases, except for sickness or injury resulting from vicious habits or contracted prior to entering the service. As a rule, the cases are treated at the employees' homes, but if serious, they are removed to a hospital, the best of attention being given in all instances. It has been found that the 50 cents a month from each employee just about pays the expenses of the department. When it exceeds the expenses the surplus goes into the fund, and when that is exhausted the company stands the extra expense.

One valuable feature of the hospital treatment is the maintenance in all the power houses and sub-stations of the company hospital, or first-aid boxes. These cases, as may be seen in Fig. 13, contain everything needed for giving first-aid treatment in case of electrical shock or burn or other accident, and in many instances limbs have been saved by the prompt use of the contents of these cases before a physician could be obtained or even called. The

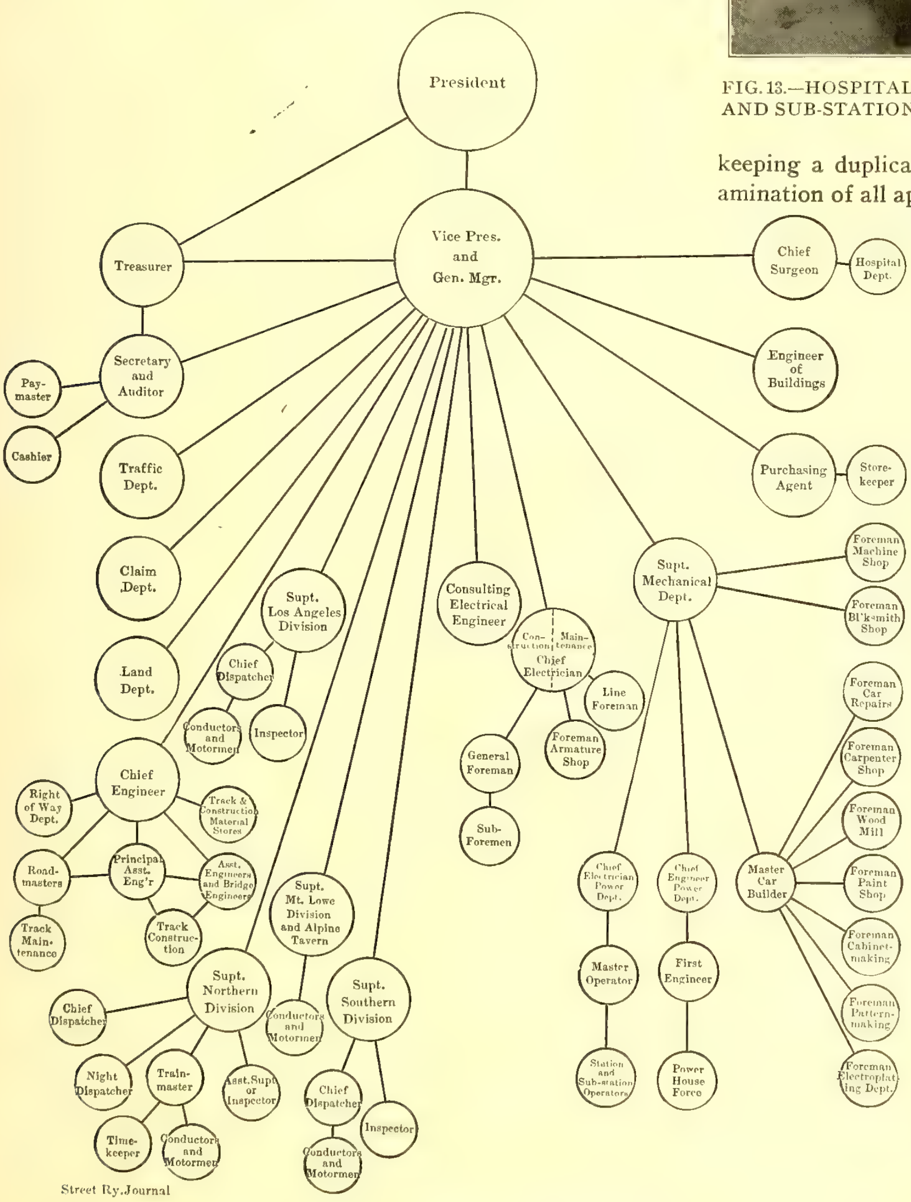


FIG. 14.—ORGANIZATION CHART

equipment of a standard case is as follows: Bottle of carron oil for burns, bottle of benzine, can of absorbent swab balls, wash basin, towel, box of absorbent cotton, tin box of lint handkerchiefs, jar of Linton moist gauze, bottle of vaseline, six packages of absorbent lint, twelve Linton gauze bandages of 1-in., 1½-in., 2-in. and 3-in. sizes, four black bandages, shears, tweezers, roll of adhesive tape and book of instructions. The cases are conveniently placed, and the sub-station operators are instructed in the use of the materials and in the treatment of different cases. Each station is also provided with a stretcher for use if necessary.

ORGANIZATION AND OFFICERS

For the operation of the different departments and the handling of the large force of men hired by the Pacific Electric Railway Company, a well-defined organization is necessary, and the accompanying tree, Fig. 14, illustrates this clearly. It is seen that all the executive duties of management are centered in the vice-president and general manager, who reports directly to the president. The treasurer reports to both officials. In the case of the chief electrician there is a division made, he reporting on construction work of overhead lines to the vice-president and general manager, and on maintenance of the overhead work and the electrical shops to the mechanical superintendent. The chief engineer is shown as reporting to the general manager, but in the instance of Mr. Pillsbury, the present incumbent of the position, he reports on new and preliminary construction work directly to Mr. Huntington, the president, and really acts as an adviser to the president. As this arrangement is really made for Mr. Pillsbury on account of his long and valuable experience rather than for the chief engineer as such, it is not shown on the tree. The position of consulting electrical engineer is somewhat different than the other officials, in that Mr. Masson, who occupies that position, maintains his own office force and staff of engineers, and does work for the other Huntington corporations and for outside parties. Under his supervision are placed the designing and construction of all electrical features. The land department is really a separate corporation, known as the Pacific Electric Land Company, which handles all lands purchased in building new lines, the railway company retaining ownership only of the right of way.

The following-named gentlemen constitute the present officers of the Pacific Electric Railway Company: President, Henry E. Huntington; vice-president and general manager, Epes Randolph; treasurer, I. W. Hellman; secretary and auditor, S. C. Baxter; land agent, George S. Patton; traffic manager, H. F. Stewart; purchasing agent, C. F. Brady; superintendent Northern division, J. B. Rowray; superintendent Southern division, F. Van Vranken; superintendent Los Angeles division, J. B. Rowray (temporarily); superintendent Mt. Lowe division and Alpine Tavern, J. F. Turner; chief engineer, George E. Pillsbury; consulting electrical engineer, R. S. Masson; superintendent mechanical department, William Jennings; chief electrician, S. H. Anderson; engineer of buildings, E. S. Cobb; chief surgeon, Dr. E. A. Bryant.

THE RIVER TUNNELS IN CHICAGO

The prospect that a bill may be passed by Congress ordering the lowering of the tunnels under the Chicago River, because they are at present obstructions to navigation, has brought to a head the question as to what should be done with these tunnels by the city in case the government should require them to be lowered to permit the deepening of the river. Some are in favor of abandoning the tunnels altogether for the present. If the tunnels are lowered the approaches will have to be moved back a block or more each side of the river to avoid too steep grade. Tunnels would prove valuable adjuncts to a system of underground street railway subways in the downtown district, and this solution may be finally adopted.

THE STANDARDIZATION OF EQUIPMENTS

BY C. E. FLYNN

Many of the smaller roads that began operating electrically about 1890 have found themselves, after a few years, with a miscellaneous equipment, purchased to take care of increased traffic at various times. Especially is this true of motor and truck equipments, any of which, while in fairly good operating condition at present, are practically obsolete or odd equipments, and repair parts when purchased are difficult to obtain. If purchased at all, the cost is excessive. The result is continuous annoyance and continually increasing operating expenses. The outcome is that the company, in order to keep its miscellaneous motors, etc., in some sort of operating condition, is compelled to manufacture its own repair parts, which means an increase in the shop force. But with all this, the odd or obsolete motors and trucks are generally in a crippled condition when needed most, on holidays, during the summer time, when travel is extremely heavy. Or, if they are not actually crippled they are sent out, and generally break down on the road, causing blockades and general financial loss to the company, to say nothing of the annoyance to passengers, who vent their feelings on the management in language of "high voltage and considerable quantity." When the cause of these odd equipments giving so much trouble is investigated it will generally be found that the shop superintendent is in the habit of keeping them as extras as far as possible, and when they get out of order, and the proper repair part is not to be had, he will use some makeshift substitute that is "good enough;" or, in case there is armature or field trouble, it will get a "lick and a promise" for something better—next time.

Now, it may be that the motors are not obsolete, but simply odd equipments purchased at different times. The trouble is, there are so many kinds. In fact, it is not uncommon to find a company operating, say, a thirty-car schedule that will have approximately forty double motor equipments, including, say, eight different types of motors of practically the same horsepower. Upon looking further, it will be found that, say, about five of the odd equipments are included in twelve of the forty car equipments, and that the remaining three types are in twenty-eight car equipments. Under such circumstances I have found it good practice to standardize equipments as much as possible, and this can be done at this time at a surprisingly small cost by exchanging the odd equipments for types corresponding to those used on the majority of the cars. This can be done through one of the many dealers in rebuilt equipments, or an exchange made with other roads. Supposing that the forty equipments are distributed as follows:

Type No.	1,	15	30-hp. equipment,	manufactured	by	A. B. & Co.
" "	2,	8	" "	"	"	C. D. & Co.
" "	3,	5	" "	"	"	E. F. & Co.
" "	4,	4	" "	"	"	G. H. & Co.
" "	5,	2	" "	"	"	I. J. & Co.
" "	6,	2	" "	"	"	K. L. & Co.
" "	7,	2	" "	"	"	M. N. & Co.
" "	8,	2	" "	"	"	O. P. & Co.

For the types numbered 4 to 8 inclusive there would be extra parts in the stock room approximately as follows:

5 armatures, approximate value	$125.00	$625.00
5 sets of armature coils, approximate value	25.00	125.00
5 sets of field coils, approximate value	80.00	400.00
5 commutators, approximate value	30.00	150.00
5 gears, approximate value	12.00	50.00
5 pinions, approximate value	3.00	15.00
5 sets brush-holders, approximate value	2.00	10.00
200 lbs. field wire, approximate value	.20	40.00
5 sets brass journal bearings, approximate value	5.00	25.00
Controller and miscellaneous parts		50.00

This is supposing that the smallest practicable stock of repair parts is carried for each type.

This $1,500 does not take into account loss of interest on the

stock investment, loss of car time, insurance, and the fact that repair parts and repairs on odd equipments are, as a matter of fact, never as well looked after in actual operation as if motors were confined to one or two standards. The same remarks apply to wheels, axles and truck parts.

There are many cases where an exchange of motor equipments with some other railway company can be made on an even basis, or when made with some second-hand supply house, motors corresponding to the majority already in use on the road can be obtained in exchange for something like $150 per double equipment. When this is done it is possible to make an immediate reduction in the number of repair parts kept in stock, which goes a long way toward paying for the cost of the change. In the case under discussion, the twelve odd equipments included in types 4 to 8 in the table would be exchanged for types 1 and 2, resulting in a general lowering of the maintenance of equipment account and a consequent increase in net earnings, to say nothing of the mental relief obtained by the management.

ACCIDENTS

BY LINCOLN NISSLEY

No explanations will excuse railroad accidents, for they are results of the same old cause, repeating themselves over and over. Some one is always at fault, and investigation always shows that the trouble might have been avoided. However, explanations are always demanded and the causes are carefully compared and weighed. The busy public always takes time to do this, but having linked the chain of circumstances together, the matter is dropped, with an idea that things are not as they ought to be, but with no knowledge of how they can be corrected.

Some people ask why laws are not made to cover these cases. A reply is seldom received, for it is known that all railroads have regulations in force intended to prevent accidents. If these rules and regulations fail after years of trial and adjustment by men whose every-day work makes them thoroughly acquainted with all the details that are affected by the rules, how can it be expected that State laws will better answer the purpose?

The constant repetition of accidents shows that the provisions made to prevent them are not sufficient, or that the regulations in force are not carried out, or that accidents are bound to occur. While it is true that there is always a sufficient cause for every accident, still, an imperfection almost unnoticeable, or a cause almost inconceivable, may make trouble, and sometimes most serious trouble, while at another time a very serious defect may not have any bad result. A case comes to mind of a trolley car, under full headway, being blown from the track—lifted so completely that the track was not injured in the least. Another, when the car left the track, on a sharp curve, the track remaining in good condition, the only conceivable cause being a spike or some obstruction on the outer rail causing the car to jump the track. On the other hand, at one point on a trestle a car broke all the bolts in a rail-joint, broke the joint tie, and broke the opposite rail across from the joint, and still the car was not derailed. How can it be expected that a defect like this—a broken tie on a trestle, supporting a rail-joint with the fastenings broken, the opposite rail also broken over the broken tie—should allow a car to pass over without causing a wreck? Instance after instance could be recited to show that the results are not in keeping with the apparent causes, and that it is impossible to prevent all accidents. How a better state of things can be produced will now be the subject for consideration, and naturally leads us into a broad field.

It is evident that of the vast mileage of urban and interurban electric roads built during the last few years in this country, the larger portion are second-class roads, and that many of them have to be operated with the least possible outlay, in order that they may be operated at all. It is not to be expected that this class of road will be as substantially built as the more favorable high-class lines operating many cars daily and serving a number of populous centers. Wooden or pile trestles, for instance, can be allowed on roads running only a few cars daily, these cars being light and run at a slow speed. It would not be justifiable to make use of such structures on an important line running many fast trains at a high speed. That there is and must be a different standard of construction and equipment on different classes of roads is certainly the case.

The fact that electric railways are fast being gathered into systems, with trunk lines already extending across some States, and auxiliary lines branching off almost to every town, is a matter of considerable promise. For, if honestly operated, a far better condition of roadway and equipment can be maintained than would be possible if each line was operated separately. Methods of work and standards of construction for the trunk line will be introduced on branch lines, as fast as the business of those lines will justify. In this way a standard of excellence is established and a progressive movement started—the two things most to be desired.

Accidents may be divided into three classes:

1. Defective Roadway.
2. Defective Equipment.
3. Inefficient Service.

Of the first class, the most serious accidents are probably connected with defective bridges. The faults of all the old-style bridges have been pointed out over and over. Although an improvement over the old wooden type used for the early electric car, they were not intended for the present heavy cars and increased loads. The factor of safety that was supposed to have been a known quantity is found to be very indefinite. All roads must know the weakness of their old bridges, and any amount of watching and care cannot make them absolutely safe. The timber structures are probably responsible for most trouble, as they are subject to very rapid decay. They should be closely watched by trackmen and roadmasters. Cattle guards, when constructed as "open guards," are liable to cause trouble, should a derailed car pass over an open guard where rails are spiked lengthwise on a stringer, without the use of ties, as the truck would certainly enter the pit and a wreck would follow. All cattle guards should have good sound ties, which should be securely fastened in place, so that if necessary they would stand the blows given by derailed truck wheels.

Broken rails are a source of many accidents, and this danger is one of the hardest to provide against. The writer has a record of over 100 steel rails that broke the last ten years, seventy broke within a foot of the end of the fastening, showing the weak place to be at that point. The precautions that should be taken are to have as strong joint fastenings as can be procured. The joint and shoulder ties should be sound and full spiked, to hold the rail as firmly as possible in case it does break; and good ballast is needed to secure properly tamped ties, thus preventing joints in a great measure from getting low.

Another weak point with the maintenance of rails is that the elevated rail on sharp curves keeps working over. The base of the rail on the outside cuts into the tie until the latter are rendered unsafe, while the timber is still sound. The inside base of the rail at the same time cuts the spikes until there is danger from the rail tipping over. Tie-plates are made which, if used, will prevent the rail tipping over by keeping it from cutting into the ties. One danger from frogs, guard rails and rails in crossings is that people get their feet caught in them. Blocking has sometimes been used to overcome this danger, but it soon decays or becomes loose, and is itself a source of danger. The accidents occuring at switches and frogs are numerous,

and are frequently the result of a split switch having previously been run through by a car or train damaging the switch. Some roads use a connecting rod with a spring attachment, but these are not safe at all times; for should snow or some obstruction clog the switch-rail the lever could still be sprung to place and fastened, leaving the switch-rails in a dangerous position. Connection rods could be made, however with a coil spring compressible by passing wheels, but so stiff that a person in handling a switch could not spring it.

Dangers to be classed with those of roadway, although having very little connection with it, are that of loaded teams crossing the track and of stock running at large on public highways, either of which if struck might derail the car or train. These are things over which the railway company has no control, and the only thing that can be done is to keep the wagon road next the track and over the rails in such a condition that teams will not get stuck and delayed while passing over the track. Quite similar to the case last mentioned is that of stock being struck on the track, not on public highway. In this case trouble can be traced to defective fences or from gates being left open. The law requiring all railroads to fence their so-called right of way is a police regulation, made to protect the traveling public from accidents that are liable to happen when stock is run over. Railroads are held liable for damages, as accidents of this kind are considered to be the result of a lack in complying with the law. But it is impossible for railroad companies to keep gates at farm crossings closed, and the land owners should be made responsible by law for all damages sustained on account of such gates being left open or insecurely fastened.

Passing to the second class of accidents, those connected with the rolling stock, the item that first presents itself is that which has received so much attention in the last few years, viz., trucks. Defective wheels are sometimes responsible for accidents. A case in hand is where a wheel in the motor car broke. The base of the wheel had a circle of flaws in the center of the tread that were plainly visible on each piece of the broken wheel, and there were a large number of the pieces. There have been some accidents from trucks not being properly "trammed"—one wheel crowded the rail until the flange became worn half off, and very sharp, the other wheel not showing any sign of wear on the flange. Such trucks are very liable to catch the point of a switch-rail or frog. Brake beams and shoes get down and catch under the wheels, derailing the car. Axles and wheels break, causing wrecks. Motor suspension bolts become loose, allowing the motor to drop. Gear cases are broken by obstructions on the track, and the broken pieces are caught in the gearing, causing wrecks and derailments. These defects, like the defective wooden structures in the track, require constant watching from all employees as well as from those who are directly in charge of them.

The third class of accidents covers those that are the hardest to prevent. A mistake on the part of almost any employee engaged in the work of maintenance of road or equipment, and particularly of those in the operation of the road, brings in an element of danger which, though small, may result in a serious disaster. Still, work is done day after day without a thought of the responsibility that attends it. From the trackman who fails to find the broken rail, to the train despatcher who gives a "lap order," the same fault almost always exists, viz., the lack of close application.

Trackmen may fail to examine their track after heavy rains, or report a bad trestle, because recently examined by an engineer. Superintendents may think a wooden structure will last another year, or until men are working in that vicinity. Car repairers may neglect to repair a car because it is not needed until the rush hour, when it goes out with the rest. Trainmen may leave a switch open, expecting to pass through again soon, but an "extra" reaches there first. Motormen follow close to another car or train, when the rule is to keep several minutes behind. These and many other slips that are made are all because of lack of close application.

The best service is obtained by carefully selecting men to do the work. There should be different grades, and promotion should be the reward for careful and thorough work. It often happens that trainmen, in order to get over the road quickly, or to make up lost time, will take risks that are known to be wrong. The fact that violations of this kind are not noticed unless they result in a wreck, leads men to think that while the rules should be observed, when there is known to be danger, they are impracticable for constant application; and knowing if bad results follow they will be met with the severest punishment, it becomes to them a matter of luck whether they get into difficulty or not.

Under this state of things, constantly neglecting small matters of precaution, men become familiar with danger and a condition of things the very opposite of what should be desired gradually comes about. Every time a regulation is violated the acute sense of responsibility is blunted, when, for the sake of all concerned, it should be constantly growing stronger. To this end all rules should tend; they certainly should be made applicable at all times, and the fact impressed that it is as serious a matter to violate a rule at one time as at another.

Electric railway management is a complicated problem. It is a great and growing industry; and, considering the difficulties to be overcome, is entitled to greater commendation. That the managements of our lines lay hold of improvements as fast as introduced shows that they recognize the importance of having everything in the best possible working order. Failures point out the way for improvement, and if their voice is listened to, and the lessons they teach is rightly obeyed a progressive state of systematic improvement in all departments will exist. With experience as a guide and a willing disposition to improve, what is now known to be an unsatisfactory state of things may be changed into one that will be highly commendable.

THE BENEFITS OF INTERURBAN ELECTRIC RAILWAYS TO SMALL CITIES

Under the above title John W. Fulwider, city engineer of Lebanon, Ind., in a paper recently read before the Indiana Engineering Society, at Indianapolis, outlined the many actual advantages enjoyed by his community as the result of the construction through it of an interurban railway. In his opinion there is nothing else in this decade that adds as much to the enjoyment and convenience of the people, and especially to that of the rural population and residents of small cities. While people of the great centers may profit greatly in a commercial sense, and because of the opportunity to get nearer nature with convenience there cannot be the vital effect on their condition that there is on that of the rural population.

It is especially with conditions as they exist in Lebanon, through which the Indianapolis & Northwestern is constructed, to which the writer referred. Before the construction of the line there was a fear that some business interests would be injured, but it has not proven so. While some has been lost, much more was gained. A livery man said that his business was much better than before the advent of the line. While it cut off many long drives it added many more short and more remunerative ones. The high school of the city has been greatly benefited by the advent of the interurban, on account of the increase of attendance from those living out of town. There is also a marked increase of church attendance from the rural districts. One of the advantages most appreciated by the business men and public is the freight service. If the merchant has a call for something he has not in stock he knows he can

get it in from two to three hours time from the city. The customer knows that he can depend upon it with practically an absolute certainty.

ELECTRIC RAILWAY TESTS AT ST. LOUIS

One of the most interesting and valuable features of the St. Louis Exposition, from a street railway standpoint, will be the elaborate series of tests which will be conducted at St. Louis, under the auspices of a special commission appointed by the Exposition authorities last year. In previous fairs of this kind comparison between electric railway apparatus could be made by inspection only as the appliances were shown in the exhibit. At the St. Louis Exposition, however, the tests described will determine not only the commercial value of the apparatus shown, but also, it is hoped, some interesting and valuable results of a scientific character will be derived, which could not well be obtained by any experiments conducted under private auspices.

The personnel of the Electric Railway Test Commission has already been announced in this paper, and consists of J. C. White, New York, chairman; H. H. Vreeland, New York; W. J. Wilgus, New York; James H. McGraw, New York; and George F. McCulloch, Indianapolis. A number of meetings have been held by the commission, and some of the results accomplished can now be announced.

On the grounds of the Exposition the authorities will provide special tracks, having an almost level grade and well ballasted, for the operation and testing of railway car and locomotive equipments. These special tracks consist of one section, 1400 ft. in length, and one section 2000 ft. in length, the two sections being parallel. Upon these tracks it is proposed to carry on the greater part of the operating, acceleration, braking, coasting and motor-heating tests, which will be described below, as well as tests to determine car and train friction. That the length of the tracks is adequate for the greater part of these tests is assured when it is remembered that for a given temperature the capacity in tons per motor is practically a fixed amount, and independent of the number of stops per mile. The number of stops made by an electric car will vary from a maximum of fifteen stops per mile in city practice to a minimum of about one stop in about 5 miles in local interurban practice. Five stops per mile is a very frequent figure, even in interurban work, whereas the test track facilities admit of a rate of operating equivalent to five stops in 2 miles.

The tests for determining the heating of electric railway motors in service under different conditions of gearing and schedule, etc., can be made by operating the car continuously over a given length of track as a shuttle train, first in one direction and then in the reverse direction. In this way conditions can be kept perfectly uniform, and wind resistance, to a great extent, eliminated. The effect of passengers can be obtained by a dead weight load upon the car, and variation in the behavior of the car under light and heavy loading investigated.

In addition to the capacity and acceleration tests already mentioned, it is thought that some valuable wind resistance tests can be conducted, and the importance of this subject will readily be admitted by all conversant with railway work. Most of the data now at hand has been developed largely through tests made upon steam railroads, and very little reliable information of even this kind is available, especially as to the effect of different shaped car ends on single or multiple-car operation. When such data is determined, as expected in St. Louis, it will be possible much more accurately to adapt railway car and train equipments to economic service on the roads for which they are designed than at present.

In case the tracks at the Exposition should not be of sufficient length to conduct these train resistance or some of the other tests proposed, it is possible that they may be carried on elsewhere, not far from St. Louis. If this should prove necessary, Commissioner McCulloch has offered the use of part of the track system of the Indiana Union Traction Company. This company has a number of long tangents, one of them 8 miles in length, laid with 80-lb. rail, level and well ballasted, which would be eminently suited for high-speed running.

In addition to the trials which will be conducted on these tracks, as detailed above, the commission will carry on a number of tests in the Electricity Building.

All of these tests will be supervised by some engineer of national reputation, to be selected later, and all instruments and appliances used in connection with them will be calibrated by the National Bureau of Standards. The latter bureau will erect in the Palace of Electricity a laboratory for this purpose, equipped with all appliances needed for the accurate standardization of all the instruments, meters, etc., required.

Before deciding upon the detailed tests to be made, the Test Commission appointed four engineering committees to draw up a series of recommendation of the various tests, which, in their opinion, would cover the main branches of electric railway work as at present developed. These committees were as follows:

ENGINEERING COMMITTEE ON TEST OF CITY AND SUBURBAN EQUIPMENTS

M. G. Starrett, chief engineer, New York City Railway Company.

D. F. Carver, chief engineer, Public Service Corporation of Jersey City.

W. S. Twining, chief engineer, Philadelphia Rapid Transit Company,

ENGINEERING COMMITTEE ON TEST OF INTERURBAN EQUIPMENTS

A. L. Drum, assistant general manager, Indiana Union Traction Company.

Charles Jones, chief engineer, Elgin, Aurora & Chicago Railway.

C. A. Alderman, chief engineer, Appleyard System, Springfield, Ohio.

ENGINEERING COMMITTEE ON TEST OF HEAVY TRACTION EQUIPMENTS

F. J. Sprague, New York City.

B. J. Arnold, New York City.

W. J. Wilgus, New York Central & Hudson River Railroad, New York City.

F. R. Slater, assistant engineer to L. B. Stillwell, New York City.

ENGINEERING COMMITTEE ON NEW ELECTRIC RAILWAY SYSTEMS

B. J. Arnold, New York City.

Paul M. Lincoln, Westinghouse Electric & Manufacturing Company, New York City.

W. B. Potter, General Electric Company, Schenectady, N. Y.

The following are briefly the tests which have been recommended by the first two of these committees, and which have tentatively been adopted by the commission. A digest of the tests in the departments of heavy traction equipments and new electric railway systems will be published in an early issue.

TESTS FOR CITY AND SUBURBAN EQUIPMENT

The tests on apparatus in the Electricity Building suggested are as follows:

(1) Tests of various kinds of electric railway motor equipments under constant load, regulated by brake, to determine rate of heating (a) of the armature, (b) of the field coils.

(2) Tests of electric railway motor equipments of the various kinds, to determine the motor efficiency under different fixed conditions of operation, including a varying number of stops per mile.

(3) Tests on motor equipments to determine their torque curves and accelerating power.

(4) Tests on electric railway motor equipments under constant loads, to determine the rheostatic losses corresponding to various lengths of time consumed in application of full-current strength.

(5) Tests on electric railway motor equipments to determine at what loads, speeds and frequency of stops it becomes economical to adopt automatic control in place of hand control for single cars.

(6) Tests of hand, automatic and multiple control systems to determine their relative economy, certainty and regularity of starting motor car equipments under fixed conditions of load and track.

(7) Tests of electric railway motor equipments to determine safe load during continuous operation, as compared with rated capacity of motors.

The tests on the experimental track are as follows:

(8) Tests to determine the relative values of two-motor and four-motor car equipments: (a) as to power consumption with fixed loads, and with varying loads; and (b) as to acceleration with both fixed and varying loads.

(9) Tests to determine the proper method of mounting a two-motor equipment on an eight-wheel two-truck car, viz., on which two of the four axles shall the motors be mounted?

(10) Acceleration tests on single cars and on motor car and trailer, showing rate of acceleration and power used with both hand and automatic control.

(11) Comparative tests on different types of power brakes, both electric and mechanical, in respect to efficiency and economy.

(12) Braking tests on single car and on motor car with trailer, under varying conditions, with both hand and power brakes.

(13) Tests on single car equipments to determine motor and truck friction at different speeds.

For tests on storage battery cars the following are recommended:

(14) Tests to determine the efficiency of batteries under maximum, average and varying loads; also

(15) Tests to determine life of batteries under average and adverse conditions of service.

TESTS FOR INTERURBAN EQUIPMENT

The tests on apparatus to be conducted in the Electricity Building for interurban equipment are largely the same as those recommended for city equipment. For the experimental tracks the committee has recommended a series of tests with various classes of cars and equipments, provided time will permit. If only one type of equipment is tested the committee suggests a car body weighing 16 tons to 20 tons, exclusive of trucks and motors, with a pair of trucks weighing 8 tons to 12 tons per pair and a standard four-motor equipment of 75-hp motors, equipped with different types of hand and train controlling apparatus.

The three points to which effort will chiefly be directed, in case facilities for conduction high-speed tests are available, are as follows:

(1) The relation between the average electrical losses in the motors and the rise in temperature attained under various conditions of high-speed service.

(2) The train resistance (or power required to propel a car or train at uniform speed) at very high speeds.

(3) The performance of cars equipped with controllers so arranged that the acceleration is automatic, as compared with the performance under similar conditions, where the rate of acceleration depends upon the handling of the controller by the motorman.

In the test on electrical losses an effort will be made to determine, of course, the average losses at different schedule speeds with a given rise in temperature and with different periods of stops and lay-overs.

The train resistance tests recommended are with single cars, and also with trains made up of different numbers of cars at various speeds, from 40 m. p. h. upwards, and measured in different ways, viz., by direct measurement of instantaneous power input when running at uniform speed, and by the coasting method.

In the test of control systems it is proposed to investigate not only the efficiency of different systems of control, but the effect of automatic acceleration on the power consumption, etc.

The Electric Railway Test Commission has already taken up the subject of the scope of these tests with the American Street Railway Association, and has been assured by the executive committee of the latter that the association considers these tests of great interest and value to street railway companies as a whole. To defray the expenses of the tests, which are estimated at about $10,000, a fund is being raised by voluntary contributions, and the different railway companies in the country will be asked for small contributions to the fund.

CONVENTION OF THE OHIO INTERURBAN RAILWAY ASSOCIATION

President Harrie P. Clegg, of the newly-organized Ohio Interurban Railway Association, has sent a letter to presidents, managers and operating officers of all electric railways in Ohio and Eastern Indiana, announcing the formation of the association. After reviewing the proceedings of the meeting of Feb. 29, which was reported in full in the STREET RAILWAY JOURNAL of March 12, President Clegg writes as follows:

It is undoubtedly apparent to you that there are many advantages which can be derived from such an association, if properly conducted and enthusiastically entered into by all of the roads. Your active co-operation is requested in this work, and it is hoped that we may enroll you, as well as the other officers of your road, as members of this association, so that your interest may be represented at a meeting which will be held at the Algonquin Hotel, Dayton, Ohio, on Thursday afternoon, March 31, at 2 p. m.

The enclosed circular gives a brief outline of the purposes and objects of this organization, together with a synopsis of the means which will be employed to carry out same.

This invitation is issued to you for the purpose of enlisting your interest in the matter, with the hope that you will see to it that your properties are properly and adequately represented in all departments of the organization.

An early response, together with an expression of your opinion as to the advantages of such an organization, will be duly appreciated.

The circular mentioned is as follows:

THE OHIO INTERURBAN RAILWAY ASSOCIATION

The object of this association shall be to promote knowledge on all matters relative to the construction and management of interurban railways and their equipment, which may be brought before the association for consideration and discussion, to promote, encourage and facilitate the interchange of traffic, and further social relations among its members.

Any person engaged in the construction, operation or maintenance of interurban railways, or persons of distinction in the interurban railway world, and any others whom the association may wish to honor, shall be eligible for active membership.

Subjects of an interesting and instructive nature will be arranged for discussion at the meetings of the association, and also for the presentation of suitable papers in conection with subjects for discussion.

The meetings will be held on the fourth Thursday of each month, at places designated by the executive committee.

The annual dues of the association will be $3, and will be payable at the time application blank is sent to the secretary, and within thirty days after the annual meeting thereafter. The association will be carried out upon the lines of the "New York" and "Pennsylvania" associations, and also the "New England Street Railway Club," which associations stand pre-eminent and are of considerable influence in the electric railway world at the present time. These associations have demonstrated and proven by years

of experience, the absolute necessity of organizations of this kind among the electric railway men, and it is sincerely hoped that all interurban railway officials will give this association their hearty support, that the "Ohio" association may stand at the head of similar associations, as the State stands to-day ahead of any other State in the equipment and extent of her interurban properties.

J. H. Merrill, of Lima, Ohio, secretary of the new association, and chairman of the committee appointed to decide on interchangeable mileage, states that at a meeting of this committee held last week certain agreements were prepared and will be recommended to the members of the Ohio Interurban Railway Association at the meeting to be held at Dayton, March 31. Companies interested in the interchangeable mileage plan and desiring to become parties to the agreement are requested to communicate with Mr. Merrill at the earliest possible date, because it is probable that at the meeting the committee will be instructed to proceed with the printing of the mileage books, and it is desirable to have as large a list as possible as parties to the first issue of the uniform mileage.

Mr. Merrill's committee has recommended that the Thrall form of coupon mileage be adopted rather than the straight mileage, as used by steam roads. Under this plan the book will consist of 200 5-cent coupons, which will sell at $7.50. The association will make an arrangement to print the tickets in bulk, it being understood that each company will have its name printed on each coupon of the books it will sell, which will serve as identification. By means of a clearing house, coupons will be forwarded to the selling company weekly, and remittances for the same will be made not later than the tenth of each month, on a basis of 75 per cent of the face value of the coupons collected. The books are to be sold with a limit of two years, good for the individual whose name appears on the cover. In event of it becoming necessary to redeem any of the books prior to expiration, redemption will be made upon a basis to be decided upon later.

The form recommended by the committee is presented below, and Mr. Merrill requests that Ohio and Indiana managers give it careful consideration and present recommended changes or suggestions, either by communication to the chairman, or in person, at the meeting of association above mentioned.

As evidence of the ultimate success of the universal mileage movement, Mr. Merrill informs us that twelve leading Ohio companies have already agreed to adopt the mileage in its present form, these being the following:

The Dayton, Springfield & Urbana Electric Railway Company, Springfield.
The Urbana, Bellefontaine & Northern Railway Company, Urbana.
The Springfield & Western Electric Railway Company, Springfield.
The Dayton & Troy Electric Railway Company, Dayton.
The Dayton & Western Traction Company, Dayton.
The Dayton & Northern Traction Company, Dayton.
The Dayton, Covington & Piqua Traction Company, West Milton.
The Toledo, Bowling Green & Southern Traction Company, Findlay.
The Toledo, Fostoria & Findlay Railway Company, Fostoria.
The Cincinnati, Dayton & Toledo Traction Company, Cincinnati.
The Dayton & Xenia Transit Company, Dayton.
The Western Ohio Railway Company, Lima.

The form recommended by the committee is as follows:

BOOK COVER

Form.......... Book No..........

Interchangeable Coupon Ticket

Sold by.........................Railway

Good between all stations on the Interurban Electric Lines mentioned below:

(Probably names of 12 companies on first book printed).

Good only for the individual use of persons whose signature appears on contract and when officially stamped by Selling Agent and subject to all the conditions named in contract. Signature to contract must be made in ink.

Care should be taken to keep the coupon strips in their original folds within the cover for the convenience of the conductor in tearing coupons. Read all conditions and notices hereon.

Days of the month, name of the month and year to be printed on the margin, providing for a 2-year limit.

AGENT'S STUB

To be filled out and detached by Selling Agent and forwarded to the Auditor's office with his daily report.

Interchangeable Coupon Ticket
$7.50
Book No........
Good only for use of

....
....
....
....

Sold at......................................Station
..............................190 .
This book expires..................................190 .

AUDIT CHECK

Interchangeable Coupon Ticket
Book No........

....
....
....
....

Signature of persons authorized to use this ticket.
Sold at......................................Station
..............................190 .
Expiration date punched in margin of cover..........190 .

The conductor will take up this audit check upon first presentation of ticket, and return same to Audit office with other tickets.

CONTRACT NO...........

1. This cover when accompanied with money strip consisting of 5-cent coupons, all of which must be attached to cover in consecutive order, entitles the purchaser, whose name appears as signature to this contract, to transportation over any of the electric railways herein mentioned, and will be hereafter bulletined, providing the signature on back of coupon made in the presence of the conductor agrees with signature affixed to contract.

2. Failure on part of conductor to note discrepancy in signature on coupon does not forfeit Selling Company's privilege to demand surrender of ticket at its option.

3. Mutually agreed that if this reduced rate ticket is presented by any other than the original purchaser, or if the conductor demands the surrender of the ticket and payment of full fare, said ticket to be surrendered and application for rebate made on company from whom the original purchase was made. No attempt to be made with the object in view of adjusting differences with the conductor.

4. All coupons will be null and void unless attached to cover in same consecutive order as originally purchased, and good only when torn by conductor in the presence of the passenger.

5. Conductor will detach sufficient number of coupons to cover local fare on his train.

6. This ticket does not permit of checking baggage gratis.

7. This ticket good over lines heretofore mentioned for two years from date of purchase. No rebate will be allowed for unused portion of ticket at expiration of time limit as punched on margin.

8. Minimum fare to be collected limited to 10 cents.

9. Sign in ink.

....
....
....
....

The electric railways centering at Toledo recently suffered losses from floods for the third time this winter. High water in the Maumee River completely tore up 400 ft. of track on the Waterville line of the Maumee Valley Railway & Light Company, and three stone piers and a portion of a trestle of the bridge of the Toledo Urban & Interurban Railway were carried away, inflicting a loss of $10,000. The Toledo Railways & Light Company saved its power house from another tie-up by building a brick wall around the station. The Lake Shore Electric Railway again suffered between Toledo and Fremont. The company practically sealed the walls of its power house, which had previously been flooded by high water, and kept the plant free from water by the aid of pumps installed on the boiler room floor.

CORRESPONDENCE

KEY WAYS IN WHEEL SEATS

March 21, 1904.

EDITORS STREET RAILWAY JOURNAL:

I notice a reference in your last issue to the use of keys in seating car wheels. The advisability of doing this has been a mooted question on our road, but I have always maintained that it is better not to use keys. A key way of half an inch on the axle and of a similar depth on the hub necessarily weakens both the axle and the hub. That is, if the axle is 6½ ins. in diameter, its strength is practically only that of 6 ins., so that the burden of proof as to the value of keys is certainly with the advocates of their use. The only argument which can be presented for the use of keys is, of course, that the wheels will not become loose, but I have never known of any actual instance where a wheel has become loose when it has been properly pressed on the axle without a key. On the other hand, the use of keys tends to poor work on the part of the wheel fitter. If he realizes that a key is used he will become careless in fitting on wheels, whereas, without a key he will realize that the fit must be close and good, otherwise the wheel will not hold.

MASTER MECHANIC.

MAINTAINING THE SCHEDULE

Denver, March 15, 1904.

EDITORS STREET RAILWAY JOURNAL:

As an observer of street and interurban railway traffic in the East and West, certain points have come to my attention that carry an operating interest to those concerned with the maintenance of schedules. The subject is not altogether new, to be sure, but the problem is always with us, and it may not be out of place to emphasize some of the vital factors which bear upon it. Broadly speaking, it is difficult to point out anything which causes a greater falling off in public good will and confidence than frequent failure to cover a given run between terminal points in the advertised time.

One could multiply dozens of illustrations of the discomfort, inconvenience, exasperation and loss of time induced by breakdowns in railway schedules, if it were essential. From the business man trying to catch a train to the small boy who is kept after school for tardiness, there is just one opinion of the service which is responsible for their predicaments. The financial loss to the operating company induced by the higher cost of service per car mile and car-hour, the greater cost of power per ton mile in making up lost time, the diminished receipts per car-hour—these and other cogent reasons demand a perfect schedule from the company's standpoint. Clearly it is a loss all around when the cars are late.

It is surprising how many little things affect the schedule, and how much it can be benefited by close attention to details. That the motorman must know the "feel" of his car over every foot of the route almost goes without saying. There are few places in the entire transportation industry where sound judgment draws greater interest. Then there is the conductor, the man of many duties. Promptness in giving the bell signals, quickness and accuracy in making change, skill in replacing a lost trolley, alertness in helping passengers on and off the car, sharpness of observation and a thorough knowledge of the route all come into play in covering the required distance in the established time. One small feature, although an unimportant one, used in Denver for saving time to the conductor, is the cash carrier, in which different varieties of change are carried in small parallel cylinders, and change can be made in the fraction of a second. The proper use of sand by motormen and the careful handling of the controller so as not to cause delays by blown fuses, might also be mentioned in this connection.

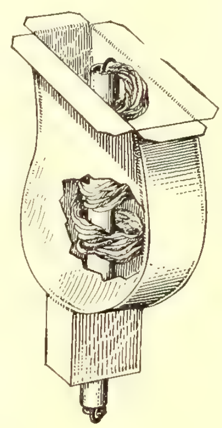
No better illustration of the importance of schedules could be given in conclusion than the studies of the Boston Elevated Railway Company prior and subsequent to the operation of its train system. For months before wheels turned upon the elevated structure, engineers plotted speed-time distance curves in every conceivable combination; the alignment and grade was gone over with templates, planimeters and patience, and the effect of every change estimated. The road began operation, and from that day to this it is safe to say that the schedule problem has never been lost from sight. Stop-watch tests by the hundred have been made, and the whole problem studied in the light of that experience which only active operation can give.

OBSERVER.

OIL FOR MOTOR LUBRICATION IN UTICA

The Utica & Mohawk Valley Railway Company, of Utica, N. Y., is now using oil for lubricating the motor bearings of all of its double-track car equipments. The results have been so satisfactory from every standpoint that oil will be used on the single car equipments as well. The motors employed on this road are the Westinghouse No. 56 and No. 68, which are primarily designed for grease lubrication. When oil was first substituted for grease the boxes were filled by a man stationed at each end of the line, who simply poured a quantity of oil into the old grease boxes of the motors. The journals, however, ran quite hot and gave considerable trouble, and it was found that in pouring in the oil into the boxes a good deal of dust would find its way in, too. As a rule, this dust and dirt would come from the tops of the box lids and from the sides of the motor casing.

To avoid this trouble the oil cup illustrated herewith was designed by the chief engineer of the Galena Signal Oil Company, whose oil was being used, and was put in service last July. The results have been very satisfactory, as the oil bill has been reduced one-third. Standard steam railroad oil is used. The boxes are made of tin, and of the somewhat peculiar shape shown, so as to fit into the present grease boxes of the motors. The old grease box covers of the motors fit over them and keep them dust and dirt proof.



OIL CUP USED FOR LUBRICATING MOTOR BEARINGS IN UTICA

It was first thought by some of the officials of the railway company that the oil cups would feed all the time, but such has not been found to be the case. The feed depends upon the number of woolen strands used, and can be regulated to a nicety by varying the number of strands employed. The present practice of the road is to regulate the feed to three or four drops per minute. Once a week the cups are taken out and cleaned. They are filled once a day, and do not require refilling, even on cars which run 10 hours per day.

In this connection it might be said that the Utica & Mohawk Valley Railway Company is using almost entirely at the present time solid motor bearings instead of split bearings. The mechanical department of the road has also taken out the oil rings that were furnished with the motors by the manufacturer, and has cut oil ways in the new solid bearings, for use in connection with the oil cup illustrated.

The State Senate has passed the Heinlein bill, giving the right of eminent domain over private property in cities to electric railways. The bill restricts this power to railways desiring entrance to a city or for straightening tracks, but prohibits power houses, car houses or terminals under the provisions. The bill is now pending in the House.

SNOW REMOVAL IN NEW ENGLAND

The term, "a real old-fashioned New England winter," is familiar to many of the readers of this paper, and it has possibly been used in the editorial columns of the paper during the present season in connection with the subject of the removal of snow from electric railway tracks. To those who know the meaning of the term only by hearsay, however, a visit to some of the Northern States in New England during the cold months will be somewhat of a revelation. Snow storms are not only frequent but heavy, and the snow piles up on the track in a way to defy anything but the heaviest and most powerful plows.

The accompanying engravings, which were furnished through the courtesy of D. A. Belden, president of the New Hampshire Traction Company, illustrate some scenes on the lines of that road during February. Mr. Belden states that the views depicted are in no way exceptional, but can be taken as a fair indication of the conditions in Northeastern Massachusetts and Southern New Hampshire during January and February of this year.

TYPICAL SNOW SCENES ALONG THE LINE OF THE NEW HAMPSHIRE

As shown in the views nose plows are used, and wings clear the track for a short distance on one side the car, to give access to it. The company has fifteen double-truck four-motor Taunton snow-plows of the heaviest type. The work performed by these plows has been very satisfactory, but after succeeding storms the snow becomes so high on every side of the track that the company has come to the conclusion that nothing short of a rotary snow-plow is effective under these extreme conditions. As the company has had no rotaries this year shoveling has been resorted to in some cases.

The annual meeting of the Lake Street Elevated Railroad Company, of Chicago, has been postponed until March 31.

THE WESTINGHOUSE SINGLE-PHASE RAILWAY SYSTEM

Some interesting details of the power station and car equipments of the new single-phase motor system of the Westinghouse Electric & Manufacturing Company have recently been made public. From advance proofs of an article by Clarence Renshaw, in the "Electric Club Journal," the following particulars are taken:

GENERATING AND DISTRIBUTING SYSTEM

Two-phase generators are preferable to single-phase on account of the increased output for a given amount of material. The two phases should be kept separate, and should supply different parts of the road. An insulator must, of course, be placed in the trolley wire to separate the two parts of the line thus served. Where three-phase machines are already installed, they can be utilized by carrying off three separate single-phase circuits, and dividing the line into three sections instead of two.

The standard frequency of 3000 alternations, or 25 cycles, has been adopted for single-phase railway work.

The voltage of the transmission line, which supplies the high-tension side of the transformer stations, may be chosen in the same manner as the voltage of any high-tension transmission line, with reference to the distance of transmission and the general local conditions.

Power will be supplied to the trolley through transformer stations located along the line. Each station need contain only a single transformer unit, since the stations will be placed so close together that in case of accident to one of them the adjacent ones can supply sufficient power to enable the cars to still operate over the portion of the line ordinarily fed by the damaged transformer station. In general, with a trolley voltage of 1000, a car equipment not larger than four 100-hp motors, and with a schedule such that no more than two cars will at any one time be located between two adjacent transformer stations, the transformer stations may be placed from about 6 miles to 8 miles apart without requiring any 1000-volt conductors other than the trolley wire and the track rails.

There will be no moving machinery in these transformer stations, and, therefore, constant attendance will be unnecessary. As transformers require only a comparatively small space, the transformer station buildings may be small and comparatively cheap. Fig. 1 gives a general idea of the connections of the apparatus in a transformer station containing the following apparatus:

One oil-insulated self-cooled transformer.

Two high-tension fuse circuit breakers, with the necessary barriers.

Two low-equivalent lightning arresters for protecting the high-tension transmission lines.

Two choke coils for use with lightning arresters.

One automatic oil circuit breaker in the low-tension circuit between the transformer and the trolley, so arranged as to open only on a continued short circuit, or a fuse and a switch.

Two knife switches to disconnect the circuit breaker from the trolley, to enable inspection or repairs to be made.

One low-tension lightning arrester.

The voltage which may be used on the trolley is limited in general by the insulating material which is available. A high-voltage trolley will require different line material from the present standards. Line material for 1000 volts can be readily obtained in the market at present, and it is not known that such material for any higher voltage is now on the market. Hence, approximately, 1000 volts (i. e., 1100 volts at the generator or transformer station) is, in general, the maximum allowable at present, and this is considered as standard. Lower trolley voltages may be used where local conditions require it.

An equipment can readily be arranged to operate at two different trolley voltages, so that, for instance, a high-voltage trolley may be used in open country and a lower-voltage trolley in towns or cities. This arrangement can be provided for by means of a low-voltage tap on the high-tension side of the main auto-transformer on the car and a double-throw switch, so that the wire from the trolley can be connected to either one of the two taps on the main auto-transformer. Figs. 2 and 3 show how low-voltage sections of trolley may be supplied. If the low-voltage section is adjacent to a transformer station fed by the high-tension transmission line, an extra tap from the low-tension side of the transformer will suffice.

Where it is necessary to pass over tracks already occupied by cars using direct current, an additional trolley wire may be placed alongside of the direct-current trolley wire to carry the alternating current. The voltage of this alternating- current trolley may then be made approximately the same as that of the direct-current trolley.

Should a direct-current car place its trolley on the alternating-current wire, the inductive resistance of the motors would prevent sufficient current flowing to damage them, and

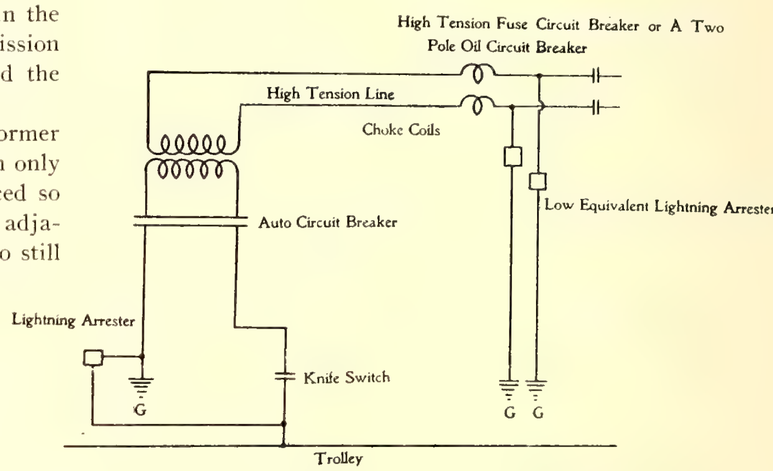


FIG. 1.—CONNECTIONS IN TRANSFORMER STATION.

the error would be quickly evident from the fact that the car would not operate. Should the trolley of an alternating-current car be placed on the direct-current wire, a large current would instantly tend to flow through the transformer, but this would open the circuit breaker at once, and damage would thus be prevented.

CAR EQUIPMENT

The essential details of car equipments are shown in Figs. 4 and 5. Starting from the trolley, these include the circuit-breaker, main auto-transformer, induction regulator (or hand controller), reverse switch, motor cut-out switch and motors. Lighting transformer, lightning arrester, lamps, sockets, wiring, etc., are also included.

Any standard equipment for use on cars where compressed air is available (i. e., cars with air brakes) can be supplied with induction regulator control. When this is used the regulator, reverse switch and circuit breaker will be operated by compressed air from the brake system of the car, and controlled by means of a master switch through electromagnetic valves. These valves will be similar in general to those used on direct-current unit-switch control and on the signaling systems of various railroads. The action of the induction regulator may be easily understood by reference to Figs. 6 and 7. The regulator is essentially a transformer with the primary core and winding movable with respect to the secondary. With the primary, as in Fig. 6, the maximum voltage is generated in the secondary of the regulator, and it opposes the voltage of the main auto-transformer. With the primary at 180 degs. from this position, the voltage of the regulator will aid that of the auto-transformer. With the primary of the regulator as in

Fig. 7, the voltage of the secondary is zero, so that it neither aids nor opposes the voltage of the auto-transformer.

The car is started with the voltage of the regulator a maximum, and opposing that of the auto-transformer. The regulator is then moved gradually until the position is reached where its voltage is a maximum and aids that of the auto-transformer. This is then the full-speed position. The induction regulator control can be readily adapted for multiple-unit train operation, with slight additions in the way of apparatus and wiring.

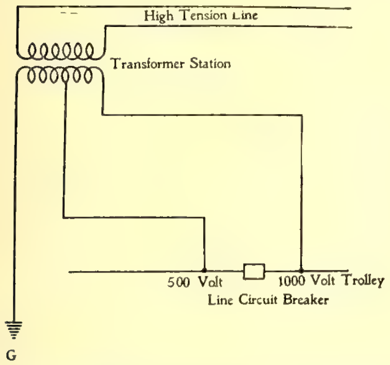


FIG. 2.—METHOD OF FEEDING TROLLEY WIRE SECTIONS OF DIFFERENT VOLTAGES

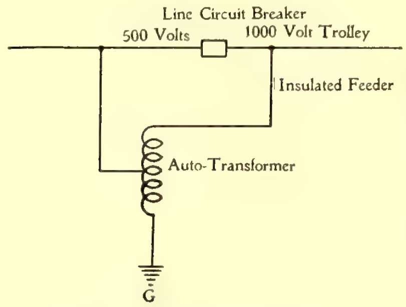


FIG. 3.—CONNECTIONS ON CAR FOR TROLLEY WIRE SECTIONS OF DIFFERENT VOLTAGES.

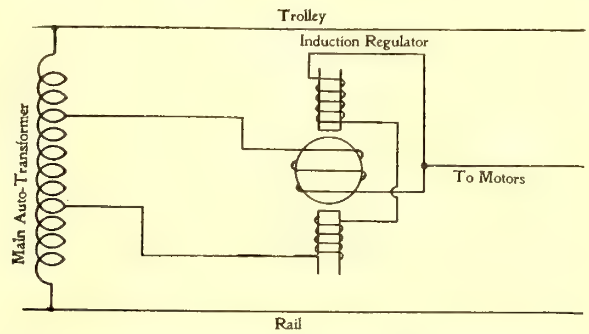


FIG. 6.—DIAGRAM SHOWING ACTION OF INDUCTION REGULATOR ON CAR

For small equipments hand control may be used. This will consist of platform controllers similar in general to the present direct-current controllers. With the hand control, as now proposed, the motors will be connected successively to different taps on the main auto-transformer, as shown in Fig. 5. The voltage applied to the motor thus depends on the position of the contact point *D*. This control will have a definite number of steps similar to the direct-current control, but the motors can be run continuously on any step, and there will be no rheostatic losses.

As may be seen from Figs. 4 and 5, the motor voltage is entirely independent of the trolley voltage. A standard motor voltage of 250 has been adopted for single-phase railway motors, regardless of the trolley voltage used.

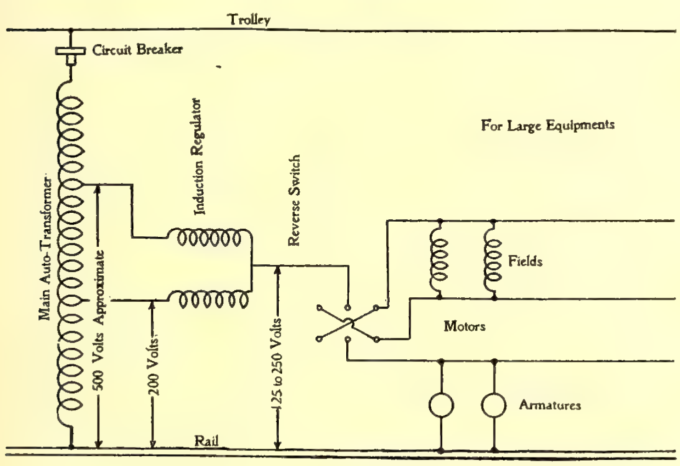


FIG. 4.—DIAGRAM OF CAR CONNECTIONS FOR LARGE EQUIPMENTS

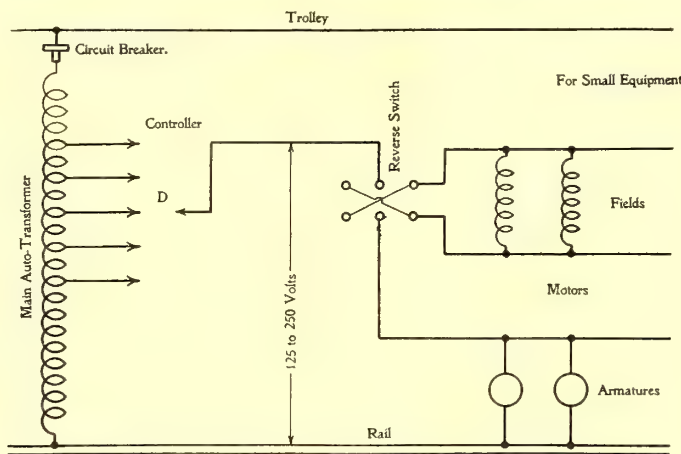


FIG. 5.—DIAGRAM OF CAR CONNECTIONS FOR SMALL EQUIPMENTS

In general, the lights in the car will be supplied by a small auxiliary transformer reducing the trolley voltage to approximately 50 volts. If electric heaters are desired, these may be operated from the main auto-transformer. The air compressor for supplying brakes and operating the induction regulator will be operated by a series alternating-current motor taking current from the lighting transformer.

As a rule, the motors will be connected permanently in parallel, both in two and four-motor equipments. The use of voltage control makes series-parallel connections unnecessary and inadvisable. The fields of all of the motors will also be connected permanently in parallel, substantially as shown in Figs. 4 and 5, thus allowing a simple reverse switch. Such an arrangement is permissible with alternating current, although not with direct current, since with the former the currents automatically adjust themselves to give equal field strength in each motor.

In general, the motors will weigh approximately the same as direct-current motors of the same capacity. In general, also the regulator and transformer for a four-motor equipment will, together, weigh approximately the same as a single motor. A complete equipment, including all apparatus, will weigh approximately 15 per cent more than a direct-current equipment of the same capacity. Since the weight of an equipment usually forms only about one-fourth of the total weight of car, equipment and load, however, an alternating-current car should in general exceed the weight of a direct-current car by less than 5 per cent.

For single cars, run at speeds not over 60 m. p. h., and with trolley voltage of approximately 1000, it is proposed at present to use standard direct-current trolleys, except that an insulating base will be provided. Protection in handling the trolley rope will be afforded by insulators between the rope and the trolley, and by having a grounded metallic end on the part of the rope which is handled. For very high speeds, or where cars are to be run in trains at all times, a form of bow-trolley will be used.

Motors of 50 hp, 75 hp, 100 hp and 150 hp are being built, and are considered standard sizes. In general, the external appearance of the motors will be similar to that of direct-current motors. The construction, however, will be slightly different. The entire magnetic part of the field will be laminated, the field being built up of annular punchings, with poles projecting radially inward. The punchings will be held together in a steel

frame. The motor will thus be of the box type, the armature being put in or taken out through the ends. The field coils will be of copper strap of large cross section, and there will be but few turns per coil. The armature will, in general, be similar in all essentials to the armatures of direct-current railway motors.

The horse-power ratings which are given to these motors correspond, in general, to the nominal horse-power ratings which are given to direct-current railway motors. That is, it is the load which the motors will carry at rated voltage for 1 hour, with a rise in temperature of approximately 75 degs. C. in the windings. The temperature is measured by thermometers. In general, in actual service, these motors will carry continuously from 45 per cent to 50 per cent of their full-load current at the reduced average voltage which would be placed upon them under these circumstances, with a rise in temperature of approximately 60 degs. C. As the armature may be momentarily short-circuited without damage to the motor, there should be no tendency to flash across between brushes, or from the brushes to the frame of the motor.

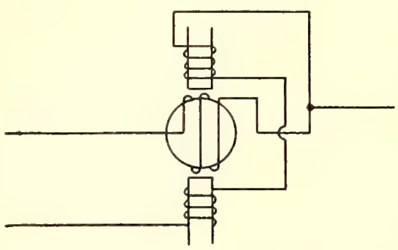


FIG. 7.—DIAGRAM SHOWING ACTION OF INDUCTION REGULATOR ON CAR

The apparent input of an alternating-current motor may be divided into two components at right angles to each other. One of these is called the energy component and the other the inductive component. The energy component represent the power input to the motor, and includes not only the useful input which appears as output at the shaft of the motor, but also the losses. The relation between these two components is such that the sum of their squares is equal to the square of the total apparent input.

The power factor of a motor is the ratio of the energy component to the total apparent input, and since it is merely the ratio of two quantities, the power-factor alone gives no idea of the value of either quantity. In judging whether the performance of a given motor is good or bad, a knowlege of the power factor alone is thus of little value. The important considerations in any given case are the actual magnitudes of the energy and the inductive components and the proportion of the former which represents useful energy, and in order to determine this, further information is necessary. If the apparent input, for instance, is known in addition to the power factor then the value of the energy and inductive components can be readily found. If the efficiency is also known, the useful energy may then be found from the total energy.

Many engineers hold the idea that high power factor in a motor is desirable under all circumstances, in the same way, for instance, as a high efficiency would be desirable. This idea is mistaken and misleading.

The effects which are ordinarily attributed to a low power factor are really due to a large inductive component. If the value of this inductive component is kept the same for any given output, and the power factor raised by increasing the energy component, the general conditions will be worse rather than better. If two motors, for instance, have the same inductive component with a given output, but the efficiency of the first is less than that of the second, then the energy component of the first will be greater than that of the second, and, consequently, the power factor of the first will also be greater than that of the second. In this case, however, the motor with the higher power factor is the poorer of the two, since it has the same inductive element and at the same time requires a greater actual power input.

In the alternating-current railway motor the inductive component depends on the current. Since approximately the same current is required to produce a given torque, whether the motor is merely at the point of starting or whether it is running at full speed, the inductive component will be practically the same for a given torque whether the motor is starting or whether it is running at full speed. When the motor is running at full speed, however, there is a large output, and, consequently, a large energy component, thus giving a high power factor. At the moment of starting there is no output, and the only energy component in the motor is that due to its losses. If the internal losses are low (which will be the case with an efficient motor) then the power factor of the motor when starting will also be low.

Since the alternating-current railway motor has a high power-factor at full load (approximately 90 per cent or more), it is evident that the value of the inductive component under these circumstances must be relatively small. It has already been noted that when the motor is starting with full-load torque the inductive component is the same as at full load. Since there is no power developed when starting (due to the fact that the speed is zero), the only energy component which there can be is that due to the losses. A motor of low efficiency, therefore, would show a fairly high power-factor under these circumstances, since it would have a fairly large energy component. The fact that the power-factor under these circumstances is not high, thus shows that the losses are not high—that is, that the motor is an efficient one.

In considering the matter of power-factor when starting, the alternating-current railway motor must be carefully distinguished from the induction motor. In an induction motor, to produce full-load torque at the start, there must be an expenditure of full-load energy in the secondary circuit, and for other starting torques a proportionate amount of energy is required. In an induction motor, therefore, the energy component at starting is in general taken as an indication of the torque, although a large expenditure of energy does not necessarily mean a large torque.

In induction motors, as in all alternating-current motors, it is desirable to keep the inductive component as small as possible, and since a large energy component is necessary to produce a large torque at starting, a high power-factor when starting with large torque is in general taken to mean a low inductive component, and consequently a favorable condition. A high power-factor at the start in an induction motor, however, does not necessarily mean a low inductive component, and hence does not necessarily mean a favorable condition.

In starting any alternating-current motor, it is impossible to avoid the presence of an inductive component. In starting an induction motor, however, an energy component proportionate to the torque developed is also required in addition to this inductive component. In the alternating-current railway motor, however, the torque developed depends on current only, and the development of a given torque does not require the expenditure of any given amount of energy. The inductive component or wattless current has the same effect in producing torque as an energy current of the same amount. In the alternating-current railway motor, therefore, since the inductive component will be present in any case, it is desirable to utilize this current for producing as much of the necessary torque as possible, thus keeping the energy current (and the energy) for a given torque as small as possible. That is, with a given inductive component it is desirable to reduce the power-factor at starting to as low a value as possible, since this means that the losses will then have as low a value as possible.

The fact that a low power-factor at starting represents an advantageous condition rather than a disadvantageous one with the alternating-current railway motor, may be seen in another way. In order to produce a given torque, a certain current is necessary. With a direct-current car, practically the same cur-

rent per motor would be required to produce a given torque as with an alternating-current car, provided the conditions of gear, ratio, etc., are the same. In the direct-current car, however, the product of the current and volts would represent the energy taken from the circuit. In the alternating-current car the product of current and volts would be approximately the same as that for the direct-current car, but this product would represent only apparent energy and not real energy. Since the power-factor in the case of the alternating-current car would be low, usually from about 30 to 40 per cent, the real energy supplied to the alternating-current car would be only this percentage of that supplied to the direct-current car for producing the same torque.

There has been a tendency on the part of engineers who have not fully understood this point to criticise the fact that the alternating-current railway motor has a low power-factor when starting. It will be seen from the above, however, that this low power-factor when starting represents a favorable condition instead of an unfavorable one. It is evident that a certain current is necessary to produce a good starting torque, and if this current can be obtained without a corresponding expenditure of energy, so much the better.

COMPARISON WITH DIRECT-CURRENT SYSTEM

The operation of direct-current railway systems has been eminently satisfactory fo: two main reasons: First, because the direct-current series motor, owing to its variable field, has speed torque characteristics which make it particularly suitable for traction work; and, second, because only a single trolley is necessary. The direct-current railway system has, however, a number of disadvantages, the most serious of which, perhaps, is the comparatively low trolley voltage which is necessary. This feature has hampered, to a considerable extent, the development of such roads.

Owing to the ease and economy of voltage transformation with alternating current, the use of alternating-current motors would permit a high trolley voltage, and at the same time a low voltage at the motors, since a transformer could readily be placed on the car to reduce the trolley voltage for use at the motors. Until recently, however, the only alternating-current motors which were available were of the polyphase induction type, and such motors, in addition to not having the proper characteristics for railway work, had the further disadvantage of requiring at least two trolley wires.

The alternating-current railway system which the Westinghouse Company has recently placed on the market possesses the two main advantages of the direct-current system, since the motor which is used has the same speed-torque characteristics as the direct-current series motor, and since single-phase circuits obviously require only one trolley. In addition to possessing these two main advantages of the direct-current system, this alternating-current system overcomes a number of its limitations. This is best shown by the statements in parallel columns, which follow:

DIRECT-CURRENT SYSTEM

(1) The voltage of a direct-current circuit can be changed only by the use of rotating machinery. It is thus, in general, necessary to utilize power at approximately the same voltage at which it is generated. A high voltage is desirable for transmitting power, in order that the currents necessary for a given output may be small. On the other hand, the voltage for which motors of the commutator type can be made is limited. A voltage of nominally 500, but actually as high as 600, has been adopted as the standard for direct-current railway work. This is a compromise—being low from the transmission standpoint and high as regards the use of commutator type motors.

(2) Power can be transmitted with reasonable economy by direct current at nominally 500 volts for from five to ten miles from the generating station. For greater distances than this the cost of conductors becomes excessive. A long-distance railway would thus require power stations located from ten to twenty miles apart.

To overcome this difficulty, power is often generated as alternating current and transmitted at high voltage. It is then changed into direct current by means of lowering transformers and rotary converters located in sub-stations at suitable intervals along the road. Such a system is much less expensive to install and maintain than would be a number of separate power houses. In general, however, the cost of installation and maintenance of a sub-station is such that the use of such a system may be looked upon as a method of making long-distance railways possible, rather than as a means of reducing the cost of direct-current feeders.

(3) Variable voltage for starting and regulating the speed of the motors is obtained by connecting the motors in series or parallel, thus obtaining two economical speeds. Additional speeds are obtained by the use of a rheostat in connection with both of these combinations. As ordinarily installed, the capacity of the rheostat is such that it may be left in circuit for only a very short time, so that, except momentarily, only two speeds (i. e. series and parallel) are available for continuous running with a given torque.

(4) The motors are connected in series or in parallel and to the various resistance steps by means of a controller, which, in general, consists of a number of contacts bearing on a revolving drum. The circuit is partially opened whenever the connection is changed from one resistance step to another; and in changing from series to parallel, or in cutting off the power, the circuit is completely opened. A powerful magnetic blowout is used to break the arc which is formed on opening the circuit, and thus prevent burning of the contacts.

(5) When starting a car the rheostatic loss is large, since almost the entire voltage of the line is taken up in the rheostat.

(6) The use of direct current on grounded circuits is always attended by electrolysis. In large cities considerable difficulty is now experienced from this cause. In future the difficulty will probably be even greater, since the number of cars in operation will increase and greater currents must hence be used.

ALTERNATING-CURRENT SYSTEM

(1) The ideal arrangement of high trolley voltage, giving economy of transmission, and low motor voltage, giving minimum motor trouble, can be obtained by means of a transformer on the car.

(2) Long-distance roads can be supplied by means of transformer stations, instead of rotary converter sub-stations. These will be comparatively cheap, will contain no synchronous or moving machinery, and will consequently not require constant attendance.

The omission of synchronous machinery renders the service less liable to interruption, since momentary short-circuits, or similar troubles, which might interrupt the service where synchronous apparatus were used, would in many cases cause no interruption in a system where such apparatus was not used. Moreover, in case of a shut-down from any cause, service on a system without synchronous apparatus can be resumed much more quickly than in the case of one in which it is necessary to synchronize a number of rotary converters before power can be put on the line.

Although the rotary converter is a highly efficient machine, some losses necessarily take place in it, especially where it is operating with a low load-factor. The omission of rotary converters, and their consequent losses, should thus add materially to the general efficiency of the power system.

A trolley voltage much higher than is at present in use is allowable with alternating-current railway motors, supplied by means of a transformer on the car, and this, combined with the cheapness of transformer stations, will, in general, allow the latter to be placed sufficiently near each other to render any feeders other than the trolley wire unnecessary. Moreover, in order to bring about this condition, these stations will, in general, not reqire to be placed much closer together than would rotary converter sub-stations.

(3) Owing to the ease and economy of voltage transformation with alternating current, any desired voltage may be applied to the motors without the use of resistance. Motors may thus be run continuously at full speed, or at any lower speed, and the power consumption at all speeds will be proportional to the energy actually expended in driving the car.

(4) Instead of a controller making and breaking a circuit on each step, the motors (in all equipments except those of small size) will be controlled by means of an induction regulator. Such a regulator is simple and substantial in construction, and has to make and break contacts or similar wearing parts. In changing from one voltage to another, this change is produced gradually instead of by definite steps, the control being effected through magnetic, instead of by direct, action on the circuit.

(5) Since there are no rheostats, there will be no rheostatic loss.

(6) With the use of alternating current instead of direct current, electrolysis will practically disappear.

In concluding this description of the various features of the single-phase railway stystem, and its advantages as compared with the present direct-current system, it should be borne in mind that the advantages accruing from this system are due primarily to the use of alternating-current, rather than to any advantages of the alternating-current railway motor over the direct-current railway motor. It is, in general, sufficient praise for the alternating-current railway motor to say that it weighs no more than the direct-current motor, that it has equally good characteristics, and that it is almost as efficient. The credit for the entire advantage gained, however, must be given to the alternating-current railway motor, since it is the development of this motor which has made the exclusive use of single-phase alternating current on railway systems practicable.

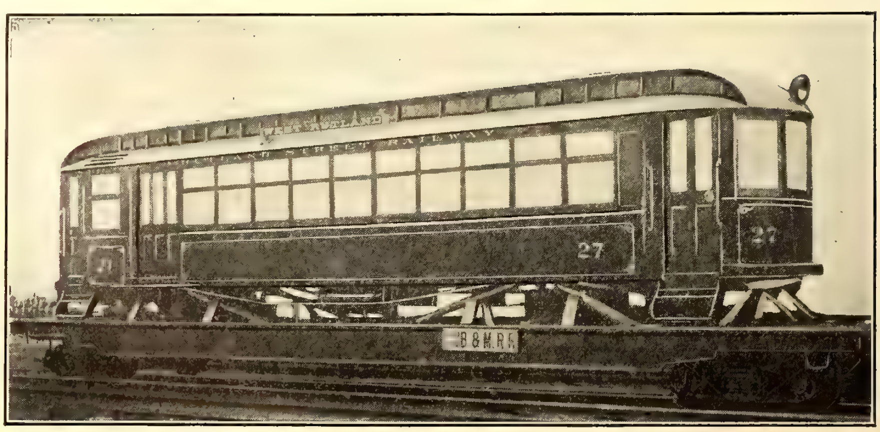
CARS FOR THE RUTLAND STREET RAILWAY COMPANY

The Rutland Street Railway Company, of Rutland, Vt., has placed in operation recently for suburban service a number of combination passenger and baggage cars, built by the Laconia Car Company, of Laconia, N. H. One of these cars is shown in the accompanying cuts.

The car is 45 ft. 11 ins. long over all. It is of the semi-convertible type, the windows being arranged to drop flush with the window-sills. The car body is placed on Laconia 9-B-3 trucks having 3-ft. wheel base and fitted with 3-in. double-plate wheels. The operating equipment includes G. E. 64-hp motors and Christensen air brakes.

The interior finish is of red birch with inlaid marquetry work. The ceiling is of decorated quartered oak. Elaborately shaped center clusters, as well as lamps along the sides, serve to light the car. The seats in the passenger compartment are of the Wheeler type, made by Heywood Bros. & Wakefield Company, and are upholstered with Chase figured plush. The baggage compartment is furnished with folding seats for smokers. The car is equipped with Providence fenders, Sterling-Meaker registers, Consolidated car heaters, Ham trolley catchers and the Curtain Supply Company's curtains.

INTERIOR OF CAR FOR RUTLAND STREET RAILWAY



EXTERIOR OF CAR FOR RUTLAND STREET RAILWAY

The Toledo & Western Railway Company is experiencing great difficulty in handling all the freight that is now being offered by the grain elevators along its line. Large elevators at Matamora and Lyons are full of grain, and companies have been organized to build elevators at Pioneer, Fayette, Morenci and Adrian. The Toledo & Western has leased a number of cars from steam roads, and will purchase additional freight rolling stock in the near future.

IMPROVEMENTS IN DRAFT RIGGING

Two patents have been issued recently to W. T. Van Dorn, of Chicago, covering improvements recently incorporated in the Van Dorn automatic couplers and draw-bars. As these couplers are so extensively used by elevated and interurban railway companies, the accompanying illustrations showing these improvements will be of interest. Fig. 1 shows an improved draft rigging, which provides for an up and down motion of the draw-bar without causing uneven wear on the draw-bar springs. The draw-bar slides through a casting attached to the bottom framing of the car. This casting is hollow, but has a rib in its center which carries the draw-bar. The springs at either end bear against collars, which work on the ball and socket principle, as the draw-bar rises and falls.

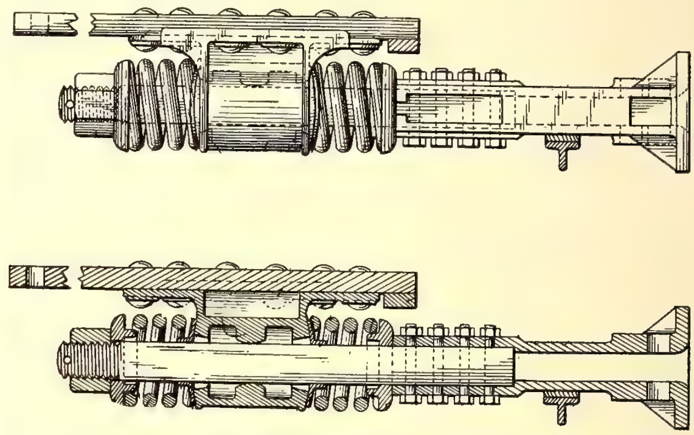


FIG. 1.—SHAFT RIGGING PROVIDING FOR UP AND DOWN MOTION OF DRAW-BAR

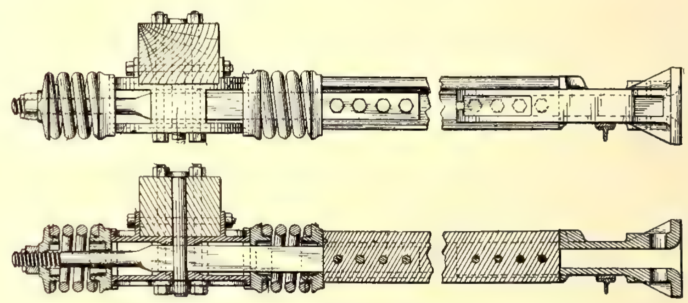


FIG. 2.—METHOD OF ATTACHING DRAFT RIGGING TO BOTTOM TIMBERS

In Fig. 2 is shown the method of attaching draft rigging to the bottom timbers, which is said to be an improvement on anything heretofore employed in connection with these draw-bars. Where possible the two parts of the draw-bar pass each side of the king-bolt. If the truck is too far back for this the draft rigging is attached to some other cross timber nearer the end of the car.

CARS FOR THE GRANITE CITY AND ST. LOUIS RAILWAY COMPANY

The Laclede plant of the St. Louis Car Company has recently turned out for the Granite City & St. Louis Railway Company some cars which are good examples of double-truck cars of moderate length. Fig. 1 is an exterior view of one of these cars just before shipment, and Fig. 2 an interior view. This car is 37 ft. over all, with a car body 27 ft. long. The width over all is 8 ft. 6 ins., and the height from rail to top of roof 12 ft. The car is equipped with St. Louis Car Company's reversible cross-seats, having a seating capacity of thirty-six. The interior finish is cherry. The trucks are the builder's short-wheel base No. 47. The cars will be equipped with air brakes and also hand brakes operated with the company's vertical hand wheel. This type of brake wheel is bevel-geared to the regular brake staff, and is furnished usually with the company's vestibule cars.

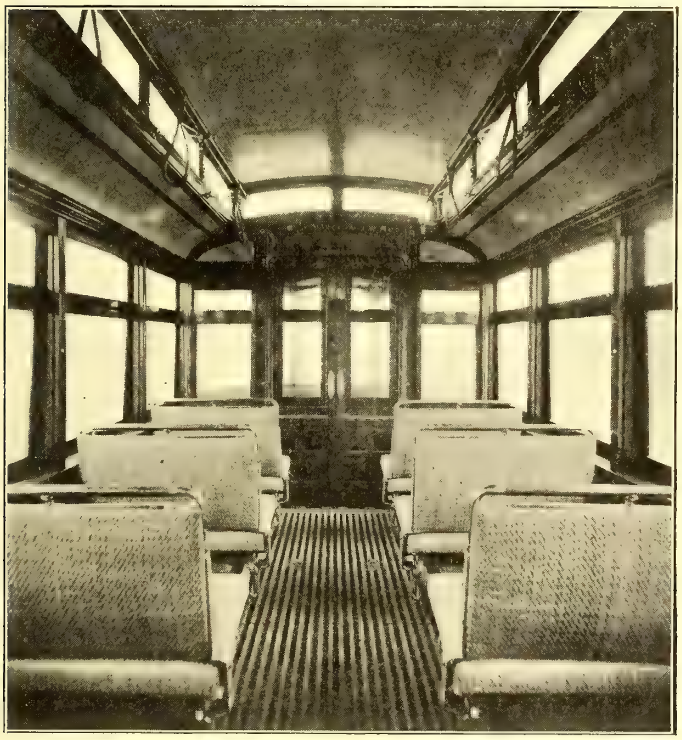


FIG. 2.—INTERIOR OF CAR FOR GRANITE CITY & ST. LOUIS RAILWAY

FIG. 1.—CAR FOR GRANITE CITY & ST. LOUIS RAILWAY COMPANY

FINE CAR FOR LEWISTOWN & REEDSVILLE RAILWAY

The Lewistown & Reedsville Electric Railway Company has lately received from the J. G. Brill Company the handsome car shown in the accompanying illustration. The railway company is extending its lines and adding to its equipment. Between the two towns is a long mountain range, and the traffic from the two valleys in which both towns are important centers, is over one route through the only break in the range. Until the trolley line was constructed all intercourse was by stage or wagons. Lewistown is the county seat of Mifflin County, and is known throughout the State chiefly from the fact that Bucknell University is located there. The company controls an amusement resort, known as Central Park. This place is but a short distance from the town, and is popular both summer and winter, because of its picnic grounds and skating lake.

CAR FOR LEWISTOWN & REEDSVILLE RAILWAY

The car body is 33 ft. 4 ins. long over end panels, and is seated for forty-eight passengers. The upper sashes of the windows are stationary, and the lower arranged to drop into wall pockets furnished with covers. The interior is finished in natural ash with ceilings of decorated birch. Upper truss rods, 2 ins. x $\frac{5}{8}$ in., are shouldered on the side posts, $19\frac{1}{2}$ ins. from the floor; and under truss rods are $1\frac{1}{8}$ ins. in diameter. The center platform timbers are reinforced with angle-irons, offset for the purpose, and bolted at the outer ends to the crown pieces. They are 14 ft. 6 ins. long, extending back from the center of the body bolster 4 ft. $9\frac{1}{2}$ ins. This is the standard practice of the builders, and provides a firm platform. The length of the platforms from panels over vestibules is 4 ft. $8\frac{1}{2}$ ins., and the total length of the car over vestibules 42 ft. 9 ins.; thickness of side sills, $4\frac{3}{4}$ ins. x $7\frac{3}{4}$ ins., with 6-in. x $\frac{1}{2}$-in. plates on the inside, turned at the ends and bolted to the $5\frac{3}{4}$-in. x $6\frac{7}{8}$-in. end sills. The center sills are $3\frac{1}{2}$ ins. x $4\frac{1}{4}$ ins., and the crossings, $3\frac{1}{2}$ ins. x $4\frac{1}{4}$ ins.; corner posts, $3\frac{3}{4}$ ins., and side posts $2\frac{3}{4}$ ins. thick. The distance from the rail to the tread of the platform steps is $16\frac{1}{2}$ ins., and from the step to the platform, $14\frac{1}{2}$ ins.; from platform to car floor, $8\frac{1}{8}$ ins.; from track to under side of side sills, $32\frac{1}{4}$ ins. The car is mounted on Brill No. 27-G trucks, with 4-ft. wheel base, and equipped with four 25-hp motors. Platform and conductor gongs, channel-iron radial draw-bars, ratchet brake handles, and other patented specialties of the builder's make, are included in the furnishings.

A bill has been introduced into the Ohio Legislature placing the numerous express companies operating on electric railways under the same taxation laws as regular express companies that operate on steam systems.

FINANCIAL INTELLIGENCE

WALL STREET, March 23, 1904.

The Money Market

The natural inclination at this season toward contraction of bank reserves, has been observed in the operations of the last few weeks. Currency has not yet begun to move out to the interior in response to the usual demands for spring trade, but the inward movement has ceased. At the same time the banks are losing to the Treasury, although, owing to the decline in revenue-bearing imports, this loss is not as great as it has been in previous years. It is quite to be expected that local cash holdings will continue to fall off for another month at least. This prospect, however, is hardly disturbing, in view of the exceedingly strong position of present bank resources. Surplus reserve still stands above $27,000,000, which is the highest total for the period in eight years. The check upon the winter's bank loan expansion is also most reassuring. Last week's statement, to be sure, showed a small addition to the loan account, owing to renewed advances to the Stock Exchange, but the extraordinary borrowing by corporations has stopped, and this is the most important fact for consideration. The only doubt admissible regarding the immediate money market is as to whether or not gold will have to be exported this spring. Shipments have already been made in some volume to South America, but these are irregular transactions. Sterling has risen this week to the highest of the season, within less than one cent in the pound below the customary point at which gold can be sent to Europe at profit. The bank of England maintains its 4 per cent discount rate, and the continental markets have not so far recovered from the recent strain to show signs of early reaction. Relatively, credit is cheaper here than abroad, and should this disparity continue, our export trade balance being on the decline, it is exceedingly probable that within a few weeks we may be sending gold to Europe. Even this, however, if it does not occur, will probably not cause any perceptible hardening of money rates. If the Panama Canal settlement, which now seems to have been indefinitely postponed, should come along at the time these other influences are at work the outflow of gold might be heavy enough to effect the market, but these are possibilities not in the foreground of present banking discussion. The chances are that quotations for money will remain about as they are, until the end of the summer. All the loaning business now going on distinctly favors the borrower. Cases are continually being reported of loans made as low as 3¾ per cent for long periods, while for the shorter maturities bankers are forced to make concessions in order to obtain custom. Call money is quoted at merely nominal figures, 1¾ per cent being the renewal rate on the Stock Exchange.

The Stock Market

The past week has been noted for several important incidents, first, a general advance in prices, following the discovery that the Northern Securities decision was not the serious factor for the market that had been anticipated, second the spectacular collapse in cotton accompanying the Sully failure, and finally enormous buying of all securities concerned in the great Northwestern merger. These three episodes have entirely transformed the character of the market from what it was a fortnight ago. Trading has become very active, the outside public has reappeared to greater extent than at any time since the boom of 1902, and in fact Wall Street has taken on again the familiar characteristics of a vigorous speculation for the rise. In this column a week ago the bearings of the Supreme Court decision were discussed in some detail, and it is unnecessary to rehearse them now. It is sufficient to say that the dealings of the past week have justified the optimistic conclusions that were drawn immediately following this event. The market too refused to be shaken by the disastrous sequel to the cotton corner. On the contrary, this was regarded as a distinct help to the financial situation, inasmuch as it removed what might have been a serious restraint upon the export trade, as well as a cause of great disturbance to domestic industry. It is upon the sensational movement in the group of Northwestern Securities that the market's attention is now converged. An abrupt advance of 15 points in Northern Securities stock on the curb, an eight point rise in Union Pacific on tremendous transactions and extremely heavy purchases of all the bonds and stocks associated with the merger enterprise, foreshadowed the announcement made this morning of the dissolution of the Northern Securities Company on terms which will be very advantageous to all the participating securities. It is too early at this writing to consider the effect upon the general market, but it is hard to see how it can be anything but favorable, inasmuch as the distribution of the merger company is arranged so as to guarantee permanently harmonious relations among the great railroad interests in the Northwest. Other and more routine topics have been set aside this week by the excitement aroused over the developments referred to. Railroad earnings, such as have come to hand, however, have given satisfactory assurance that the strain of the severe winter is now over, and that losses as compared with a year ago will henceforth not be heavy. This assurance has helped materially toward the market's recovery, as has the breaking of the drought in the winter wheat territory, and the fall in prices of all farm commodities.

In the local traction group the movement has corresponded so closely with the general market movement that it calls for no separate analysis. It has become pretty clear that the heavy drop in Metropolitan two days ago was due to special liquidation, rather than to anything unfavorable in the condition of the properties. The stock has rallied easily during the past week, and has been well bought. Allowing for the recent dividend, Manhattan Elevated sold this week a half point above its high price of January. Brooklyn Rapid Transit has been an active favorite with bull traders, and professional Wall Street continues to be particularly well disposed toward this stock.

Philadelphia

The active speculative favorites in Philadelphia have all risen sharply during the week. Improvement in general market conditions rather than any special developments in connection with individual properties, has, of course, been the animating cause. Union Traction was the strongest stock on the list, advancing from 47½ to 48¾, on what appeared to be chiefly investment buying. Philadelphia Company common rose from 39¼ to 40¼ on heavy transactions, and the preferred sold at 44 and 44¼. Philadelphia Electric was very active also between 5 15-16 and 6⅛. A few hundred shares of Rapid Transit changed hands at an advance from 13¾ to 14⅛. One hundred Union Traction of Indiana sold at 35. Consolidated Traction of New Jersey gained a half per cent to 63, on sales of 300 shares. Philadelphia Traction was unchanged at 95½. Fairmount Park Transportation sold for an odd lot at 21¼. American Railways was dull, but firm, between 43¼ and 43½.

Chicago

The most notable incident of the week in Chicago was the sharp recovery of nearly 10 points in Metropolitan Elevated preferred. A little over a week ago the stock sold down to 41. It sold at 50½ on Saturday last, and at 50 on Monday. Metropolitan common also rallied two points to 17. The fact that transactions at the rising prices were comparatively light strengthens the other evidence, pointing to the true cause for the recent decline being forced liquidation by one or two large individual holders, and not anything either actual or prospective unfavorable in the condition of the property. Further proof that the Union Traction group of securities have ceased to be pressed for sale, has been afforded during the week. North Chicago stock recovered to 73, or 9 points above its recent low record, 200 shares of West Chicago sold at 44½, while Union Traction was active and strong around 6. City Railway, selling ex-dividend, recovered to 161½. South Side gained a point and a half to 91½, Northwestern common sold at 16½, and Lake Street at 2⅛.

Other Traction Securities

The Boston dealings have not developed the life that might have been expected in view of the week's revival of speculative interest in the general market. Boston Elevated sold up to 139½, which is the highest price reached in some time, but reacted later to 138⅞. West End common went to 93 for an odd lot, but most of the sales were made at 92½. The preferred sold between 109 and 109½. Massachusetts Electric common was exceeding dull, ranging as low as 18 and as high as 19. The preferred changed hands between 72¼ and 73. In Baltimore the United Railways securities were fairly active and strong. The income bonds rose from 53⅜ to 54, the general 4s sold between 90¾ and 91⅛, and 800 shares of the stock were dealt in at an advance from 7⅜ to 8. City & Suburban (Baltimore) 5s were strong, gaining five-eighths of a point from 112½ to 113⅛. Charleston Consolidated 5s, on the other hand, lost

a point and a half, selling at 83½. Other sales for the week comprised City & Suburban (Washington) 5s at 90⅜ and 90¾, Baltimore City Passenger 5s at 108, Central Railway extension 5s at 113, and Atlanta Consolidated 5s at 105¼. The active feature on the New York curb was Interborough Rapid Transit. Two thousand shares sold on the rise from 103½ to 108½; at the higher level heavy profit-taking appeared, and on sales of 1000 shares the stock fell back to 108¼. Six hundred New Orleans Street Railway common sold at 9, and 200 more at 9½. Three hundred St. Louis Transit sold between 12 and 12¼. Washington Traction preferred was heavy, declining from 45 to 44¾ on sales of 1500 shares.

Continued rumors of a deal in Cincinnati, Newport & Covington Light & Traction gave the issues of this company another bullish movement in Cincinnati last week. It is reported that the company is to be absorbed by outside interests, but all efforts to secure any confirmation of the rumors are unavailing, and the statement is made that no such deal is under consideration. The common stock of the company advanced from 29⅞ to 32½ on sales of over 1900 shares, while the preferred had a range of from 84⅞ to 87¼ on sales of about 1000 shares. Detroit United, which has been quite active, suffered a decline the middle of the week due to the report that the dividend on the stock would be deferred for one month. The company has announced that this action is taken in order that the semi-annual bond interest and the quarterly dividend shall not fall on the same date. The stock opened at 63½, declined to 61¾ and advanced again to 64. Sales about 1000 shares. Cincinnati Street Railway was rather quiet, sales about 200 shares, with a range of from 137½, for a very small lot, to 139. A small lot of Miami & Erie Canal sold at 11, the outlook for this proposition seems more promising. Cincinnati, Dayton & Toledo sold at 20¾, and Columbus Railway preferred at 106½. Several lots of Cincinnati, Dayton & Toledo 5s aggregating $10,000 worth sold at from 79 to 80½.

Continued demand from Cincinnati for Cincinnati, Dayton & Toledo dislodged about 150 shares at 20¾ in Cleveland last week. Northern Ohio Traction & Light advanced from 15 to 15⅛ on sales of 110 shares. A small lot of Cleveland Electric sold at 71¾, a slight decline. Miami & Erie Canal came into the trading at an advanced figure at 11⅞, and then went to 13. Monday a small lot of Cleveland Electric sold at 72.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid March 15	Closing Bid March 22
American Railways	43	43
Aurora, Elgin & Chicago (preferred)	a55	—
Boston Elevated	138¼	138½
Brooklyn Rapid Transit	41⅜	43
Chicago City	157	*158
Chicago Union Traction (common)	5	6
Chicago Union Traction (preferred)	30	30½
Cleveland Electric	72	73½
Consolidated Traction of New Jersey	62	63
Consolidated Traction of New Jersey 5s	105¼	105½
Detroit United	61	64
Interborough Rapid Transit	105	108¼
Lake Shore Electric (preferred)	—	—
Lake Street Elevated	1¾	1¾
Manhattan Railway	*141¼	143¼
Massachusetts Electric Cos. (common)	18	19
Massachusetts Electric Cos. (preferred)	71½	72
Metropolitan Elevated, Chicago (common)	14	16½
Metropolitan Elevated, Chicago (preferred)	43¼	a48½
Metropolitan Street	107½	112⅛
Metropolitan Securities	77¾	77
New Orleans Railways (common)	8	9
New Orleans Railways (preferred)	29	29
New Orleans Railways 4½s	78	79
North American	88¾	85¼
Northern Ohio Traction & Light	14¾	14½
Philadelphia Company (common)	38	40
Philadelphia Rapid Transit	13½	14
Philadelphia Traction	*95¼	95½
St. Louis Transit (common)	12¼	12
South Side Elevated (Chicago)	90	90½
Third Avenue	114	120½
Twin City, Minneapolis (common)	88½	92
Union Traction (Philadelphia)	47½	48½
United Railways, St. Louis (preferred)	51	54½
West End (common)	91½	90
West End (preferred)	109½	109½

a Asked. * Ex-dividend.

Iron and Steel

Reports from the iron trade, while rather more conflicting during the past week than they have been recently, are still in the main encouraging. Demand for pig iron continues heavy and, although the majority of consumers are still buying only from hand to mouth, there are a number who have begun to place orders for as long as three months ahead. In the finished branches of the industry the situation is more uncertain, the railroads are still keeping their purchases at a minimum, the volume being less than half what it was a year ago. This is being felt to such an extent in the steel billet manufacture that there is some question as to whether lowering of prices will not be necessary. The threatened strike in the building trade in New York is another possibility which cannot be viewed without some uneasiness. Quotations are as follows: Bessemer pig iron $13.80, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 12½ cents, tin 28¼ cents, lead 4⅝ cents, and spelter 5 cents.

ANOTHER CAR HOUSE FIRE IN CHICAGO

On March 20, just one week after the destruction by fire of the car houses of the Chicago Union Traction Company at Blue Island Avenue and Leavitt Street, the car house of the company at Western Avenue and Division Street was destroyed. There has been some talk of incendiaries, the two fires occurring so close together. It is stated, however, that the Western Avenue fire was first seen in the vicinity of a sand drier. The wind was high at the time, the flames spread rapidly and soon the building was totally destroyed, together with 103 cars. In the fire of the week before 250 cars were lost. The total loss in the last fire is variously estimated at $100,000 to $250,000. Of the cars destroyed 41 were summer cars, 60 closed cars, and the balance sweepers and snow plows. Thus, within a week, the company lost 273 cars. Both losses, however, were fairly well covered by insurance. A dispatch from Chicago says the receivers of the company will order 100 new cars in a few days.

ANOTHER RACE ON THE KANSAS CITY-LEAVENWORTH LINE

There was telegraphed to the East a few days ago and printed in the daily papers a story of a race between an electric car on the Kansas City-Leavenworth Electric Railway and an express train of the Missouri Pacific Railroad, in which the electric car beat the locomotive. Stories of this kind are being published with increasing frequency, and there seems to be little reason why they are given such prominence. On the Kansas line it is nothing new for electricity to vanquish steam, and the only excuse for the publication of the article seems to be that the trial was arranged "with malice aforethought," as the managers of the electric railway and other officials were aboard the electric car. One newspaper in the East has gone so far as to expatiate upon the subject editorially, and, taking itself seriously, tells its readers that "the Kansas City race was picturesque and even suggestive, but it does not really prove anything as to the relative speed capacities of the two motive powers."

TO INCREASE NUMBER OF COMMISSIONERS IN NEW YORK

Governor Odell of New York has sent to the Senate for confirmation the nomination of Frank M. Baker to be State Railroad Commissioner, to succeed himself. The nomination has been referred to the committee on railroads.

The expectation that the Legislature will pass, and Governor Odell will sign, a bill increasing the number of State Railroad Commissioners from three to five, received corroboration March 22, in the introduction by Chairman Bedell, of the Assembly railroads committee, of a bill to that effect. There is already before the Assembly a bill to this end, introduced by Mr. Wallace in behalf of the board of trade and transportation. The Bedell bill not only provides for two additional commissioners but also allows the expenditure of $100,000 by the board (instead of but $60,000 as at present), exclusive of rent and cost of printing the annual report.

The Wallace bill requires that the two additional commissioners shall be residents of New York City and civil engineers. The Bedell bill makes no specifications as to the additional members, either as regards their residence or otherwise, save that they, like the present three commissioners, shall be appointed by the Governor.

FROM BUFFALO TO ROCHESTER

George A. Ricker, chief engineer of the Buffalo & Depew Railway, which is to run through to Rochester from Buffalo, says that no time will be lost in rushing the work just as soon as the weather modifies. Ten miles of the heaviest grade east of Depew were completed last fall, when the cold weather stopped operations. It is the intention of the company to connect Buffalo and Batavia this year. The line as located passes through one of the most fertile and productive sections of the State. When this extension is completed the cars will leave Buffalo at a point near the Soldiers' Monument, in front of the Buffalo Library, and passing to and out Genesee Street to Pine Hill, where the present double-track line to Depew begins. After passing through Depew and Lancaster, the line parallels the New York Central, a short distance north of the latter company's tracks to Batavia, continuing through Grimesville, Looneyville, Wende, Crittenden, Corfu and West Batavia. After leaving the city of Batavia the line continues to the eastward, passing through the villages of Stafford, Le Roy and Caledonia. The line then continues through the village of Mumford, and from this last point by private right of way, after which the cars may run at high speed through Clifton and Chili to Maplewood, which is just south of Rochester. From Maplewood to Genesee Street at the southerly line of the city of Rochester, the line is in the River Road, where the traveler may enjoy the beautiful scenery of the Genesee Valley.

Entrance to the city of Rochester will be made by way of Genesee Street and the cars will run to the famous "Four Corners." It is expected that terminal negotiations with the International Railway of Buffalo and the Rochester Railway Company will be concluded in a short time.

When the entire line is completed and in operation there will be hourly service between the two cities.

THE OPPORTUNITIES IN THE ELECTRICAL BUSINESS

The electrical section of the Western Society of Engineers, of Chicago, listened to a paper on the above subject by George A. Damon, the evening of March 18. Mr. Damon had collected statistics from one hundred young, successful electrical men in Chicago. It is interesting to note that nearly all of those to whom Mr. Damon's list of questions was addressed responded. These questions deal with the technical training and preparation which had been enjoyed by these men and also with recommendations as to the training of the coming generation. The results of Mr. Damon's inquiries were presented in an attractive way, and in a way which made them valuable. The general interest in the subject was manifested by the fact that it proved to be the largest meeting ever held in the Western Society rooms. The entire evening was taken up with a discussion of the paper, which had been sent out in advance, and as much more time could have been profitably taken up by the discussion had it been available.

THE FIFTH ANNUAL CONVENTION OF THE SOUTHWESTERN GAS, ELECTRIC & STREET RAILWAY ASSOCIATION

A joint meeting of the Southwestern Gas, Electric & Street Railway Association and of the Southwestern Electrical Assocciaion is to be held in Dallas on April 25, 26 and 27. The convention will be held at the auditorium of the Commercial Club and the headquarters of the associations will be at the Oriental Hotel. Preliminary plans have also been worked out for the consolidation of the two associations, and if this step is approved by both organizations, the consolidation will be effected at the meeting in Dallas. The membership of both organizations is about 200.

The territory of the Southwestern Electrical Association is Indian Territory, Oklahoma Territory, Kansas, Arkansas and Texas; of the Southwestern Gas, Electric & Street Railway Association is Indian Territory, Oklahoma Territory, Arkansas, Louisiana, Texas, New Mexico, Old Mexico.

The following subjects among others will be discussed at the meeting next month: "Advantages of the Combination of Gas and Electric Light Plants," The Operation of the Single-Phase Motors from the Central-Station Standpoint," "Framing of City Franchises for Public Service Corporations," "Combination of Public Utilities in Small Cities," "Water Purification Processes and their Values," "Economics of the Meter," "Benefits and Evils of Telephone Competition," "Accidents on Street Railways and Damage Suits," "Central-Station Accounting," "Electricity and Risks, Requirements of the National Board of Underwriters in the Southwest," "Development of Interurban Railways in the Southwest," "The Development of the Modern Gas Plant."

THE RAPID TRANSIT BILLS IN NEW YORK

The attempt to extend the municipal credit of New York beyond the $50,000,000 bond limit authorized by law for the construction of tunnels in New York, has resulted in queer complications at Albany. To carry on the extension of the rapid transit system, as planned, a bill was sent to Albany abolishing the restriction of $50,000,000. The passage of that bill would allow the commission to go ahead and let the extension in Manhattan, on which the New York City Railway Company is anxious to bid in competition with the Belmonts, and the extension of the Brooklyn tunnel. This bill was consolidated with two Elsberg bills left over from last year, the intention being to defeat the new bill, so it is said. The Rapid Transit Commission voted Friday, March 18, to send representatives to the committee hearing this week to urge the separation of these bills and the passage of the one extending the power of the commission to do with municipal ownership and operation. The Elsberg bill, however, aims at direct municipal construction of future subways and separate contracts for operation, with the alternative of operation by the municipal authorities themselves. Under the present law the commission contracts for the construction of the subway with funds advanced on the credit of the city, and the contractor is bound to equip and operate the roads and by way of rental to pay the interest on the city bonds and provide for their liquidation at the end of the contract period, when the whole property will come into the city's possession without any cost to itself and with the privilege of making new contracts for operation. If there should be a separate and independent contract for construction, without any assurance that the contractor would have the privilege of operating the new lines, this advantage of rapid and economical work would be lost.

REORGANIZATION OF THE KUHLMAN CAR COMPANY

As already announced in these columns, a deal has been effected whereby the J. G. Brill Company obtains control of the plant and business of the G. C. Kuhlman Company, of Cleveland. At a meeting of the company held last Tuesday, Samuel N. Curwen, of Philadelphia, was elected president of the reorganized company to succeed Fayette Brown, of Cleveland. Charles A. Ricks, secretary of the company, continues in office. The Cleveland members of the new directorate are: R. A. Harman, C. E. Cowen, P. M. Hitchcock and D. B. Dean.

THE RIGHT TO REGULATE FARES IN MASSACHUSETTS

The decision of the Massachusetts Supreme Court declaring that the right to regulate street railway fares rests solely with the Legislature, acting through the Railroad Commissioners, is of such import that it is the purpose here to give a brief outline of the case, supplementing the announcement of the decision made in the STREET RAILWAY JOURNAL of March 12. The decision, of course, makes it useless for the Selectmen of towns and the municipal officers of cities, in granting franchises, to attach provisions regulating the rate of fare to be charged.

The question was brought before the court by Albert Keefe, of Somerville, who sued the Lexington & Boston Street Railway Company for 5 cents. Mr. Keefe claimed that he was overcharged this sum on Oct. 5, 1902, when riding from Concord to Arlington Heights. Attorneys for the railroad claimed that the Selectmen of Concord and Bedford had no authority to impose the regulations as to the fares, which the plaintiff alleged had been violated. The defendant's attorneys further claimed that even if the restrictions were found to be legal, the interpretation of the company should be adopted, and finally that the charge was entirely reasonable and proper under any interpretation. The court brushed aside the latter two points and decided the case on the broad ground of the illegality of the provisions as to fares.

In the opinion, drawn by Chief Justice Knowlton, it is said that the statute gives to the directors primarily the right to fix and regulate fares and then makes their action subject to revision by the Railroad Commissioners, who are to act upon broad considerations of public policy. The court says: "With street railways extending long distances and passing through numerous towns and cities, it would be unwise and inexpedient to permit each town to fix the fares within its boundaries, as a condition to granting a location. The purpose of the Legislature to prescribe broad and general provisions for the regulation of fares is further emphasized by the statute of 1901, which puts street railways upon precisely the same grounds as railroads as to provisions relative to changes and regulations of their fares."

EXPERIMENTING WITH TRAINS FOR RUSH-HOUR SERVICE IN CLEVELAND, OHIO

The Cleveland Electric Railway Company is experimenting with large, double-truck trail cars for rush hour and summer service. A two-car train has been placed in operation on Euclid Avenue, and on one trip recently carried 220 passengers. The motor car of each train is equipped with four 40-hp motors, and both cars are equipped with air brakes. The company is making this experiment with a view of purchasing a number of convertible trail cars of a new type, designs for these cars having been submitted by the J. G. Brill Company. The vestibule will be at the side and there will be no platforms. The capacity will be forty-nine passengers. It is the plan to have two conductors, and on the trains tried recently there was an extra trolley man.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

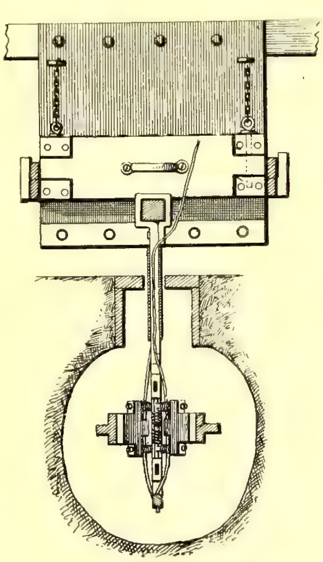
UNITED STATES PATENTS ISSUED MARCH 15, 1904

754,473. Guide Wheel; Alexander H. Mathesius, Brooklyn, N. Y. App. filed Feb. 14, 1901. The cross section of the conductor and the tread of the trolley wheel are so related in shape as to reduce slipping and abrasion of the contact surfaces.

754,551. Emergency Car Brake; Stephen A. Duvall, Penrith, W. Va. App. filed Dec. 8, 1903. Spring-pressed rail grippers are hung in a suspension-bar held normally elevated, but adapted to be lowered to grip the rails.

754,603. Mechanism for Operating Car Brakes; John L. Peacock, Buffalo, N. Y. App. filed Sept. 3, 1903. Comprises a pinion on the lower end of the brake-post, a gear in mesh with the pinion and integral with a spiral brake-chain drum adapted to operate with a variable leverage, the spiral tapering downward to a cylindrical part and of parabolic curve in its broadest portion.

754,778. Trolley Wheel Retainer; James A. Kilpatrick, Niles, Ohio. App. filed Dec. 19, 1903. A pivotally mounted retainer frame normally held horizontal by gravity and retainers carried by the frame normally extended across the conductor wire.


No. 754,832.

754,832. Electric Railway Plow; John H. Akers, Washington, D. C. App. filed Aug. 8, 1903. An electric railway plow having vertically hinged frames with horizontally projecting arms, shoes mounted on said arms to slide thereon and springs to force the shoes out and allow them to yield inwardly.

754,894. Self-Adjusting Wheel; Edgar A. Root and Charles M. Wallace, Huntington, W. Va. App. filed May 23, 1903. Details.

754,921. Brake Shoe and Method of Producing Same; Charles G. Ette, St. Louis, Mo. App. filed Oct. 30, 1903. The method consists in first producing an insert, coating it with a material which is a non-conductor of heat, and then casting the body portion of the shoe about the coated insert, whereby chilling and shrinking of the body portion about the insert is prevented.

PERSONAL MENTION

MR. PERCY CLIFTON, formerly superintendent of the White Line Electric Railway, of Sandusky, Ohio, has been appointed master mechanic of the Toledo & Indiana Railway, of Toledo, Ohio.

MR. JESSE SPALDING, a prominent capitalist of Chicago and a director of the Chicago Union Traction Company, died at his home in that city March 17. Mr. Spalding was seventy-one years old.

MR. G. P. ALTENBERG, manager of the foreign department of woodworking machinery in the world, is on his way to Europe.
of woodworking machinery in the world, is on his way to Europe.
He will visit England for a few weeks, and then tour the Continent. He expects to be abroad for several months. Letters will reach him, if addressed to Mr. G. P. Altenberg, No. 31 Boulevard Haussmann, Paris, France.

MR. CLARENCE O. SCRANTON has been appointed auditor of the Stark Electric Railway Company, of Alliance, Ohio. He formerly was auditor and general passenger agent of the Lake Erie, Alliance & Wheeling Railroad (steam).

MR. ALFRED BAKER, formerly manager of the London County Council Tramways, and now manager of the Birmingham Corporation Tramways, has been elected president of the Tramways & Light Railways Association, of Great Britain.

MR. A. BETTLES has sold his interest in the Coeur d'Alene & Spokane Electric Railway, of Spokane, Wash., and has resigned as second vice-president and general manager of the company. He is succeeded in his official positions by Mr. R. F. Blackwell.

MR. W. H. PAPE, formerly general manager and purchasing agent for the Butler Passenger Railway Company, at Butler, Pa., has resigned his position to become associated with the Galena Signal Oil Company, whose headquarters are at Franklin, Pa.

MR. H. M. HEATH has resigned as president of the Lewiston, Brunswick & Bath Street Railway, of Lewiston, Maine, in order to devote all his time to his private law practice. Mr. T. L. Peters, of New York, will act as president of the company until the annual meeting in May.

MR. JOHN J. LANDERS, formerly cashier of the Conneaut & Erie Traction Company, has been appointed general manager of the company, succeeding Mr. George E. Moffett, who has gone with an electric railway in Washington. Mr. Landers was formerly with a company at Scranton, Pa.

MR. GODFREY MORGAN, for some time superintendent of the Youngstown & Sharon Railway, of Youngstown, Ohio, has resigned, and will be succeeded by Mr. G. J. A. Paul, formerly chief engineer of the People's Light & Railway Company, of Streater, Ill. Mr. Morgan tendered his resignation some months ago, but it was not accepted until recently.

MR. G. G. CRANE has resigned as master mechanic of the Columbus, Delaware & Marion Electric Railroad Company, of Delaware, Ohio, to become master mechanic of the Joliet, Plainfield & Aurora Railroad, of Joliet, Ill. Mr. Crane's resignation from the Columbus, Delaware & Marion Company becomes effective April 1.

MR. PHILETUS W. GATES and MR. HENRY W. HOYT, respectively general superintendent and second vice-president of the Allis-Chalmers Company, are about to retire from active participation in the management of that company. Mr. Gates was president and Mr. Hoyt secretary and general manager of the Gates Iron Works for fifteen years prior to the incorporation of the Allis-Chalmers Company in 1901. They have been prominently connected with the manufacturing interests of Chicago and have taken an active part in all of the manufacturers' associations. Messrs. Hoyt and Gates, after a well-earned vacation spent in traveling, will re-engage in business in Chicago.

MR. MATTHEW R. BOYLAN has been appointed general auditor of the street railway department of the Public Service Corporation, of New Jersey, to succeed Mr. E. N. Hibbs, who resigned to take a position with the United Railway Company, of San Francisco. Mr. Boylan began his street railway career as stenographer to the late Mr. Charles B. Thurston, then president of the Jersey City & Bergen Railroad. When that road was taken over by the Consolidated Traction Company, and later by the North Jersey Street Railway Company, Mr. Boylan was appointed an inspector, and subsequently went through all the grades up to the position of assistant to Mr. Hibbs. Mr. Alonzo Dickson has been promoted to the position of assistant auditor.

MR. MATHEW C. BRUSH, who was recently appointed assistant to Mr. Adams D. Claflin, president of the Boston Suburban Electric Companies, has been promoted to the newly created office of general manager of the following companies, controlled by the Boston Suburban Electric Companies: Newton Street Railway Company, Newton & Boston Street Railway Company, Lexington & Boston Street Railway Company, Wellsley & Boston Street Railway Company, Commonwealth Avenue Street Railway Company, Westboro & Hopkinton Street Railway Company and the Norumbega Park Company. Until further notice Mr. Brush will have general charge of the operation of all the foregoing companies. The department of supplies has been abolished and all matters pertaining to the purchasing of materials and supplies will be hereafter in charge of Mr. Brush. All superintendents will report directly to him, and all matters relating to the operation of the companies will be in his charge.

NEWS OF THE WEEK

CONSTRUCTION NOTES

MONTGOMERY, ALA.—The City Council has passed an ordinance granting the Montgomery Street Railway Company a franchise to build on Cleveland Avenue from Stone Street to Mill Street, and thence on Mill Street west to the city limits.

OAKLAND, CAL.—It is rumored that H. E. Huntington is projecting an electric railway system in Richmond and Oakland. It is believed that rights of way, some on public thoroughfares, others on private lands, are being secured for the Huntington system.

OAKLAND, CAL.—Residents of the Peralta Heights district have undertaken the task of securing from J. H. Macdonald the assignment, in favor of the Oakland Transit Company, of the franchise for the piece of road known as the "Fourth Avenue Cut-off," and originally applied for by the Oakland Transit Company. When the franchise was advertised for sale, however, it was coupled with another on College Avenue, and after spirited bidding the two franchises were awarded to J. H. Macdonald, representing parties who, for the time being, have failed to make known their identity.

SACRAMENTO, CAL.—The Board of Supervisors has granted a franchise to construct and operate a street railway over the J. Street Road to the Sacramento Gas & Electric Railway Company.

SAN FRANCISCO, CAL.—In reference to the talk of electrifying part of the Southern Pacific Company's lines, General Manager Kruttschmitt, of the company, who has just returned from New York, says that plans are under consideration for changing the motive power of the local system in Oakland from steam to electricity, but that no definite plans have yet been decided upon.

SANTA CRUZ, CAL.—The right of way has been secured for the extension of the Santa Cruz, Capitola & Watsonville Railway to Capitola.

NEW HAVEN, CONN.—It is announced that the Wallingford Tramway Company, which holds a franchise to build an electric railway from the terminus of the Meriden Electric Railway in Wallingford to Montowese, will begin work very soon. The new road will be 7 miles long. A traffic arrangement by which cars will be run from Wallingford into New Haven had been entered into with the Fair Haven & Westville Railroad before the recent sale of the latter to the New York, New Haven & Hartford Railroad. The completion of this line will furnish an electric railway from Hartford to New Haven by the way of New Britain, Southington and Meriden, which is an indirect route. The New York, New Haven & Hartford now owns both the Meriden line, which forms an important feature of this through trolley route, and the Fair Haven as well, which will form its southern terminal. The Wallingford Company has an authorized capital stock of $500,000.

ATLANTA, GA.—At the next regular meeting of County Commissioners, which will be held on April 6, J. J. Spalding and Forrest Adair, representing the Atlanta Water & Electric Power Company and allied interests, will apply for a franchise for an electric railway from Atlanta to Bull Sluice. The right of way of the projected line extend along the Roswell public highway, and the road will be in operation by May, 1905, when Bull Sluice will be opened to the public.. The Atlanta Water & Electric Power Company is spending $1,500,000 on the big dam and other improvements at Bull Sluice, while the Morgan-Smith Company, of York, Pa., owners of 1000 acres of land fronting on the big lake, will expend a large sum in beautifying its property.

JERSEYVILLE, ILL.—The City Council has granted to the Central Traction Company a franchise to construct an electric railway in the city on Prairie, State and other streets, covering a distance of 3 miles. The company expects to begin work within a few weeks. The line will also be extended to Hardin, Calhoun County.

STERLING, ILL.—The Dixon, Rock Falls & Southwestern Railway Company plans to begin the construction of its proposed line April 1. H. L. Sheldon, of Rock Falls, says all the preliminaries are fast being arranged.

EVANSVILLE, IND.—W. N. Harding and F. J. Shultz, representing Indianapolis and Chicago capitalists, spent a week here inspecting several routes for proposed interurban electric railways from this city.

FORT WAYNE, IND.—It is stated that work will be started at once on the Fort Wayne-Goshen line, the cost of which is estimated in the neighborhood of $2,000,000. The line will run northwest from Fort Wayne, passing Blue Lake, Churubusco, Syracuse, Lake Wawasee, Goshen and other important cities and lake resorts, and will proceed thence to South Bend by way of some of the most thriving cities in Northern Indiana.

GOSHEN, IND.—The voters of this city and township have rejected the proposition to vote a subsidy of $50,000 to the Winona, Warsaw & Goshen Traction Company. The sentiment expressed was that the company asked too much.

HARTFORD, IND.—Interests concerned in the Oil Belt Traction Company state that arrangements have been made in the East for the financing of the company. The construction mapped out for this year includes a line from this city to Fairmount and Alexandria, the ultimate object being to construct an extension to Celina, Ohio. J. P. McGeath, of this city, is interested.

JEFFERSON, IND.—Local capitalists headed by Hon. Louis Schneck and George H. Voight, have employed competent hydraulic engineers to examine Fourteen Mile Creek and the Tunnel Mill property with a view to utilizing the falls of the natural tunnel for developing power. If the report is favorable, and it is almost sure to be, a company will be formed to establish a power house for generating electricity by water power. The experts say that sufficient fall can be had to furnish 10,000 hp. It is the intention to operate an electric railway connecting this city and New Washington by this power.

LIBERTY, IND.—A fifty-year franchise has been granted by the commissioners of this county to the Interstate Traction Company, which proposes to extend the line from Dayton and Camden, Ohio, through this town, to Connersville, Ind.

NEW CASTLE, IND.—The Richmond & Northwestern Traction Company, recently reorganized, announces that the enterprise has been amply capitalized by Eastern financiers, and that the road will be built this spring. The City Council of New Castle has granted the company a franchise.

RICHMOND, IND.—The Commissioners of Wayne County have declared the franchise of the Union City & Traction Company forfeited. The franchise was granted two years ago, with a provision that the road should be in operation within that time. Subsidies were voted to the road, but never collected. The Columbus, Greensburg & Richmond now proposes to build through the same territory and the residents are encouraging the enterprise.

RUSHVILLE, IND.—The Columbus, Greensburg & Richmond Interurban Company has secured free right of way for its line from Greenfield and Carthage to New Salem, at which point the Greenfield line will connect with the main line from Columbus to Richmond.

CEDAR RAPIDS, IA.—The Eastern Iowa Railway Company has been organized with a capital stock of $10,000, to purchase, acquire, construct, maintain and operate railways of all kinds within Iowa and adjoining States. The officers are: A. F. Groeltz, president; A. D. Barnes, vice president; W. W. Chamberlain, secretary and treasurer. All the officers are residents of Cedar Rapids.

IOWA CITY, IA.—The City Council has voted a franchise to the Iowa City, Davenport & Muscatine Electric Railroad Company. The company plans to build from Iowa City to Davenport, a distance of 53 miles.

SIOUX CITY, IA.—The Sioux City Traction Company plans a number of important improvement during 1904. The principal improvements will be the double tracking of the East Fourth Street line, the broadening of the gage of the stock yards line down Iowa Street from Fourth Street, and the completion of the double track of the Riverside line. Rails have been unloaded for the East Fourth Street track. The gage of these tracks and all other new tracks will be standard. Ten new trailers for the Riverside service are being built at the shops of the company. Six new cars for the stock yards line are also being constructed. In the construction of these six cars nine of the old short cars of the inside lines are being used.

LOUISVILLE, KY.—The Council has passed the ordinance granting the Louisville & Southern Indiana entry to this city. The ordinance granting the company the right to build a viaduct to connect with the Big Four Bridge was also passed.

LEXINGTON, KY.—Judge Phil. T. Van Site, of Detroit, Mich., attorney for Senator George B. Davis, of that city, who proposes to build electric railways from Lexington to Versailles, Frankfort, Richmond and Nicholasville, Ky., says: "I have heard some talk to the effect that Cincinnati and Hamilton capitalists would build the road between Lexington and Frankford. They may do it, but they will certainly not build it over the right of way obtained by Senator Davis. We have spent in the neighborhood of $100,000 in securing the franchise and grading for the road, and we do not propose to give up now. I want to state most emphatically that Senator Davis has the capital behind him to build the roads, and we propose to begin work on them in the very near future. All told, we expect to build in the neighborhood of 100 miles of road, which will cost us at least $12,000 per mile. This talk about County Court of Fayette and other counties taking away our franchise is nothing more than talk, for the very reason we propose to build our lines along private rights of way, and will not touch a single country turnpike. We paid a considerable amount of money for our country franchises, but I doubt if we will use any of them, but you can make the positive statement that every road in which Senator Davis is interested will be built, and we will begin work on the road between Lexington and Frankfort very soon." As stated several weeks ago, Cincinnati and Hamilton capitalists composed of O. M. Bake, F. W. Whitaker and Mr. Rice, of the Equitable National Bank, stated that they would in all probability build the road from Lexington to Frankfort, and over the route Senator Davis had laid out for his road.

NICHOLASVILLE, KY.—The Fayette Interurban Traction Company is applying for franchises in Woodford, Jessamine, Clark and Madison counties. The line to Versailles will be undertaken first and ground will be broken within a very short time. The Winchester line will likely be completed in the summer. The incorporators of the Fayette Interurban Traction Company are L. Gognets, J. W. Rodes, C. J. Bronston, Peter J. Powell, W. N. Bayne, T. H. Bronston.

SUMMIT, LA.—A survey has been completed for the electric railway between Summit and Magnolia.

SOUTH THOMASTON, MAINE.—The promoters of the Rockland, Owls' Head & South Thomaston Railway were here recently, and drove over the route of the proposed road. It is said that the contract for constructing the line will be let in a few weeks. Wm. H. Hill, Jr., has accepted the position of secretary of the company. Mr. Hill is a son of Wm. H. Hill, of Richardson, Hill & Company, bankers, of Boston.

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, APRIL 2, 1904. No. 14

Published Every Saturday by the

McGRAW PUBLISHING COMPANY

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: 929 Chestnut Street.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues)................................ $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

The Bonus Plan and Accidents

A number of companies have adopted the plan of giving a bonus in addition to the regular wages to motormen and conductors for operating during a given period of time without accidents. Just what the effect of such practice will be in the long run, is hard to determine by a few months trial. In some cases the bonus arrangement has been made to take the place of an increase in wages. In such a case, it means practically an increase in wages for a large percentage of the men, and tends to make them more careful. Some companies which have tried it, believe thoroughly in the system; others fear that the tendency which it has to make the motormen and conductors fail to report petty accidents is likely to result in more harm than the accidents which would occur if the bonus was not given. As one manager, who is opposed to the system, put it, "It is not the large accidents that are the most to be feared from a financial standpoint; such accidents are to be regretted and avoided, but a certain number of them are inevitable in the operation of any street railway system. When they are due to the fault of the company or its employees, claims arising from such accidents should be paid promptly as a matter of course. What companies have occasion to fear the most is the multiplication of claims arising from petty accidents which are never reported, or fake claims which are without any foundation. Anything which tends to withhold from the company full information about these petty accidents puts the company at a disadvantage in handling damage claims arising from them."

It would seem that this objection to the system of paying a bonus for freedom from accidents would depend very much on what the management of the company included as accidents when making up the list of those to receive the bonus. We believe most of the companies which are operating under this plan do not include petty accidents which cost the company nothing when deciding upon the motormen and conductors who are entitled to a bonus on account of freedom from accidents. In some cases, where the accident has resulted only in injury to some portion of the equipment, like the car body, it is the practice to charge the cost of the repair to the motorman and conductor. Of course, with accidents resulting in injury to persons, it is occasionally difficult to foretell whether the casualty will cost the company anything or not, but it seems as if at the end of two or three months, the claim department should be in a position to know what accidents could safely be counted out in the reckoning of the bonus.

An Exhibition Room

Street railway managers will watch with interest the way in which M. B. Hereley, general superintendent of the Chicago Union Traction Company, will work out his plan to establish an exhibition room for street railway appliances at the company's headquarters. While the scheme is not altogether new, if Mr. Hereley's present plans are fully carried out, the Chicago Union Traction Company will go further than any company has ever gone in the equipment of a room of this kind. A number of companies have construction rooms where the trucks and electrical equipment are so arranged that employees can go to the room and easily study the parts and method of operation of the electrical equipment. Mr. Hereley's plan is broader than this, as it consists of an invitation to all manufacturers of street railway devices suitable for exhibition in such a room, and of any possible merit, to furnish samples for exhibition and trial. The room is to be open to all employees, who will thus have a chance to become posted on some of the latest and best appliances brought out in the electrical railway field. If employees of the company are sufficiently convinced of the merits of any device for the particular use of the company, it will be given a trial. Suggestions from employees as to improvements on existing devices will be welcomed. Such an exhibition room should have considerable educational value. We can imagine that the management will have to exercise some judgment if the space is not to be all taken up by impractical inventions, but never-

theless, it will not be the intention to draw the lines too closely, as the exhibition room will, as far as possible, be run on a free for all plan, which will encourage ideas from everybody.

Why the Double Truck is Popular

Occasionally the controversy as to the relative merits of single and double-truck cars for street railway service in large cities breaks out afresh, but year by year there is less interest in this question, as the double-truck car with four-motor equipment seems to be becoming generally accepted as the proper thing in a large city. In spite of this fact, it is quite common to hear arguments advanced for the desirability of the double-truck four-motor equipment which are entirely fallacious. When we get to the bottom of the matter, it is not unlikely that the easy riding qualities of a double-truck car have had more to do with its adoption than anything else, even though that may not be the reason recognized by some managers who have adopted it. The realization of this was recently forcibly brought to mind by a well-known manager, whose system is equipped almost entirely with double-truck cars, and who has recently made very large additions to his rolling stock with cars of the same kind. He remarked that if he could build a new street railway system from the ground up, according to his own ideas, he thought he should equip it with single-truck cars. However, he had to take conditions as he found them, and a double-truck car rides much easier on an imperfect track than a single-truck car. For this reason, he has adhered to the double-truck car. He said it was a serious question in his mind whether the saving in conductors' and motormen's wages with a big car during rush hours would offset the large amount of power required to propel the extra dead weight around the streets during the hours when the cars were not filled. It is frequently argued that power is the cheapest thing that an electric railway company has, but when it comes to propelling a big double-truck four-motor equipment on a high schedule speed in city service, the power cost per car mile begins to run up in the neighborhood of the motormen's and conductors' wages. With the car making a schedule speed of 10 miles per hour, and trainmen's wages of 22 cents, the cost of wages per mile is 4.4 cents. If the car has a large four-motor equipment, it will take not less than 2.5 kw-hours per car mile, and it may often take considerably more at such a schedule. If power is delivered at 1 cent per kw-hour, the power would be 2.5 cents per car mile. Power is likely to cost more than the above figure delivered at the car, and the consumption of energy is equally apt to be more. When we consider how much dead weight or non-paying load we are obliged to propel around the streets during the middle of the day when long cars are used and the cars are not filled, it is to be seen that there is not a very overwhelming balance left in favor of the long car, even after we have taken out the saving in trainmen's wages during the rush hours. We have, nevertheless, a car which can be operated at fast schedule over much rougher track than would be permissible with single-truck cars, and in fact on anything but a most perfect track. The public has a strong preference for the double-truck car, partly because of this and partly because usually single-truck cars have longitudinal seats, while double-truck cars are most frequently equipped with cross seats. It is sometimes considered that because double-truck cars are much heavier than single-truck cars they are much more substantial from a structural standpoint, but it is a question whether the durability is enough greater to make up for the increase in weight. As a compensation for carrying around the extra dead weight of a double-truck car, there is the fact in favor of long cars, that a smaller number of train crews are required as extras during the rush hours than if single-truck cars were used with a larger number of trippers. This is assuming, of course, that double-truck cars are to be run partially empty during the middle of the day, as is almost invariably the practice where these cars are in use. A reduction of the number of trippers is usually desirable, from a superintendent's standpoint, because of the difficulty of giving trippers and extras enough hours of work in a day to keep good men in the service. Taken altogether, the two real decisive and underlying reasons for the adoption of the double-truck car seem to be its easy riding qualities and the reduction in number of trippers required.

Electricity for Elevated Railway Service

Although New York City is the metropolis of the Western Hemisphere, and prides itself on being in advance of many of the other cities in this part of the world, it was the last to adopt improved methods of street transportation. Both the authorities and public opinion prevented the surface lines from adopting the overhead system by what has always seemed to us an absurdly strained idea of street æsthetics, and while a practicable underground conduit system was finally developed by the courage and ingenuity of those in charge of what was then the Metropolitan Street Railway Company, it was only by an enormous expenditure of capital and time.

The elevated railroad system in New York was also the last in this country to adopt electricity as a motive power. Although at the time that operation was commenced, third-rail roads on both surface and elevated structures were in common use in all parts of the country, there was considerable skepticism expressed in the daily papers as to the possibilities of commercial success. These criticisms were especially pronounced about fifteen months ago, when after a memorable sleet storm there was some delay in the operation of the elevated electric trains. In spite of the fact that the management took every pains to assure the public that these troubles were only temporary and were caused principally by the fact that the line was not completely equipped with electric power, but had a divided service of steam and electric cars, the dissatisfaction was very general.

We took occasion at that time to call attention to the fact that these fears were absolutely unfounded, and that the troubles were of a temporary character only. The occasion for referring to this matter now is that the winter of 1903-04 has practically passed, and in rigor has exceeded, according to the records of the Government Weather Bureau, any since its establishment, over thirty years ago. In spite of this fact, the elevated railroad company has had no difficulty in moving its trains at all times during the year, and has successfully demonstrated the contention which it maintained at the opening of the road, viz., that the electric system was as reliable as it was superior to steam power for the transportation of passengers. As we have stated in previous editorials and in our news columns, the road is now carrying more passengers daily than at any other period in its history, even on the days of greatest traffic with steam, and with practically the same trackage, nearly twice as many persons as were formerly considered a maximum haul under average conditions. Railroad managers are often obliged to suffer abuse, and we believe that it is equally just to award them the meed of praise when it is their due.

Switching Problems

Mr. Stillwell's paper on group switches, published in this issue, calls up some interesting reflections on the switchboard problem in general. It is no easy matter to realize the change which the last few years have made in the necessities for current handling appliances. In the days when generators of a few hundred kilowatts' capacity were ample for the needs of the largest railway power houses, the control of the energy was a very simple matter indeed. Almost any kind of a switch, if fairly well designed, and of ample size, answered all reasonable requirements, and manual operation was the universal rule. If the circuit-breakers had replaced fuses they were as likely as not tied up to avoid the trouble of closing them. But in these days of enormous direct-connected units, the switchboard of a large station may well cost more than the whole equipment of a station ten years ago, and its design is squarely in the category of heavy engineering. Even the laws of energy in the switchboard connections ceases to be anywhere nearly negligible, and the entire problem takes on a serious aspect. Among switchboard designers there are two radically different points of view. One favors connections of the simplest practicable kind, and the taking of whatever chances may be necessary to preserve simplicity. The other endeavors to include provisions for every possible contingency or combination of contingencies, so that no chances shall be taken in any event. The group switch discussed by Mr. Stillwell belongs to the armory of the second class named. Its function is to handle a group of feeders simultaneously inside the regular switches, an act which may sometimes be desirable. Its use is alien to the use of an extra switch on a single feeder, save in so far as it may be necessary to switch several feeders simultaneously. This matter of extra switches is one which has been often discussed without any definite results.

It seems to us that, as a practical matter, the weakest part of the system in a good many recent power houses, is that part which lies between the generator terminals and the exit of the feeders from the building. If extraordinary precautions are to be taken, it strikes us that they should first be directed to cutting the several generators clear of the switchboard and all that appertains thereto. If the whole board is relayed, as is now a rather common practice, the function of a group-switch as such seems to us comparatively insignificant, for with the relay switches under one's fingers, there is no time lost. In a manually operated board the group-switch may save valuable time, but very large station switches are seldom manually operated. As a practical question, therefore, we are disposed to look upon the group switch as a safety switch to stand behind the regular feeder switch in case of emergency. It thus is merely a species of insurance which may or may not be worth the while in any particular case. In a big station the results, when anything does go wrong, are so grave that it is worth while to be fairly liberal in the way of precautions. But precautions at the switchboard are only partial, as witness the celebrated case of the deflagrated cat, and the cable fire in the great Niagara plant. It seems to us that if we were building a great plant, we should not only get the best engineer obtainable to plan the work, but retain a second one merely as Devil's Advocate, to go around in a friendly endeavor to pick out the weak spots. You cannot make a plant quite on the lines of the famous "one horse shay," but it should be possible to avoid having a series of breaks of the same general kind. As a matter of fact, most of the shut-downs in large plants have of late been due to seemingly trivial causes. There is no unimportant link in the chain that furnishes power to a great system, and none that can safely be neglected.

Picking Men for Interurban Service

Every interurban manager is brought face to face with the question as to where best to secure his motormen and conductors. Some managers have a strong leaning towards steam railroad brakemen and conductors, because of their previous training in the operation of high-speed trains under train despatching rules and train despatchers. However, there are not usually anywhere near enough good men of this kind to fill the vacancies. It is, therefore, not uncommon to pick the best men from city street railway service. When interurban railroading is a few years older it will be possible to obtain more men trained by years of experience in the operation of high-speed cars under a despatching system. Until this has become drilled into a man, so as to become almost second nature, he can hardly be entirely satisfactory to serve on an interurban car as motorman or conductor.

A former steam railroad superintendent, who has recently entered the field of interurban management, recently expressed to us some ideas on interurban management which are worth considering. He believes in having as little "red tape" as possible in connection with the despatching system, but that when orders are given by a despatcher they should be safeguarded in every way possible. For example, cars which run through, from one terminal to another, report to the despatcher only once, as long as they are on schedule time. If the car gets off time or fails to meet the other car at a regular meeting point, so that despatcher's orders are necessary, he throws every safeguard possible around the receipt of the order. The conductor is required to write a duplicate order, and to read the order to the motorman. By reducing as much as can be the number of orders which must be received he believes that the men will be more careful when the emergency arises that an order must be taken, than if they were receiving orders at every turn-out with cars on time. He believes that the conductors and motormen should be held jointly responsible for an interurban car, just as are the conductor and engineer on a steam road. He has known of instances in steam road operation where the engineer has been prevented from pulling out, without orders, by the conductor. If only one man of the crew had been responsible, as on some interurban roads, the train would have gone ahead without orders.

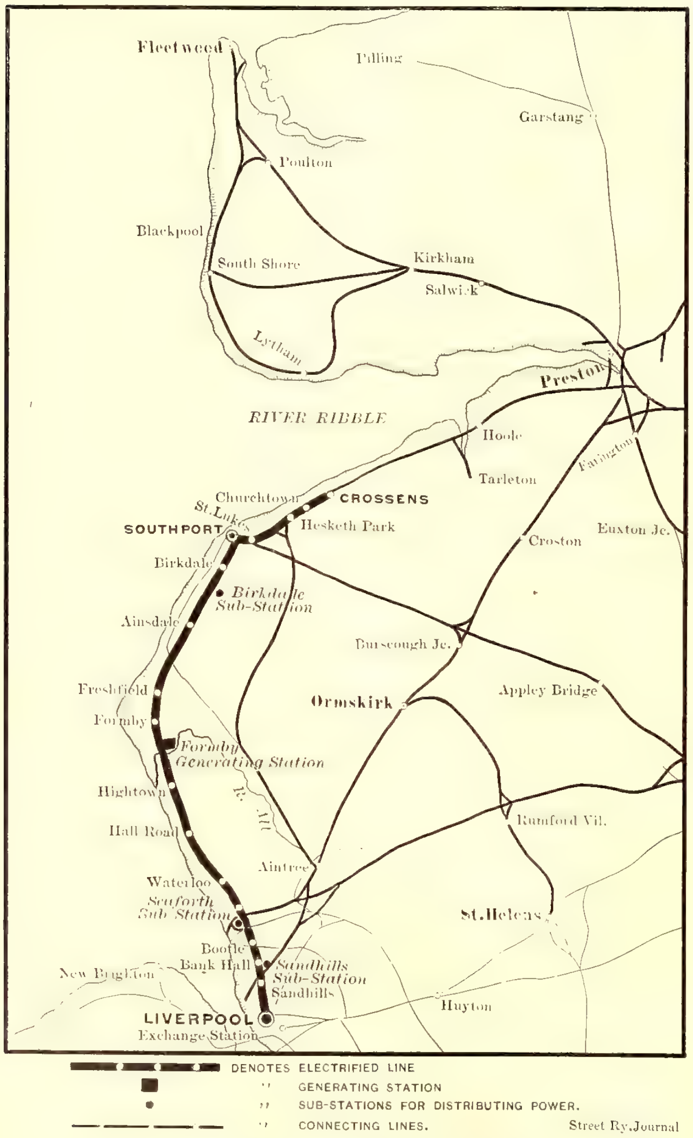
As regards collection of fares, he finds conductors trained in city service the quickest. Steam road conductors are accustomed to having plenty of time for the collection of fares between stations, and have little responsibility in the way of putting off passengers at signal stations. The street railway conductor, on the other hand, is accustomed to hustling to get his fares and to stopping his car at numerous places to let off passengers. He is, therefore, better trained for the multitude of details that an interurban conductor must look after than is the steam railroad conductor.

In selecting new employees it is an old question whether men trained in the city or in the country are best. The city-bred conductor is usually quicker at making change, in replying to inquiries from passengers and in understanding city conditions, while the man from the country is supposed to be more reliable and used to hard work. While it is difficult to lay down any general rule, we have found that most managers prefer the city-bred conductor, and some have very positive convictions on this point.

THE ELECTRICAL EQUIPMENT OF THE LIVERPOOL & SOUTH-PORT DIVISION OF THE LANCASHIRE & YORKSHIRE RAILWAY

Several short articles on the apparatus used in this system have already appeared in this paper, particularly in the issue of Jan. 30 last, but as the work is now completed opportunity is afforded for a full description. It is well known that the British steam railway companies have progressed farther than those in any other country in the actual equipment of their lines with electric power, and the Lancashire & Yorkshire Railway Company enjoys the distinction of being not only the first of these companies to put their trains in practical operation, but among the first of the steam railway companies in the world to operate electrically-equipped multiple-unit trains.

The plan for the electrical equipment of the Liverpool & Southport branch of the Lancashire & Yorkshire Railway had been maturing for a considerable time before any public announcement was made on the subject, and was made after a



MAP OF DISTRICT AROUND LIVERPOOL, SHOWING ELECTRIC LINE OF THE LANCASHIRE & YORKSHIRE RAILWAY

careful study of electric railway conditions in America and elsewhere. The scheme generally was originated by J. A. F. Aspinwall, the general manager of the company, who long ago realized the possibilities of great traffic development in the excellent residential districts which lie between Liverpool and Southport, and on the north side of the latter town, and which could not be satisfactorily served by a steam-train equipment.

The history of the equipment of the line, subsequent to the decision to employ electric power, can be briefly summed up. The entire contract, with the exception of the rolling stock, which was made at the Horwich and Newton Heath Works of the railway company, was entrusted to Dick, Kerr & Company, Ltd., of London, Preston and Kilmarnock, who have completed their work in a remarkably short time. Twelve months ago the work of construction had not been begun, yet on March 1, 1904, a scheme embracing 47 miles of permanent way, a

ELECTRIC TRAIN AT CROSSENS

transmission plant of 12,000 hp, and a complete train system has been carried out, all without interference with the running of the steam service.

The distance between Liverpool and Southport is nearly 18½ miles, the total length of track equipped being practically equivalent to 47 miles of single line. The grades on the road are slight, and there are but few curves, the steepest grade being a short length of 1 in 85 near Waterloo, and the sharpest curve one of 462 ft. at Southport. With these exceptions the line is level and straight. There are fourteen intermediate stations, which lie at an average distance of about 1 mile apart on the southernmost portion of the route, but are more widely separated on the northern portion. The traffic is almost wholly passenger, business people going to and returning from Liverpool in the morning and evening, with a considerable shopping and miscellaneous traffic during the day.

Under steam conditions there were about thirty-six trains per day in each direction between Liverpool and Southport; a similar number running in each direction between Liverpool and Hall Road, a station some 7 miles from Liverpool. The majority of these trains stopped at every station, a few expresses being run in the morning and evening for the accommodation of the business men. The running times of the trains were as follows: Express trains, 25 minutes; way trains, 54 minutes; Hall Road way trains, 25 minutes. The total train mileage per diem was about 1900.

With electricity the train mileage will be increased to 3200. The number of trains in each direction between Liverpool and Southport will be increased from thirty-six to sixty-five, and between Liverpool and Hall Road from thirty-eight to fifty-four. Moreover, the running time from Liverpool to Southport will be decreased from 54 minutes as with steam to 37 minutes, and from Liverpool to Hall Road from 25 minutes to 17 minutes; the schedule time of the fast trains will remain unaltered, but there will be an express in each direction hourly, instead of only rarely. In addition to this the express trains will run on to Crossens, giving that suburb a service of seventeen trains each way during the day. These arrangements, however, do not represent the ultimate capacity of the line, and if the traffic in the course of a year or two were to demand it, there would be

no difficulty in running an even more frequent service. It is intended to shorten the stops at the intermediate stations, and as this will make fresh arrangements necessary to deal with baggage and parcels, a special baggage car has been built to deal only with this service. This car will make numerous trips between Liverpool and Southport, and will immensely increase the ease and rapidity with which parcels can be delivered in the residential districts between Liverpool and Southport.

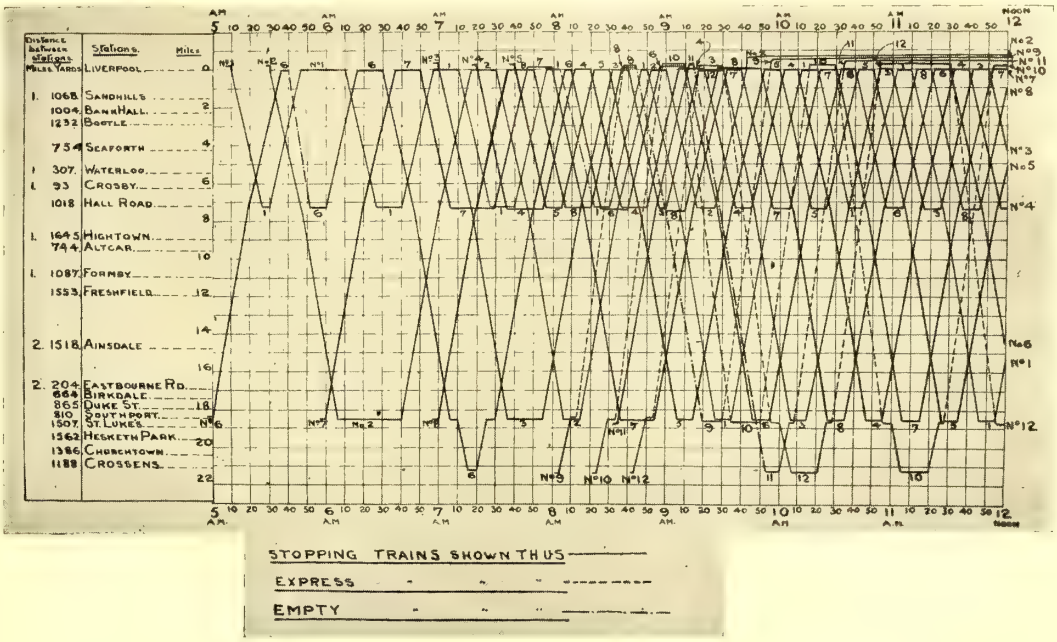


DIAGRAM OF TRAIN SERVICE ON LIVERPOOL & SOUTHPORT DIVISION

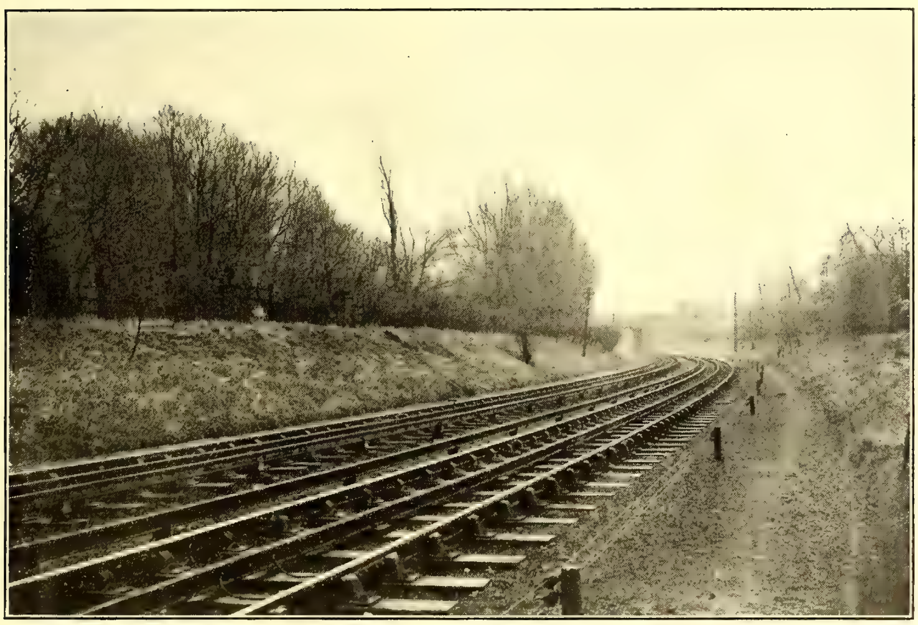
GENERAL OUTLINE OF SYSTEM

The portion of the line which has been electrified is shown on the map, and it is obvious that the distance, quite apart from conditions of service, demanded a system of high-tension transmission. The electrical energy is generated as three-phase alternating current of 7500 volts pressure, and transmitted direct to sub-stations, where the voltage is stepped down by statics and transformed by rotary converters into direct current of 650 volts pressure, the maximum voltage at the train being 600.

The power house is situated approximately about the center of the line, near Formby, directly on the River Alt, being thus favorably situated as regards economical distribution and a plentiful supply of water. The power house is utilized at the same time as a sub-station, from whence part of the electric energy is distributed direct to the adjacent track. In addition to the rotary converters at the main power house the scheme embraces three sub-stations, the first being at Sandhills, the second at Seaforth, and the third at Birkdale. The distances of these sub-stations from Liverpool are as follows:

Sandhills sub-station, distance from Liverpool, 2 miles.
Seaforth sub-station, distance from Liverpool, 3¾ miles.
Formby power house sub-station, distance from Liverpool, 10¼ miles.
Birkdale sub-station, distance from Liverpool, 16⅛ miles.

Near Liverpool it has been necessary to arrange the sub-stations closer together than on other parts of the line, in order to cope with the considerably heavier traffic of the local trains running from Liverpool to Hall Road, and vice versa. The extreme ends of the line—from Sandhills sub-station toward Liverpool, and from Birkdale sub-station toward Southport and Crossens—are each fed by one sub-station, while for the intermediate sections of the line two sub-stations supply the energy. The sub-stations are situated near the track, thus avoiding any low-tension cabling, except a short connecting length.



SECTION OF TRACK ON CURVE, SHOWING THIRD RAIL AND RETURN RAIL

The system is arranged so that any sub-station can be disconnected if required.

POWER STATION

The equipment of the power house has been laid down on simple lines, and there are none of the unnecessary luxuries and refinements which characterize many of the modern power and lighting plants. The building is a plain and substantial one, with no ornamentation, but admirably adapted for the purpose for which it was constructed. It consists of two divisions, the engine room being 280 ft. x 65 ft., and the boiler house, which is 50 ft. wide with similar length of 250 ft. The building consists of a steel roof in two bays, carried upon steel columns, all of which are independent of the brick-work. The engine room is provided with admirable lifting and traveling machinery, in the way of overhead cranes, which are capable of dealing with pieces of machinery up to 20 tons, and which are operated electrically. They were built by Jessup & Appleby, of Leicester.

For obvious reasons the size of the units is as large as possible, compatible with the running of a reduced service with a good load factor.

There are installed four 1500-kw units, of which three will, under normal conditions, meet the demands. In addition, there is a fifth unit of 750 kw, which will form a useful link between

the larger units, and thus permit considerable flexibility in obtaining a good load factor with high efficiency.

The four main engines are of the horizontal cross-compound type, the fifth engine being a vertical cross-compound. The horizontal engines have cylinders 32 ins. and 64 ins. in diameter, 54-in. stroke, and run at 75 r. p. m. The normal load of each engine is 2310 hp, with a steam pressure of 160 lbs. per square inch, but they are designed to give an overload of 20 per cent. The main engines, as well as the boilers, were supplied by Yates & Thom, as sub-contractors to Dick, Kerr & Company, Ltd. The cylinders of the main engines are of the built-up type, with separate ends and barrel, the valves, which are of the double-ported type, being placed in the cylinder ends, the cylinder end thus forming the steam box. The exhaust valves have a plain motion, derived like the motion for the steam inlet valves, from eccentrics fixed on the crank shaft. The question of government is an extremely important one in work of this character, and specially powerful and sensitive governors have been fitted to the engine, in connection with which are several devices, designed for securing good parallel running, and for dealing with greatly varying loads. Each governor is also fitted with a special safety stop arrangement, which will completely stop the engine in the event of its reaching a speed 10 per cent above the ordinary working speed, and will also shut down the plant in the event of any failure of the governing gear, yet this is accomplished without interfering with the engine taking excessive overloads, even beyond the full range of the cut-off gear.

GENERAL VIEW OF INTERIOR OF POWER STATION

Each cylinder is bolted at the front end to a massive cast-iron bed frame of the Corliss trunk type, having bored out guides formed in them for the piston rod cross-heads, the outer or bayonet ends of these frames being bolted up to suitable facings cast on the crank shaft pedestals, which are large independent castings resting directly on the foundations. The Corliss trunk frames are so designed as to bear upon the foundations throughout their entire length. Each fly-wheel is 22 ft. in diameter, and is directly attached by strong bolts to the rotor, which is otherwise independent of the fly-wheel.

The engines are solidly constructed, and of massive proportion, the weight of each bed-frame being 14½ tons. Each crank shaft main bearing weighs about 11 tons, and the crank shaft 17 tons, the crank weighing 5 tons each.

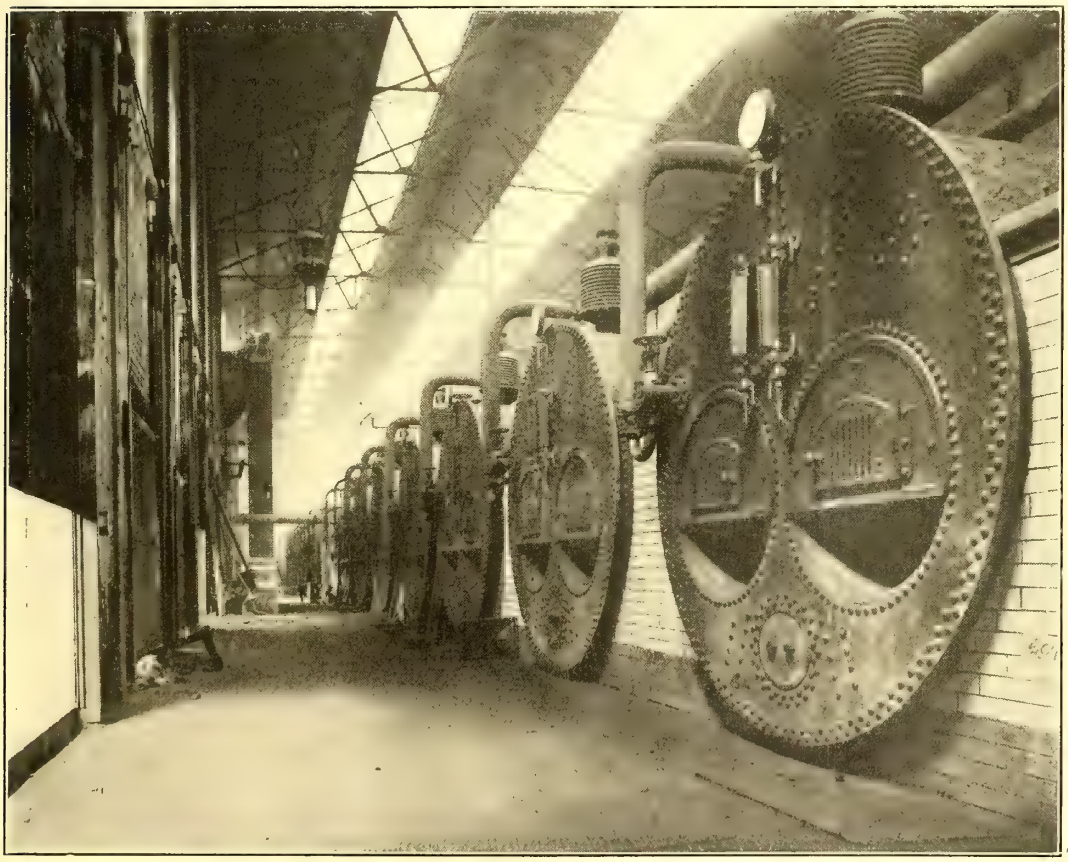
The pistons are of cast-iron, fitted with Ramsbottom rings, the low-pressure pistons having also bands of white metal, to improve their wearing properties. The piston rods are made of Siemens-Martin steel, secured to the pistons by means of large

nuts. They are cottered into the cross-head in the usual way, and carried through the back ends of the cylinders, being made of a large size so as to serve as a substantial support to the weight of the pistons.

The cross-heads are made of wrought-iron of the solid type, fitted with gunmetal steps, having suitable adjustment. The connecting rods are made of wrought-iron, the crank pin ends being solid, and the cross-head end of the jaw type, fitted with hard steel pins, held in place by large nuts. The crank pin steps are of gunmetal, lined with babbitt metal, and provided with suitable wedge adjustment. The crank shaft is made of Siemens-Martin steel. The crank shaft main bearings are of cast-iron, lined with babbitt metal, fitted with a special arrangement of oil pipes, giving ample lubrication.

A very complete system of lubrication is employed, the various parts of the engines being protected against splashing by oil throwers.

Each engine is fitted with a condensing apparatus, consisting of two Edwards air pumps, worked from the low-pressure tail-rod by means of links and levers. The condenser, which is of the jet type is suitably placed relatively to the cylinder and to the air pumps, and has in connection with it a sluice valve and an automatic exhaust valve, so that the condensing apparatus can be thrown out of action, and the engines run non-condensing when required.



GENERAL VIEW IN BOILER ROOM OF POWER STATION.

The vertical cross-compound engine has cylinders 23 ins. and 46 ins. in diameter, 3-ft. 6-in. stroke, and will develop 1180 hp when running at 94 r. p. m. The general construction of the cylinders, valve gear and other parts is similar to that of the horizontal engines described, the main difference being in the framework and staging. A similar arrangement of condensing apparatus has also been adopted, the air pumps being worked by means of levers from the low-pressure main cross-head. With each engine is also supplied a barring gear, driven by a small electric motor.

The alternators are three-phase, 25 cycles, the larger running

EXTERIOR OF POWER STATION

at 75 r. p. m., and the smaller at 94 r. p. m., with a pressure of 7500 volts. These machines, along with the remaining electrical plant, were made at the Preston Works of Dick, Kerr & Company. Each rotor or magnet wheel is carried between the cranks, the armature ring, or stator, being erected on its own slide beds, concreted in and bolted down on the engine foundations. The rotor of the 150-kw generator carries forty radial cast-steel poles of oval section, secured by tap bolts to the outside rim of two finished cast-steel rings of massive T-section, carried and driven from a central cast-iron spider through the medium of sixteen axial bolts.

The pole tips are of laminated steel with central air space, corresponding to grooves on the pole sides and the clearance between the rotor rings, dovetailed tight into the poles to keep the field coils in position. These are of bare copper strip, wound edgewise. The surface of the coils is left bare to aid the dissipation of heat, while the central ducts on the poles give ample ventilation to the iron. The cast-iron spider is built in halves and clamped to the shaft by four heavy bolts. The magnet rings are also in halves, but staggered relative to each other and the spider and shrunk together by double headed keys. The cast-iron slip rings are of stiff section, carried on either side of a cast-iron spider by axial bolts insulated with ebonite. On each slip ring there are three carbon brushes. The weight of the magnet complete is about 48,500 lbs., of which the poles account for 12,800 lbs., and the spools 6350 lbs.

The core segments of the stator are of annealed iron, punched

in sections with their paper insulations. The sections break joints to equalize the reluctance, and are strung on through bolts that clamp them up between a deep internal flange and a stiff cast-iron ring built in sections. The complete stator weighs 75,800 lbs.

Each coil is fully insulated, dried and tested to 15,000 volts before being inserted in the slots, the stator when completed being adequately tested. Special ventilation ducts are provided, the rotating field forcing cool air through these ducts and out at apertures cored in the frame. The winding of each phase is distributed over two slots per pole. The connection is star with center earthed. The stator terminals consist of three high-tension porcelain pots carried on a bracket at the bottom of the frame and enclosing the bare couplings. In each alternator provision is made for shifting the stator axially by ratchet jacks to clear the rotor and give comfortable access to the windings.

The constructional features of the 750-kw alternator are almost identical with those of the 1500-kw sets.

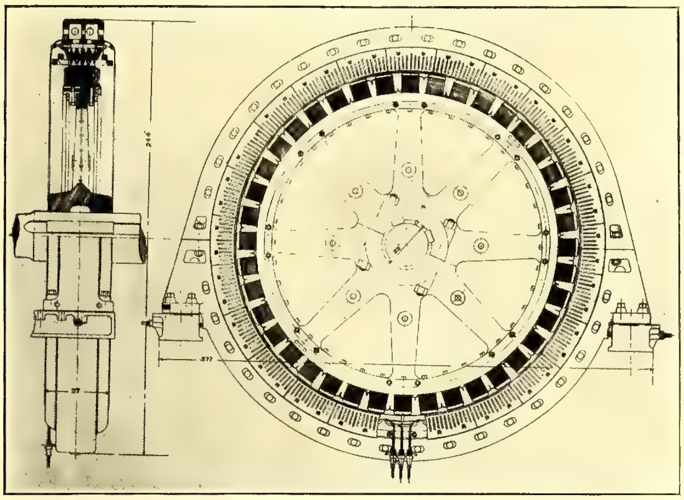
There are three direct-current exciter sets, each consisting of a standard four-pole, 100-kw generator, coupled to a Willans & Robinson high-speed engine, running at 380 r. p. m., the working voltage being 125. They also operate the station lights and ash conveyor and barring motors.

The main switchboard is erected on a gallery over a fireproof high-tension chamber, and is built up of thirty-three 2-ft. panels of enamelled slate. Starting from the right there are swing brackets carrying two A. C. bus-bar voltmeters, reading to 8000 volts, synchronizing voltmeter 0 to 16,000 volts and synchronograph with lamps. There are then five main alternator panels, one blank panel, one total station power panel, six high-tension feeder panels for distant sub-stations, Seaforth, Sandhills and Birkdale; three exciter panels, one sub-station total power received panel, four high-tension sub-station transformer panels, one blank panel, four rotary converter direct-current panels, one blank panel, one sub-station total power delivered panel, also comprising one sub-panel switch for starting the rotary converter from the D. C. 600-volt bus-bars; four sub-station feeder panels, lastly, one station lighting and blower-motors' starting panel, and swing bracket with rotary converter bus-bar voltmeter and paralleling voltmeter. All the sub-station gear is for the local sub-station at Formby.

VIEW OF SWITCHBOARD GALLERY, MAIN POWER STATION

The whole of the high-tension switch gear, oil switches, instrument transformers and bus-bars are erected in a fireproof h. t. chamber, the dimensions of which are 79 ft. x 12 ft., and constructed of steel girders and concrete. Connection between the terminals of each stator and its oil switch is made by short leads to a trifurcating box in the pit, thence by a three-core h. t. lead-covered cable passing along an independent duct through the foundation up to the cellar ceiling, along which it is run by ducts through the h. t. chamber floor, where it ends in a second trifurcating box on the wall. The rest of the h. t. wiring is by individual conductors. The three-core h. t. leads are of stranded copper cable, paper insulated and lead covered. The single cables are rubber insulated, taped and braided; they were designed to pass a flash test of 25,000 volts between the

phases and each to earth. The solid copper rod h. t. bus-bars are insulated in a similar manner, and reduced in section from alternators to local sub-station panels as power is tapped. The bus-bars and individual leads are carried on corrugated h. t. porcelain pots, connection between oil switch and bus-bar being made through a h. t. insulating or "hook switch." In the instrument transformers, supplied with the ammeters by Elliott Bros., the primary is simply a straight length of lead or bus-bar enclosed by the secondary and iron circuit. In the wattmeter current transformer, supplied by the Stanley Instrument

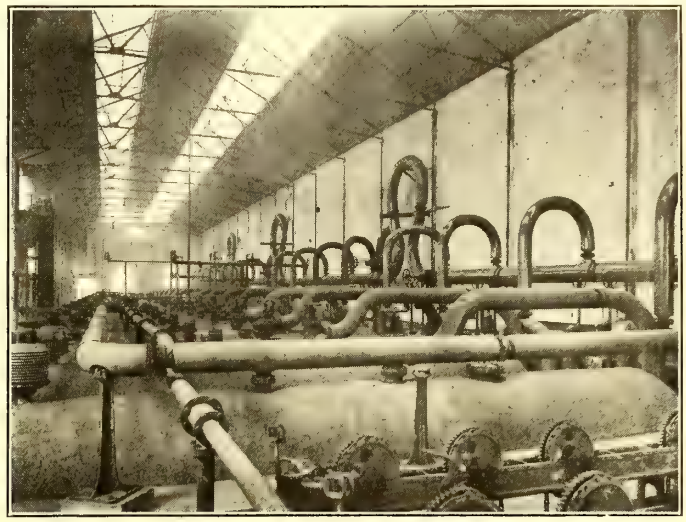


ELEVATION AND SECTION OF MAIN ALTERNATOR

Company, with its meters, the primary consists of a few turns in series with a bus-bar.

In all cases the low-tension secondary leads pass through the ceiling to the switchboard above.

The total A. C. power generated, before passing to the sub-station feeders, is recorded in an integrating wattmeter. Connection to each triplet of transformers in the sub-station is made through a hook switch, oil switch and three cast-iron tail-end glands, bushed with corrugated porcelain bobbins, piercing the front wall of the chamber. Each transformer is single-phase split-phase, and has two independent secondaries, the six of the triplet being grouped in double mesh to afford six phases for operating the rotary convertors. Connection between the grouped secondaries and the six rotary slip rings is



BOILER PIPE CONNECTIONS

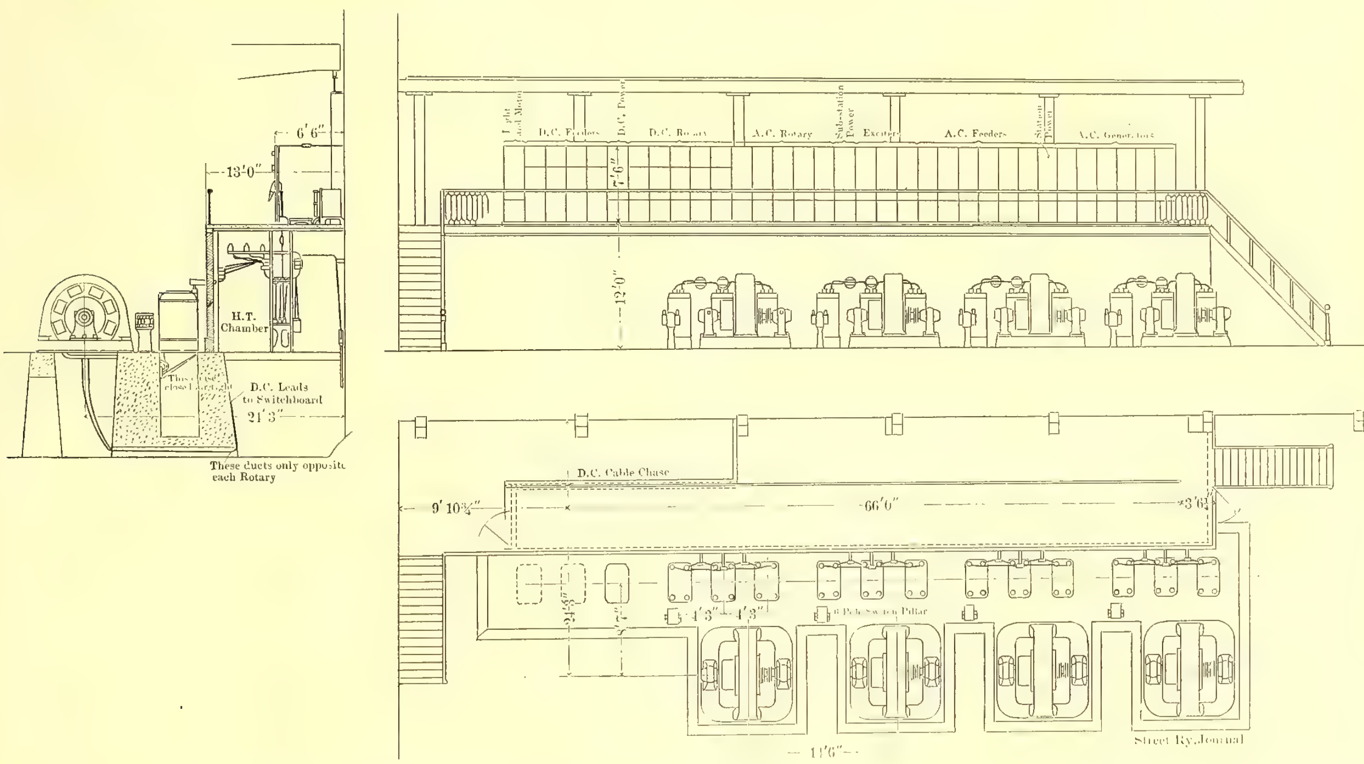
made through a pair of three-blade switches carried on a stand, on which is also placed the equalizer switch for the series field.

The chief feature of the alternating board is that the high-tension current is confined to the pit below the board, this being effected by the long-arm oil switches which are used throughout the system.

The rotor field rheostats are of massive construction, and consist of cast-iron grids insulated with hard micanite and assembled in frames forming layers in a vertical stack, which open top and bottom for thorough ventilation.

BOILERS

There are sixteen boilers, made by Yates & Thom, and of the Lancashire type. Each boiler is 32 ft. long by 8 ft. 6 ins. in diameter, with two flues, each 3 ft. 5 ins. in diameter, and is constructed for a working pressure of 160 lbs. per square inch, the shell plates being 13-16 in. thick, flue plates 9-16 in. thick, and the end plates ¼ in. thick, and each shell being in five rings



PLAN, ELEVATION AND SECTION OF FORMBY SWITCHBOARD, SHOWING GALLERY AND HIGH-TENSION CHAMBER

of one plate each. The boilers were tested satisfactorily to 260 lbs. per square inch. They are equipped with a full set of fittings and mountings, made by the same firm, and are hand-fired. They are arranged in two batteries of eight each in one row.

In each of the down-take flues at the back end of the boilers

GENERAL VIEW OF INTERIOR OF SUB-STATION

is fitted a superheater of the Galloway type. The feed pumps were supplied by Mather & Platt, Ltd.

The fans for the induced draft work are two in number, each capable of furnishing sufficient air for the consumption of 10,000 lbs. of coal per hour, with a temperature of the flue gases after passing through the economizers about 400 degs. F., and this under a normal speed of 175 r. p. m. The fans are of the three-quarter housing over hung-blast wheel type, and are directly connected to horizontal side crank engines. The housings are built on an angle-iron framework, side plates of No. 8 gage steel, scroll plates of No. 10 gage steel. The side plates are further stiffened by 4-in. x 5-in. x ½-in. horizontal and vertical angle-iron braces on engine sides, and by 4-in. x 4-in. x ½-in. angle-iron braces on the inlet sides of fans. The housings are supported on 4-in. x 5-in. x ½-in. base angles. The size of the inlets is 6 ft. 2 ins. in diameter. The size of the outlets is 4 ft. 11¾ ins. square. The blast-wheels are carried on steel shafts, 5 ins. in diameter, and supported by self-oiling water-cooled bearings, 27 ins. long. The products of combusiton after passing through the economizers enter the fans at a temperature of about 400 degs. F.., and are discharged through underground brick ducts to the base of the chimney, located just outside the building. This chimney has a height of 60 ft. in order to discharge the products of combustion above the surrounding buildings. The whole of the induced draft apparatus was supplied by the Buffalo Forge Company.

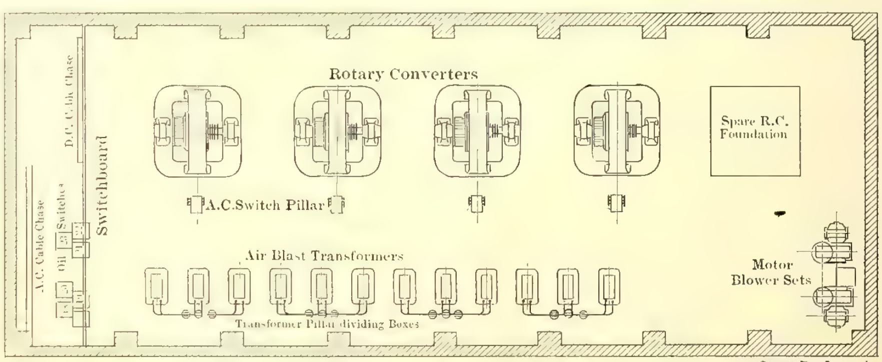
The economizers working in conjunction with the boilers were made by Green & Son, Ltd., and are constructed in groups of 120 tubes. The installation on the whole contains 1440 tubes, representing 14,400 sq. ft. of heating surface. The economizers are arranged in two separate batteries, one at each end of the boiler house, each consisting of 720 tubes. These are again sub-divided in two separate apparatus of 360 tubes, in sections of tens, so that both can be worked together or independently as occasion requires. Each group is coupled together by expansion elbows at top and bottom. The scrapers are actuated by a double set of gearing on the top of the economizers, and the whole is driven by a direct-geared electric motor. The economizers are specially constructed to work at high pressure and the top boxes are fitted with internal lids of the latest pattern. The total water capacity of the economizers is some 9000 gallons. The whole of the steam-feed exhaust and injection main and auxiliary piping was supplied by the contractors, and fitted at their Kilmarnock works. The feed ring (6 ins. in diameter) runs the whole length of the boilers, branches to each boiler being taken through check valves. The ring is supplied from pumps in triplicate. The feed water can be passed either through the economizers or direct to the boilers by a duplicate system.

The main steam piping, which is 12 ins. in diameter, is a combination of the ring and bye-pass systems. The steam is taken from the boilers, passed through superheaters and then into the main ring, or direct through a bye-pass to the engines. The steam pipes are entirely on the duplicate system, and are of steel.

The exhaust pipes from the main engines are 24 ins. in diameter, and connected direct to jet condensers. The whole of the exhaust piping from exciter sets, fan engines and boiler feed pumps is connected to an auxiliary surface condenser. The blow-off and main drain are connected to a common blow-down tank.

SUB-STATION EQUIPMENT

The sub-station equipment, save as regards amount of plant, is identical, and to describe one in detail will give an adequate idea of the whole of them. The three largest, Seaforth, Sandhills and Formby, have each four rotary converters, while Birkdale has three, provision being made in each case for extensions. Each rotary converter is arranged with its corresponding groups of statics alongside, the high-tension oil switches being placed underground.



PLAN OF SUB-STATION WITH FOUR ROTARIES

The rotary converters are in appearance similar, in general design, to the standard d. c. machines. They are eight-pole, developing 600 kw, at 600-650 volts at 375 r. p. m. The core discs are segmental, and dovetail into machined grooves on a C. I. spider, the rim of which, following standard practice, is sectional to avoid shrinkage strains. On the alternating-current side of the machine are six gunmetal slip rings, connection between the radials and the outer rings being effected by insulated bolts carried through the intervening rings. Each slip ring carries three laminated copper brushes.

The average finished weights of this rotary are: Armatures, 10,380 lbs.; magnets, 21,100 lbs.; complete machine, 40,940 lbs.

The transformers are of the air blast type, and have each a capacity of 200 kw. They are circular, and are built up of copper strip, wound on edge and insulated with special wrappings, repeatedly impregnated and dried. The secondaries are inside next the core, the primaries above and outside. Ample ducts are left between the coils, core, casing and each other to afford free passage for the blast, which, entering below, may be regulated by a baffle above.

The core plates are of the best annealed soft iron, coated with a special insulating japan, in two widths, as a first approximation to a circular section. The primary leads pass out at a pair of corrugated porcelain bobbins sealed into the hood and screw-couple to the leads emerging from the h. t. chamber through a tall end gland, ebonite screw sockets encasing the naked connection. The windings may be readily inspected on unscrewing the sheet-iron sides. The secondary loads pass under the floor up the slip ring stand. The primaries were flashed at 15,000 volts to earth and secondaries, the latter at 2500 volts to earth. Each transformer weighs approximately 5450 lbs. The blowers, of which there are two in each sub-station, consist of a standard 5-hp motor, coupled on a combined base to a Davidson Sirocco fan, which is keyed direct on the motor shaft. The capacity of each fan is 8000 cu. ft. of air per minute, at a pressure of 2 ft. to 3 ft. of water.

The sub-station switchboards consist of a high-tension and low-tension side, the latter having been supplied by Elliott Bros., the switches and circuit breakers being of the standard Dick-Kerr pattern. On the sub-station total power-received panel are three A. C. ammeters, one in each phase, and an integrating wattmeter on the sub-panel. On the transformer panels are an A. C. ammeter, center zero rotary field ammeter, voltmeter synchronizing plug, oil switch, operating gear, field rheostat hand wheel, field break switch and field two-way switch.

The rotary converter panels carry an auto-circuit breaker, and on the D. C. super-panel is an ammeter two-way paralleling plug and two single-pole knife switches, with starting bar coupler switch on sub-panel. On the power-delivered panel are an ammeter, two-pole change over switch, two-way voltmeter plug and integrating wattmeter. On the sub-panel the rotary D. C. starter, a multiple-contact switch connected to a grid resistance behind. On each of the four D. C. feeder panels are an auto-circuit breaker on the super-panel, D. C. ammeter and S. P. change-over switch, a Garton lightning arrester and choking coil being behind.

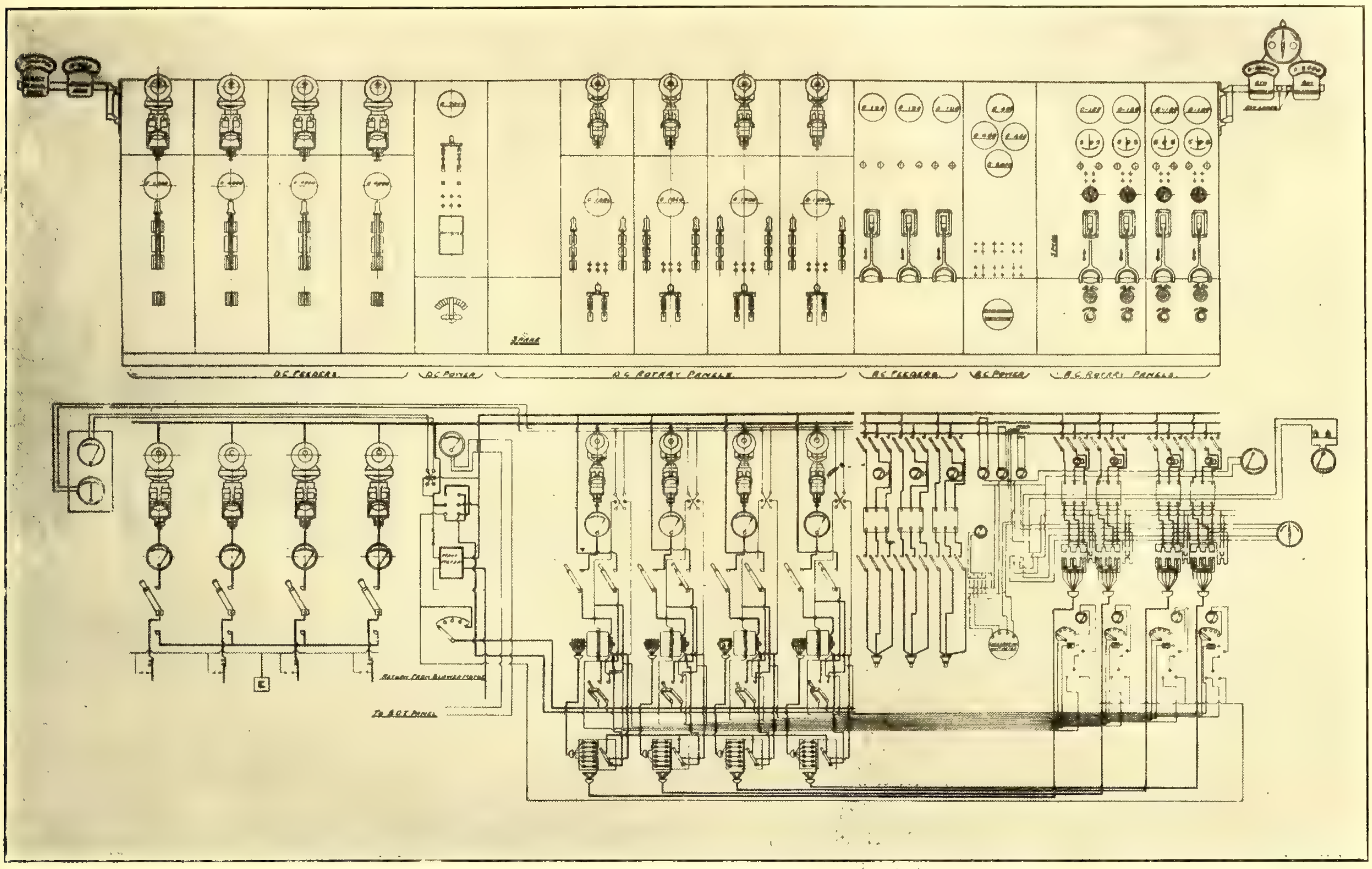
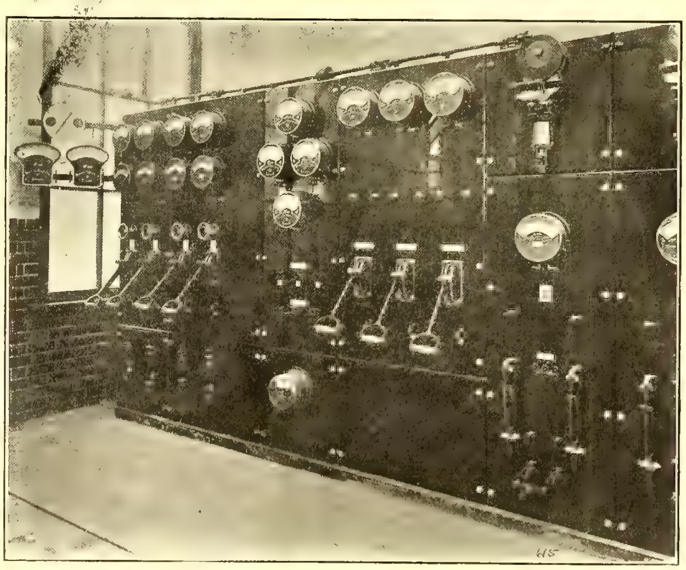
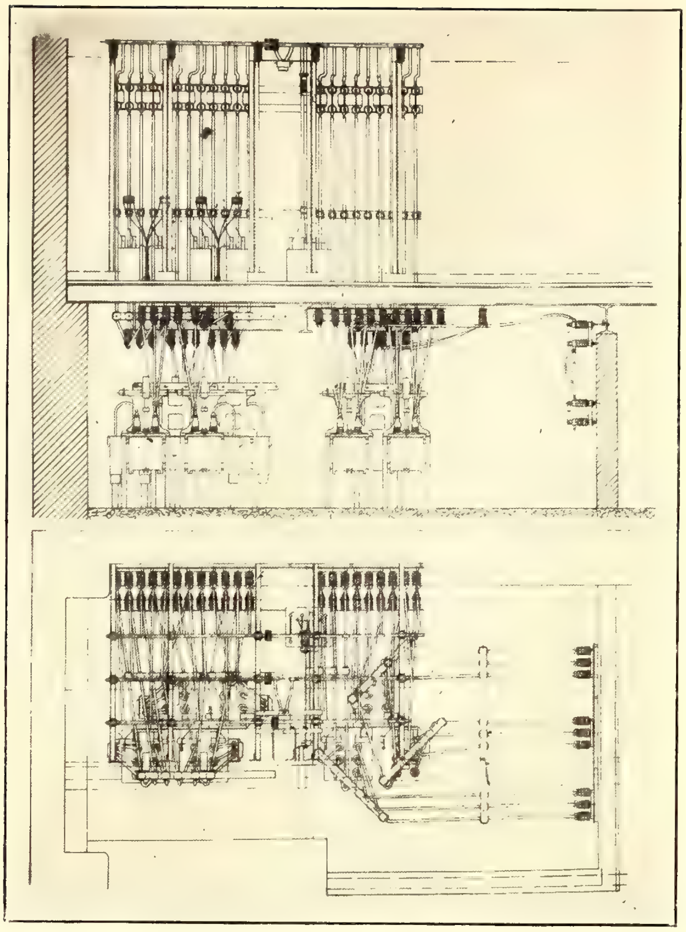


DIAGRAM AND FRONT ELEVATION OF SUB-STATION SWITCHBOARD



HIGH-TENSION SWITCHBOARD AT SUB-STATION

The change-over switches are chiefly for burning out a fault in one of the feeders, by cutting out the others or for disconnecting a sub-station. Other panels control lighting switches and motors, and a further board carries the Board of Trade instruments.



SUB-STATION SWITCHBOARD CONNECTIONS

HIGH-TENSION TRANSMISSION

The high-tension cables leading from the power house are arranged in each case in triplicate. Under ordinary working conditions all three cables are used, but in case of breakdown of any of the cables, the two remaining ones can do the work without the drop or the current density exceeding the permissible limit.

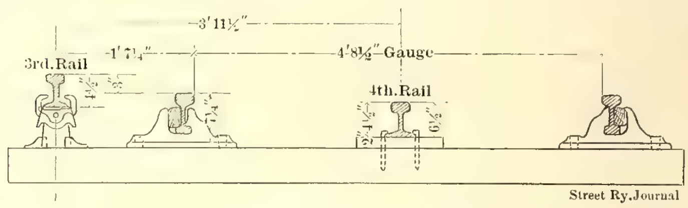
The whole of the cables were manufactured and laid by W. T. Glover & Co., Ltd., as sub-contractors. The extra high-tension cables are of the triple-triangular type, diatrine paper insulated, lead covered and armored, laid on the solid system.

Four different sizes of cable were used, viz., 37-15, 37-16, 19-15, 19-16; the length of each being, respectively, 13 miles, 6½ miles, 6½ miles and 18 miles—a total of 44 miles.

The insulation consists of manila paper impregnated with diatrine by a special process, which ensures that the paper is thoroughly impregnated, the surplus compound being removed from the surface of the paper by means of a special apparatus.

The thickness of the insulation is .36 in. between conductors, and .26 in. between conductors and the lead sheath. This latter lessened thickness is accounted for by reason of the system being earthed at the center point of the machine winding, the cables being made for a working pressure between conductors of 10,000 volts, and a pressure to earth of 5780 volts. Each of the insulated cores is finished off with a different colored layer of paper strip, which serves as a distinguishing mark.

The lead sheathing varies from .125-in. to .15-in. thick, according to the size of cable. The armoring is of galvanized steel wires, .08 in. to .1 in. in diameter, which acts as a mechanical protection in addition to making a most satisfactory and efficient earthing conductor. The joints are of the plumbed lead-sleeve type, the lead sleeve being filled up with diatrine compound.



CROSS SECTION OF TRACK, SHOWING THIRD AND FOURTH RAILS

The troughs are made of stout wood, tarred and creosoted, filled with compound and covered over with tiles. Specially prepared impregnated wood bridges support the cables at 18-in. intervals. Three cables run in each trough. The cables are laid for the most part in the 6-ft. way, and where they pass over bridges or in exposed situations are laid in stout steel troughs.

All cables were tested with 30,000 volts between cores and to earth for 1 hour before leaving the works.

TRACK CONSTRUCTION

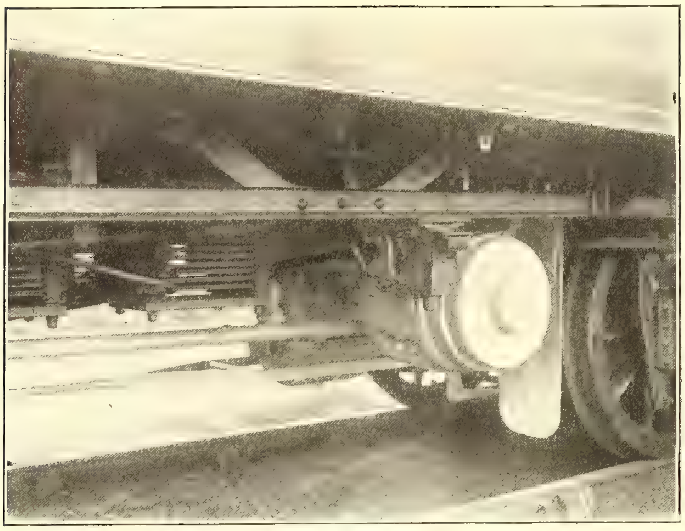
The track is furnished with two "third" rails, one for distributing and one for returning the electric current to the

VIEW AT GRADE CROSSING, SHOWING THIRD AND FOURTH RAIL INCLINES, THE FORMER PROTECTED BY GUARDS

VIEW ON TANGENT AT FRESHFIELD

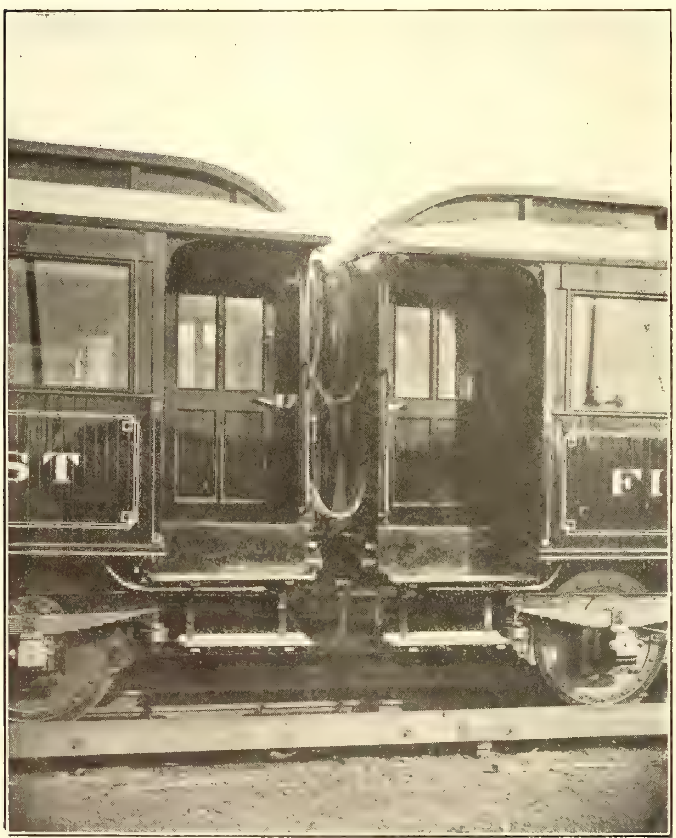
VIEW AT SANDHILLS, SHOWING JUNCTION OF ELECTRIC AND STEAM RAILROAD DIVISIONS

power station. The former is carried alongside each track in the usual way, while the other rail is placed between the running rails, uninsulated on the ties, thus forming the principal part of the return circuit. While the joints of both the third and the fourth rail are bonded in the ordinary way, in the



MOTOR-DRIVEN VACUUM PUMP

manner described below, the fourth rail is also cross-bonded to the running rails at their ends. While, by this arrangement, the troublesome bonding of the running rails is avoided, as are also the complications involved in using an insulated fourth rail for the return, the further advantage is obtained that the

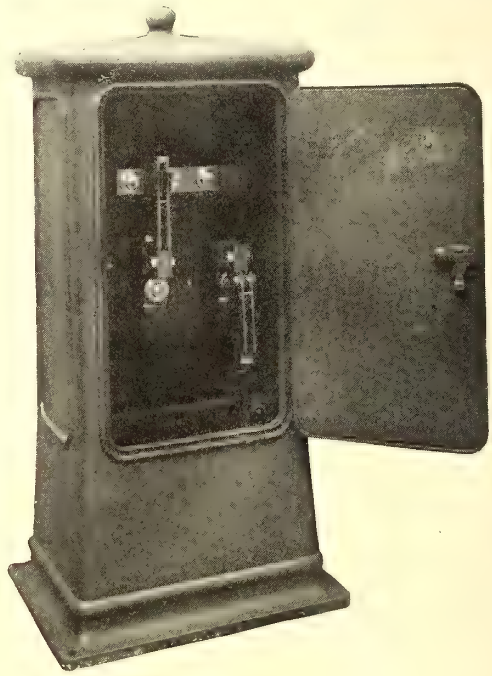


VIEW OF VESTIBULE CONNECTION BETWEN CARS

iron in the running rails is utilized as part of the return current. No collector shoe is provided on the train for the fourth rail, the current being delivered through the wheels to the running rails, and thence through the cross-bonds to the fourth rail. The installation of this rail also makes it a comparatively simple matter to renew the running rails, without unduly interfering with the continuity of the return circuit.

The third and fourth rails are both of equal section, and consist of mild steel of special high conductivity, the resistance being proved by test to be not greater than seven and one-quarter times that of pure copper. As a matter of fact, the average resistance is somewhat lower. The rails have been supplied by the Northeastern Steel Company, of Middlesborough; are of the T-section, weigh 70 lbs. per yard, and are in lengths of 60 ft.

The third rail is supported at intervals of about 10 ft. on insulators of reconstructed granite, held in position by two clips, the center of the rail being exactly 3 ft. 11½ ins. from the center line of the track, and the top of the rail 3 ins. above the surface of the track rails. This dimension may be regarded as the British standard, having been agreed upon by all the main line steam railroad companies, at a meeting held at the Railroad Clearing House, on March 3, 1903, in order to obtain uniformity in case of extensions of third rail systems. It is of ample section to convey the full amount of current required by the trains,



SECTION PILLAR, OPEN

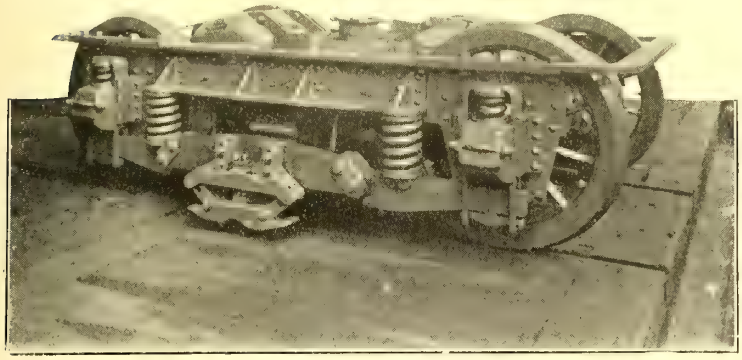
when between two sub-stations, without causing any appreciable loss in voltage. Generally, the third rail is placed in the 6-ft. way between the tracks, but occasionally it is brought outside the track to suit special conditions, and at all grade crossings the gaps are bonded with cable underground. Timber guards have been provided at all the busy places on the line, to prevent the possibility of any person coming into contact with the third rail. The fourth rail is supported on wooden blocks, and is placed in the middle of the 4-ft. way, between the two running rails.

At most stations the third rail is interrupted and the ends are connected by cables to section switches. This apparatus consists of four knife switches, one for each end of the up and down line, which, in the ordinary way of working, are connected in parallel. By cutting out one of these switches in two adjacent boxes any part of the up or down line may be made currentless.

In providing for expansion and contraction, due to change of temperatures in the rails, they are divided into sections of 300 ft., and the joints between the rails making up this section are known as "fixed joints." The joints connecting the sections themselves are known as "expansion joints." At the fixed joints no provision is made for expansion or contraction, this being concentrated at the expansion joints. The fish-plates at the fixed joints are made as rigid as possible, and the bonds are four

in number, two bonds being fixed in the web of the rail and two bonds in the flange of the rail.

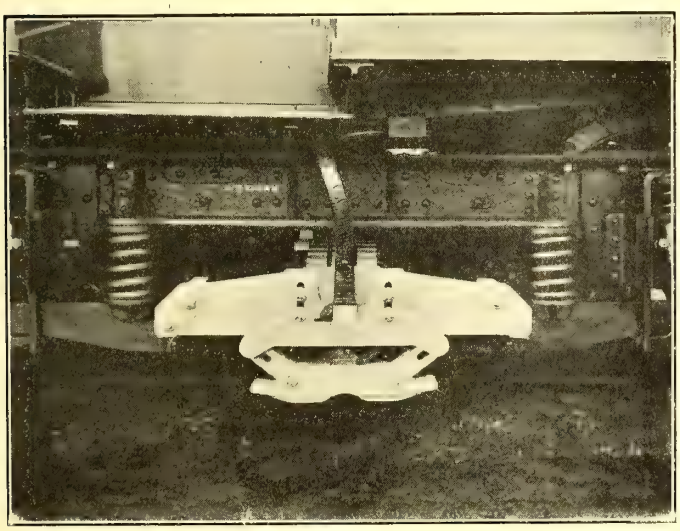
It was deemed advisable to use bonds of semi-flexible type, which have a conductor built up of parallel strands of copper ribbon or "flat wire" with solid copper terminals. They are thus sufficiently flexible to provide for any movement which may take place at the joints, and are more easily adjusted in case of any variation in distance between the bond holes at



SIDE VIEW OF TRUCK

the time of construction. The bonds at the expansion joints are four in number, of the same cross-section as those at the fixed joints, but all four are fixed in the flange of the rail. These bonds are also made of "flat wire."

The fish-plates at the expansion joints are of special design, and properly slotted to provide for any change of length which may take place in the 300-ft. section. This system of bonding is carried out on both the third and fourth rails. The terminals of all the bonds are of solid copper, and are expanded in the bond holes by means of screw or hydraulic compressors. Each



THIRD-RAIL COLLECTING SHOE

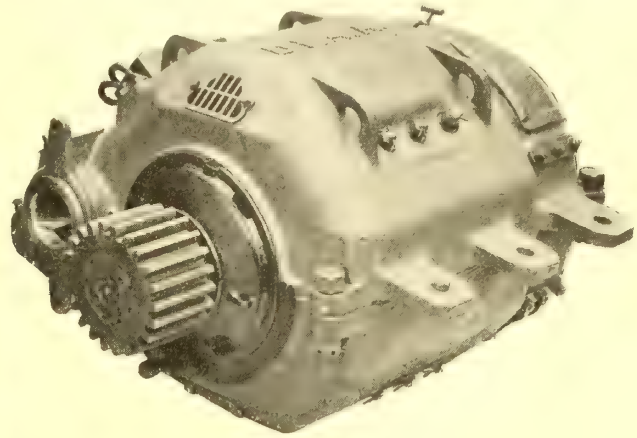
track rail is bonded to the fourth or negative rail by means of flexible cable bonds. The bonds were supplied by the Forest City Electric Company.

THE ROLLING STOCK

The trains consist in most cases of two first and two third class cars, the latter being at either end. Views of these cars and of complete trains were publishel in the issue of Jan. 30.

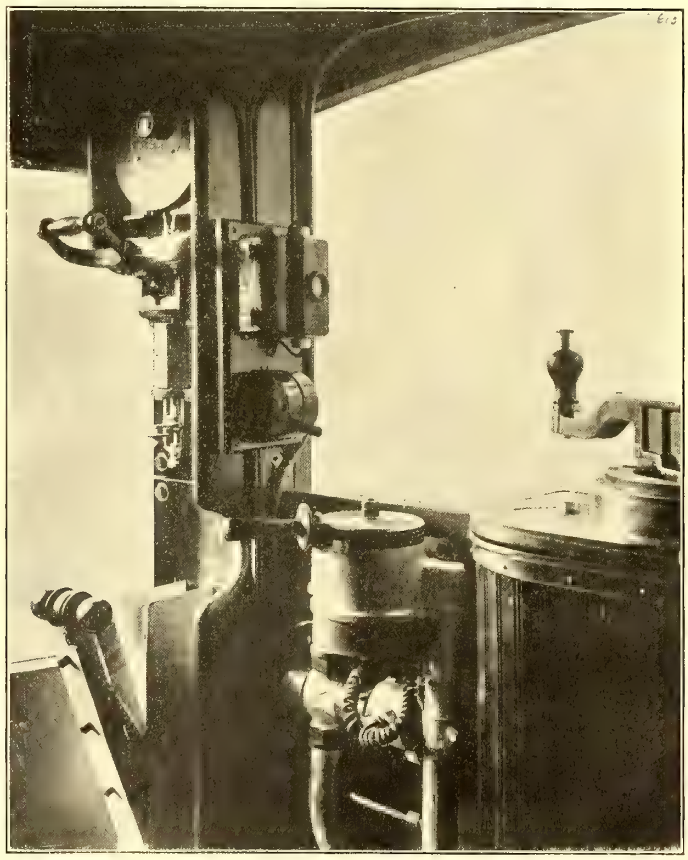
The third-class cars, which are the end cars, are also the motor cars, and as each truck carries two 150-hp motors, there are eight motors per train. The current is conveyed to the motors through a cast-steel shoe, attached to a beam on each side of the motor truck, as shown. Both types of cars are 60 ft. long and 10 ft. wide, being the widest car in Great Britain, and have an 8 ft. wheel base and 40 ft. 6 in. truck base. They are arranged with straight sides, matchboarded below the side lights.

There is a monitor or clerestory roof 6 ft. 2 in. wide, the top being 12 ft. 7⅞ inches from the rail level. The vehicles are



SIDE VIEW OF MOTOR

painted in the company's standard colors of brown and crimson lake. The motor cars are divided into two main compartments, with a baggage and motor compartment; access being obtained through entrance vestibules which are recessed back at either end, the whole arrangement being so designed that the doors shall not project beyond the 10 ft. width when extended. Immediately inside the compartments the seats are placed longitudinally against the side of the car so that ample space is

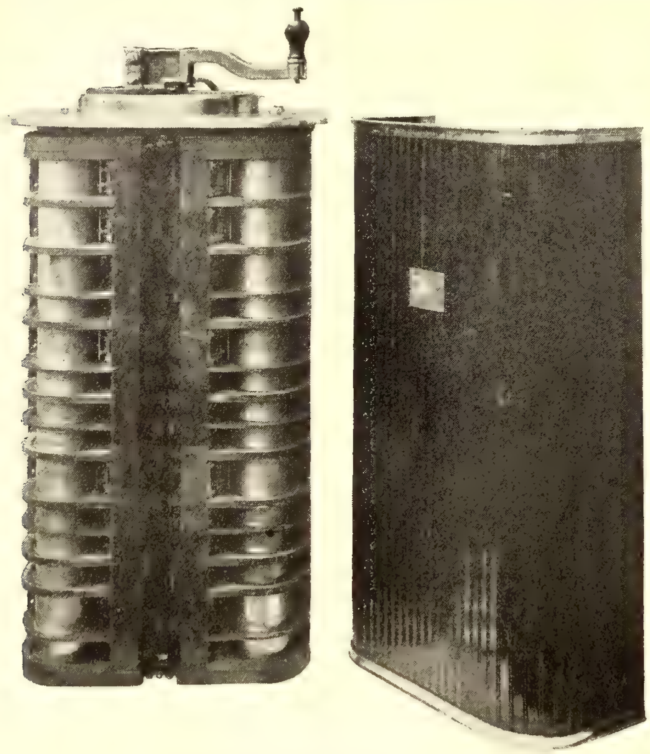


INTERIOR OF MOTORMAN'S CAB—LEFT-HAND SIDE

allowed for the inlet and outlet of passengers. The cars are otherwise fitted with cross seats and reversible backs with a passage between, the first-class accommodating two on either side and a total of sixty-six passengers per car, the third class seating three on one side, and two on the other, and a total of sixty-nine passengers per car, the total accommodation in a normal train being in this way 270 passengers,

Large fixed side lights give passengers an excellent view of the country while passing, and ventilation is obtained through hinged light in the monitor roof. All cars are vestibuled.

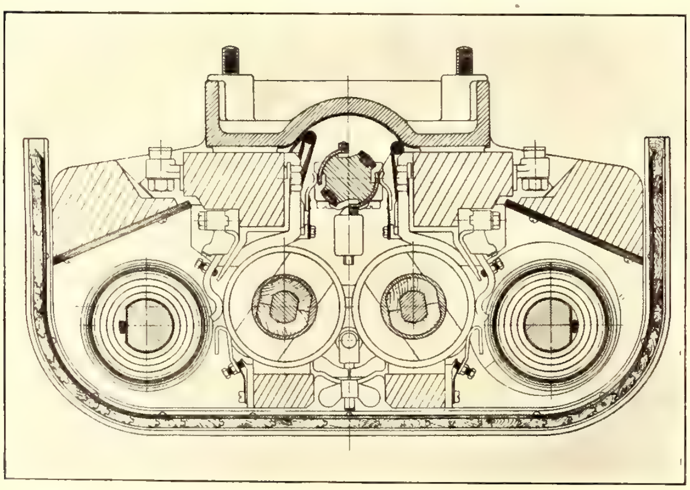
The first-class trailer cars are finished in polished mahogany,



CONTROLLER WITH CASE OFF

with polished Kauri pine panels, the seats being upholstered in epingle; nearly all the seating in these cars was supplied by Hale & Kilburn, for whom G. D. Peters & Company are British agents. The floor is covered with a crimson velvet carpet over "kork."

The third-class motor cars are finished in polished wainscot oak, all seats being covered with light rattan canework to match. Side lights and general fittings are similar to those

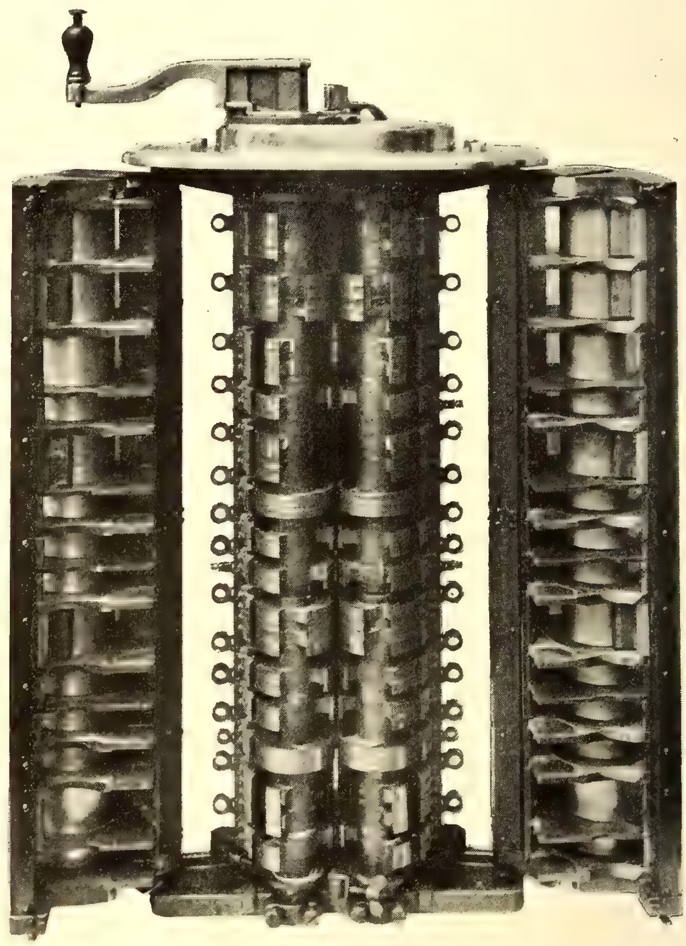


HORIZONTAL CROSS SECTION OF CONTROLLER

in the first-class cars. In the center of the motor roof is an oak rail, with leather hand straps for the use of passengers when the train starts at a station. At the driving end a baggage compartment is arranged for light luggage. Oak shutters on either side which roll down in blind fashion, and close or open the whole length of the compartment, have been arranged with the object of facilitating the work of the guard. The under frames throughout are of steel, the sides and centre sills being of channel section, each sill being trussed with rods passing over the bolsters to the steel-plate headstocks. The bolsters are of steel channel, riveted to the underside of the sills and supported by straps. Central buffing and drawbars are arranged at each end of the trailer cars, and the trailing end of the motor cars, the couplers being fitted with side guide springs to damp oscillation and lateral motion when passing over crossings and round curves. At the motor compartment end, standard buffing gear is utilized to simplify the running or shunting of these trains if brought in contact with the ordinary rolling stock.

All cars are electrically lighted and heated, the necessary switches being placed in the vestibule entrance of each coach, and so arranged as only to be accessible by means of a special key carried by the guard. There is a through bell communication which enables the guard, by means of a special key, to give the motorman the signal to start from any vestibule entrance on the train.

The total weight without passengers of each trailer car is



CONTROLLER WITH BLOW-OUT MAGNETS DETACHED

26 tons, making the total weight of each car train 140 tons, and a length over all of 248 ft. 6 in.

The trucks for the trailer cars are the company's standard, the frame being composed of angle steel section, and channel steel bolsters. Special springs have been introduced to insure easy riding.

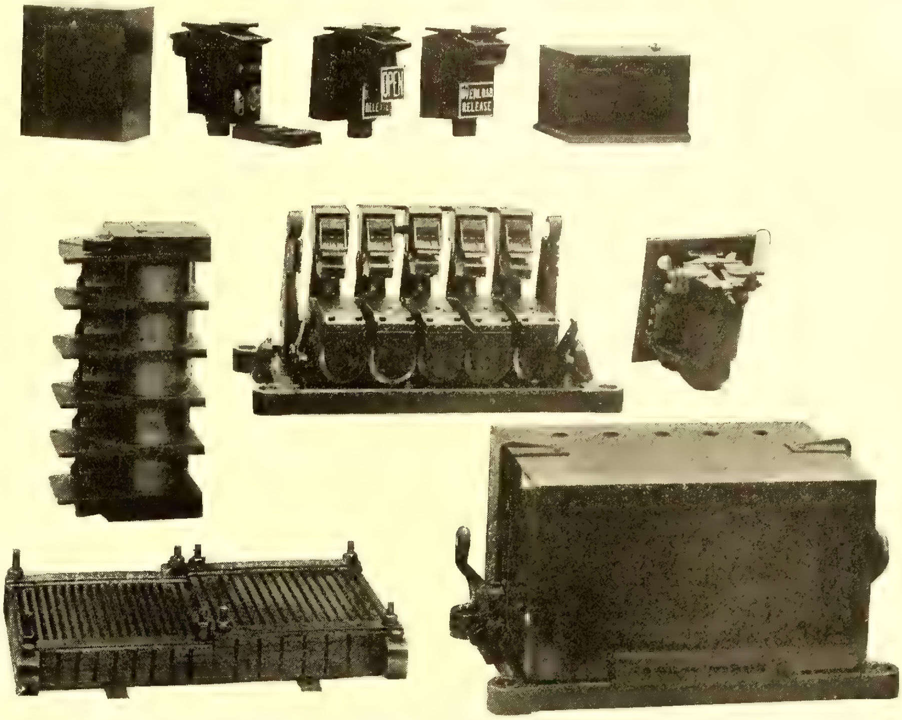
The motor truck is entirely built of steel, and as stated before, has 8 ft. wheel base; the wheels are 3 ft. 6 in. diameter. The weight of the car is transmitted from the top bolster by means of elliptical springs to the swing bolster, the weight being transmitted thence in the usual method by swing links to the truck side frame. Steel angles from the side frames, cast-steel stiffeners riveted to the outsides of these form nests for the tops of the heavy helical springs, which intervene between the truck frame and the straight equalizer bar. This equalizer bar is carried in stirrups below the axle boxes, the stirrups themselves

bearing on the box tops by means of very stiff three-coil helical springs. A special feature in connection with the axle-boxes is that the fillets on the journals are kept quite clear of the brasses, thus avoiding a fruitful source of hot bearings. The gears are solid and trussed to the axle and keyed.

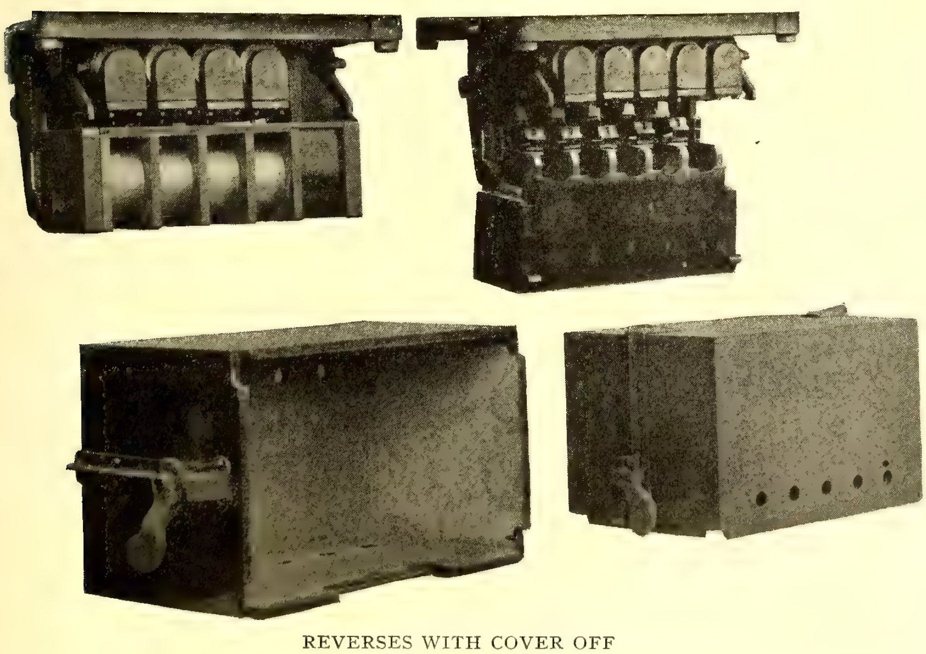
The current, as already stated, is collected by cast-steel shoes on each side of the motor truck. These shoes weigh about 90 lbs. each, and have so far given the greatest satisfaction. On straight runs of third rail, there are thus four shoes collecting at one time. From these shoes, which are suspended by forged slotted links from a wooden beam carried on extensions on the truck, a highly flexible lead of special construction is carried to a fixed terminal, from which the main cables pass to the controller.

The vacuum brake is used on the trains, thus making them adaptable for service with the company's other rolling stock and locomotives at any time. The general arrangement of fittings and brake cylinders is similar to that already in use; the steam ejector is replaced by a twin cylinder-geared vacuum pump driven by a 3-hp 600-volt motor; the usual ball valves on the brake cylinder are dispensed with, and an electrically actuated valve is substituted. The movement of the motorman's valve, when the brake handle is placed in the brake-off position, lifts these valves along the train, procuring, if desired, an almost instantaneous relief of the brake. Automatic electro-pneumatic regulators in the pump motor circuits maintain a constant vacuum in the vacuum reservoir.

A large motor car horn, containing a reversible reed of special construction is used in place of a whistle, a connection to the vacuum reservoirs enabling the air for blowing it to be supplied from the atmosphere.



REVERSES WITH OVERLOAD RELEASES AND SOLENOID SHUNT SWITCHES



REVERSES WITH COVER OFF

The motorman's compartment, in addition to the controller and switches for the main motors, contains a motorman's brake valve, a vacuum gage, a single pole switch for starting the brake motors and fuses for the pump motor and brake control circuits.

The motor compartments have, with the exception of the roof, which is covered with sheet-steel plates, been lined with Uralite, a well-known fireproof material, the floor also being fireproof. In addition to the cable troughs, in which the cables are placed for conveying current to the motors and equipment, being lined with Uralite, the whole of the floor over the motors is covered with the same material and thin steel plates. All the trains carry fire appliances, and ample steps have been taken to insure safety in this respect.

The motors are of the Dick-Kerr 4-A railway type, rated to develop 150 hp at an armature speed of 470 r. p. m. The weight of the complete motor is 6050 lbs, the armature 1920 lbs, and the gear wheels and housing 500 lbs.

The conditions of performance which the motor has to fulfill, both as regards speed and high acceleration, have necessitated liberality in design, and in consequence they will give considerable overloads for short periods with a moderate rise in temperature. The main features of the motor are similar to those of the standard traction type. The magnetic field is built up of steel shells, in which are four laminated steel poles secured to the shells by bolts. The spools are built up of copper wire and asbestos ribbon, heavily taped all over, impregnated and baked. The core discs of the armature are of annealed magnetic steel, punched with keyways and air ducts, and are strung direct on the shaft. The windings are former wound, insulated with a special combination of mica. The commutators are built up of drop forged copper bars insulated with pure mica, the whole being carried on a special hard micanite ring. The complete design of the motor is such that ready access is obtained to the brushes and the commutator.

One of the most interesting features of the equipment is the method of control, which may be termed the direct multiple control system, in contra-distinction to the multiple unit, the

main difference in the systems being that in the case of the former it is possible to control the whole equipment of the train by means of two main cable. Previously the great difficulty in the way of such an arrangement lay in the construction of the controller and the necessity of carrying the whole current through one controller.

In the Dick-Kerr system this is rendered possible by the use on the controller of the metallic shield blow-out. Each controller, as shown in the illustrations herewith, contains two power cylinders, each controlling one-half of the train, that is, one motor car is actuated from one cylinder, and the rear motor car controlled from the other. Without, therefore, interfering in any degree with the completeness of the train, it would be possible to divide one of the present trains into two distinct units.

The train is entirely operated by the motorman in his cab at the front. In the cab is a Dick-Kerr d. m. 4 controller, capable, in conjunction with eight reversers, which are bolted up adjacent to their various motors under the floor, of operating the eight motors on the pair of motor cars. The two power cylinders of the controller are geared together and operated from a crank handle, each cylinder barrel being flanked by a powerful metallic shield blow-out solenoid. These may be swung open on hinge pins, such action automatically cutting the winding out of circuit, or, if necessary, lifted off and removed for inspecting the cylinders and contact fingers.

The reversal of direction of the motors is affected by means of a special apparatus operated by the controller reversing barrel. This reversing apparatus carries contacts which are normally left open by gravity, but can be closed by an electromagnet, which becomes operative through the agency of the controller reversing barrel. There are eight reversers per train, one per motor, which are arranged in four parallels of two in series across the system. In series with each reverser pair are the contacts of two magnetic overload releases, the coils of which are each in the main circuit of one of the motors, its reverser contacts and solenoids. Consequently, whether a pair of motors be in series or in parallel, the overload current in either one will cause both releases to open and cut out the pair. These releases are inclosed in small neat cast-iron boxes mounted on the sides of the car near the truck, facing outwards. When open, a flap falls down exhibiting "open" in raised letters letters on a scarlet ground, which catches the eye immediately. The releases may also be tripped by hand to cut out any pair of motors that may become disabled.

Powerful action of the reversers is secured by a compact magnetic circuit and a free and balanced suspension of a heavy clapper, while uniform and reliable contact is insured by the use of several independent spring contacts, so hung as to render sticking impossible.

In circuit with each pair of reversers is a cartridge fuse and hand knock-out switch in the cab. The latter is for opening the relay circuits of the reversers in order to cut off the motors should the controller cylinders stick in any way, or an accident be imminent. In accordance with the usual practice, the power cylinder is locked when the reversing is in an "off" position, and only then can the handle be removed, while the reversing is locked when on "reversed" or "ahead," and the power on one of the notches.

The power couplings between two cars simply consist of stationary male plug contacts in insulating tubes screwed to the ends of the coaches, with dummies facing them on the coaches opposite, into which female plugs, buried in insulating handles at the end of long flexible leads click home, according to whether connection or disconnection is required.

The heat, light and reverser couplings are mechanically in one and similar in arrangement to the power. They are all mounted about half-way up the car wall, comfortably in reach from the platform, thus obviating all risk of getting on the track and shocks from the third rail.

M. B. HERELEY ON STREET RAILWAY MANAGEMENT

Some ideas upon street railway management recently expressed to a representative of the STREET RAILWAY JOURNAL by M. B. Hereley, who was last fall appointed general superintendent of the Chicago Union Traction Company, are of interest, as coming from a man in Mr. Hereley's position, and one whose entrance into the field of street railway management has been comparatively recent. Although a very strict disciplinarian, Mr. Hereley believes that titles should not count in the operating department of a large street railway system. "A superintendent and an assistant superintendent are of course needed, as centers of authority, but when it comes to keeping a traction system in running order, the highest official must not be slow to leave his office and go to the place where orders are to be enforced. An official of this department cannot afford to have social engagements, and there are times when he cannot even think of sleeping." While he believes that each assistant must be held responsible to his chief, it is no reflection on these assistants when a superintendent sees fit to go to the scene of a breakdown. If the chief does not sleep when there is trouble with the service his assistants are less likely to do so.

Since his appointment as general superintendent last November, Mr. Hereley has been particularly fortunate in regard to the number of accidents. For a period of three months the system was operated without a serious accident to a passenger. Part of this good fortune Mr. Hereley is certainly justified in believing to be due to good discipline and cooperation on the part of all the employees. "Strict discipline will not make enemies, so long as the rules are just and there is no discrimination," is Mr. Hereley's terse way of putting this. Every employee, from track sweeper up, is encouraged to make suggestions for the improvement of the service. The men are given encouragement for honesty and efficiency, and are taught to have an interest in the affairs of the company. Mr. Hereley does not think it less a part of his duty to compliment a conductor for returning a pocketbook, or a motorman for avoiding an accident, than to reprimand an employee for neglect of any kind. Inquiries among conductors and motormen of the Chicago Union Traction Company show that the rank and file of the employees believe that they are receiving entirely fair and just treatment by the management. It has been noticeable that there have been few complaints on the part of employees during Mr. Hereley's term of office.

EXHIBITION ROOM FOR NEW APPARATUS

Mr. Hereley is about to inaugurate a new departure in street railway practice, namely, a large room set aside for the exhibition of new street railway appliances. In the equipment of this room, the company will go further than simply making it an instruction room, equipped with standard appliances as used on the road.

Besides the usual standard car equipments, it is the intention to invite manufacturers of all kinds of street railway appliances suitable for exhibition in such a room to furnish samples. This room will be open to all of the employees of the Chicago Union Traction Company, and they will be free to come and study these new devices and to express opinions as to their practical value in connection with the company's work. If employees express themselves as sufficiently favorable to new devices, they will be given a trial. The exhibition room will be on the top floor of the company's office building, at 444 North Clark Street, and it is probable that very soon advertisers in the STREET RAILWAY JOURNAL will receive a communication from Mr. Hereley in regard to furnishing sample devices to go into this room. The objects in equipping this room are for the instruction of the rank and file of employees as to the latest street railway appliances, and for picking out of new devices of real merit.

THE MENDELBAHN

The town of Bozen-Bries, located in the beautiful Etsch Valley of Southern Tyrol, has long enjoyed the patronage of thousands of tourists, many of whom come to visit the famous Mendel Pass nearby. Until the completion of the Mendelbahn, visitors to the Pass were obliged to go in carriages, the usual length of the trip being 6 hours. The Bozen-Kaltern Railway has been in operation since 1898, and travelers to the Pass now start from Kaltern, which is about 1350 ft. above sea level, lying on a small lake below the Mendel Pass.

The Pass, which is about 4500 ft. above the sea, is covered by extensive pine forests. From this point extensive views are presented of the Nons Valley, the Brenta-Presanella range and the Ortler group. The builders of the Mendelbahn took every precaution not to disturb the beauty of the surroundings, the presence of the line being perceptible here and there only by the projection of some viaduct.

In May, 1902, the owners of the Bozen-Kaltern railway determined to extend their line to the Mendel Pass. This extension, which is partly electric and partly cable, was planned and constructed by E. Strub, the well-known engineer of Zurich, Switzerland. The line is operated from April to November.

ELECTRIC RAILWAY

This division of the line begins at the Kaltern depot of the Ueberetscherbahn as a standard gage single-track line, running southwest to St. Anton, via Kaltern and Mitterdorf. At St. Anton connection is made with the narrow-gage cable railway which runs through the Pfusserlahn gulch to the Penegal and Mendelhof Hotels at the Mendel Pass.

MOTOR CAR USED ON THE MENDELBAHN

The electrical division is about 1.2 miles long, and in that distance has a change in level of 344 ft. The track, which is laid on larchwood ties, weighs 52.4 lbs. per yard (26 kg per meter).

The rolling stock consists of two motor cars and one open trailer. At Kaltern the steam locomotive is replaced by one of the motor cars, which hauls a passenger car, and frequently a freight car, of the Uebertscherbahn.

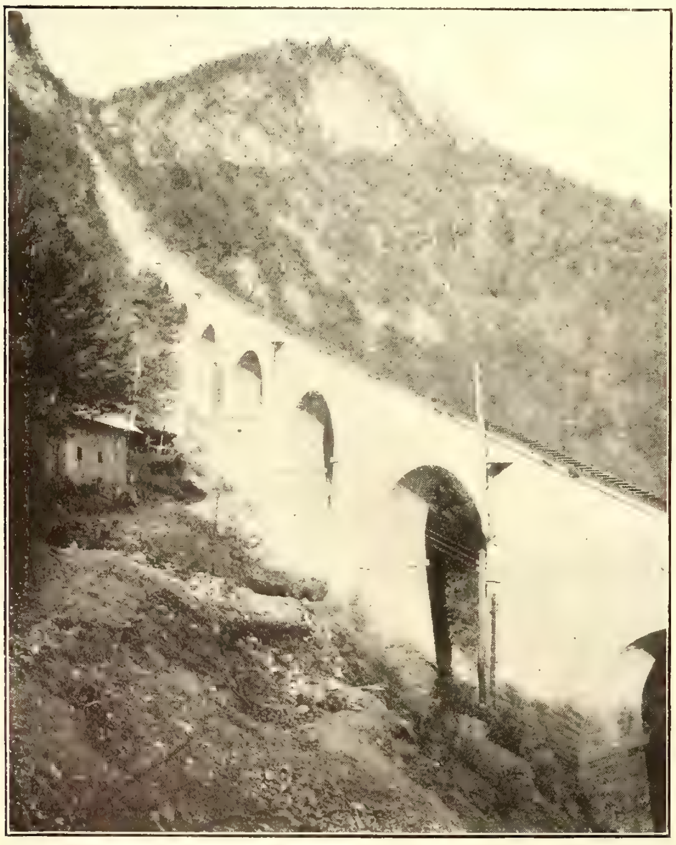
Each motor car has five first-class seats, fifteen second-class seats, and platform room for about eleven passengers. The trailer has fifteen first-class seats, thirty third-class seats, platform room for about fifteen passengers, and a baggage compartment. The weight of an empty motor car is 18.5 tons, of a trailer 12.5 tons, and of a loaded motor car and trailer 35.5 tons.

UPPER PORTION OF THE MENDELBAHN

VIADUCT WITH TWO ARCHES ON MENDELBAHN

The motor cars are furnished with two Schuckert motors, each of 60-hp capacity. Current is taken through two contact bows. The cars are fitted with Hardy automatic brakes and ordinary hand brakes. The trail car is furnished with air and hand brakes.

TRACK CONSTRUCTION AT THE GREATEST ELEVATION OF THE MENDELBAHN



VIADUCT ON THE MENDELBAHN OVER 328 FT. LONG, WITH SEVEN ARCHES

The entire Bozen-Mendel line is over 12 miles long, has a difference in level of about 3280 ft., and on a straight run can be covered in 1 hour 22 minutes, or in 1 hour 40 minutes, including stops at Kaltern and St. Anton. Five trains, which connect with the Ueberetscherbahn, are run in each direction every day. Provision is made, however, for extra trips.

TURN-OUT ON THE CABLE RAILWAY DIVISION

CABLE RAILWAY

The geological formation along this division includes disintegrated limestone in the lower portion, red and blue sandstone

CABLE CAR NEAR TURN-OUT CROSSING LONGEST VIADUCT

in the middle section and split limestone in the upper part. The roadbed was built to correspond with these variations. For about 3600 ft. (1100 m) it consists of broken stone laid on stone embankments, followed for the next 983 ft. (300 m) by mortar-

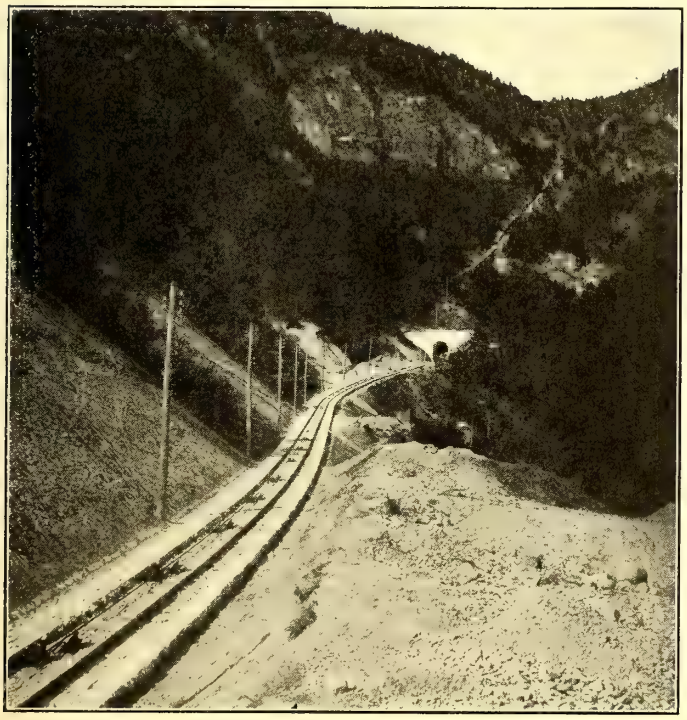
work construction. The rest of the line is built of concrete. The road is provided with a concrete stairway, built along the mountain side, and another in the center with stairs spaced every two or three ties. Along the viaducts the projections of the ties on the valley side form the support of a foot path, which is provided with a substantial hand railing.

The cable railway division includes two 230 ft (70 m) tunnels, a 328-ft. (100 m) viaduct, with seven arches, and an 82-ft. (25 m) viaduct, with two arches. The lower tunnel is built through blue sandstone, and is covered; the upper tunnel is built through limestone and is partly open.

The piers for the long viaduct were sunk to a depth of 16.5 ft. (5 m) before reaching solid rock. This viaduct begins with a curve of 6562-ft. (2000 m) radius. The lower portion of the viaduct also carries the upper part of the turnout.

The track used on this division weighs 54 lbs. per yard (26.8 kg per meter), and is of 39.37-in. (1 m) gage. The turn-out has a radius of 835 ft. (280 m), and the distance between its ends is 380 ft. (116 m).

The cable used is over 8200 ft. (2500 m) long, weighs 22,050 lbs. (10,000 kg), and on a 57 per cent grade pulls a load equivalent to 15,435 lbs. (7000 kg). As its breaking strength is 154,350 lbs. (70,000 kg), the factor of safety is 10.



VIEW OF THE LOWER PORTION OF THE CABLE DIVISION

The cable rests on sheaves placed about 29.5 (9 m) apart. The sheaves used on straight track are about 12 ins. (30 cm) in diameter, and those on curved track 16.5 ins. (42 cm) in diameter.

The cable cars have twenty first-class seats and thirty-two third-class seats, all inclined, as is customary on mountain railways. The weight of an empty car is 13,340 lbs. (6050 kg), and of a loaded car about 22,050 lbs. (10,000 kg).

POWER SYSTEM

The station at the upper end of the cable railway contains a motor which operates the cable through a system of intermediate gearing. The electric installation for the cable also includes the necessary controlling apparatus and a 650-volt, 90-hp, direct-current shunt-wound motor, running at 600 r. p. m. Power from this motor to the main cable wheel is transmitted by belting. This station, in addition, contains transformers and three rotary converters for converting the current received from the Novella hydro-electric station through a 4000-volt, polyphase transmission system. The two 200-hp units furnish the current for lighting the Mendel Hotel, the remaining 350-hp rotary being used for the Mendelbahn.

TRAIL CAR USED ON ELECTRIC DIVISION OF THE MENDEL-BAHN

The storage battery used has a capacity varying from 250 amp.-hours to 400 amp.-hours.

The car schedule is so arranged that when the electric railway cars are running uphill the operation of the cable division is suspended, because the total power required to operate both lines simultaneously at normal speeds exceeds the capacity of the railway power equipment. The electric railway usually requires 150 amps. and the cable railway 35 amps.

The rotary converter equipments were furnished by the Vereinigten Elektricitäts-Gesellschaft, of Vienna. The electrical equipment of the cable railway was built by the Austrian Union Elektricitäts-Gesellschaft.

Five copper feeders, carried on wooden poles, and suitably protected from lightning, run along the cable railway, connection to the electric railway being made at St. Anton. The electric railway division is furnished with two telephone wires for signaling. The cable railway, besides the telephone wires, has two others, one of which serves to indicate at the power station when cars reach and leave the terminals, and the other for communication between the machinist and conductor.

The car house at Kaltern is illuminated by incandescent lamps, operated five in series. The cars are also furnished with incandescent lamps.

"An Egg Hunting Contest" for the children of Nashville will be conducted by the Nashville Railway & Light Company, at Glendale Park, on April 2—the day before Easter Sunday. A similar contest was held last year, and proved a great attraction. The company provides 1000 candy eggs, which are hidden throughout the park by a committee of women appointed for the purpose. One of the eggs is dyed with gold, and a reward of $5 is offered to the child finding it. Other eggs are rated at various sums, ranging from $3 down to 25 cents, the total amount of the prizes offered being $100. The amount of the prize, if any, to which the finder is entitled is indicated on each of the eggs, those containing no mark possessing only their intrinsic value as eggs (or candy). Glendale Park is owned by the Nashville Railway & Light Company, and covers some 75 acres. The company provides numerous attractions to increase its summer traffic, including a "zoo," a casino and theatre, at which vaudeville performances are given, shooting gallery, merry-go-round, Ferris wheel, miniature railroad, etc. Among the coming attractions are a roller coaster (by the Ingersoll Construction Company, of Pittsburg) and a "Cave of the Winds and House of Trouble."

THE DUNEDIN (NEW ZEALAND) TRAMWAYS

Recently the principal cities of New Zealand have been giving considerable attention to the conversion of their lines from animal to electric traction. Although Auckland enjoys the distinction of being the first New Zealand city to have electric railways, Dunedin is a close second, as the lines in that city were formally opened on Dec. 16, 1903.

It is noteworthy that nearly all of the Dunedin operating equipment is based along American lines, while a great deal of the practice on the Auckland system follows English lines. The conversion of the Dunedin lines was carried out for the municipality by Noyes Brothers, of Sydney, Melbourne and Dunedin, under the supervision of W. G. T. Goodman, their resident engineer.

PERMANENT WAY

Double track is used in the important streets, but single track prevails where traffic is light. The rails used throughout are in 40-ft. lengths, weigh 93 lbs. per yard, and have a bearing surface of 6 ins. on the ties. They are bonded with Edison-Brown plastic bonds. The ties are of Australian hardwood, 7 ft. 6 ins. long, 9 ins. wide and 4½ ins. thick. They are set 2 ft. 6 ins. apart from center to center. Where the soil is poor the ties rest on a concrete layer about 6 ins. thick, but in good soil metal ballast is laid to a depth of 6 ins. The surface of the track is made up of a layer of 1½-in. metal, covered by 2 ins. of tarred screenings rolled and finished off with coarse sand. This has resulted in securing a smooth and almost dustless surface. The switchings, crossings and special work are of the Lorain Steel Company's manufacture. All of the curve work has been laid down with easement curves.

OVERHEAD CONSTRUCTION

The poles used for the overhead work are seamless steel tubes, made by the Mannessman Company, of Düsseldorf, Germany. The center poles are 29 ft. high and set in concrete to a depth of 6 ft. All poles are set about 125 ft. apart. Side poles are used for certain streets and where curves are necessary. Power is taken from a No. 00 copper wire supported on insulated hangers, which in turn are insulated from the poles by ball insulators.

A GALA DAY IN DUNEDIN

ROLLING STOCK

The present rolling stock comprises thirty-five cars. Fourteen are of the box type, with enclosed vestibules at each end. The car body is 18 ft. long, while the complete car is 29 ft. long over all and 7 ft. 6 ins. wide. Fourteen combination cars have also been provided. These are 29 ft. long over all, have cross-seats in the open part and longitudinal seats in the closed portion. There are, in addition, six open cars, with ten cross-benches capable of seating five passengers each.

The cars have monitor deck roofs, fitted with shutters to provide adequate ventilation. The woodwork is of quartered oak, with aluminum stenciling. The window sashes are also made of quartered oak, and are set in felt to minimize vibration. Ample provision has been made for lighting from handsome electroliers, each car being furnished with nine 16-cp incandescent lamps and one 32-cp headlight. The car bodies are in Indian red, and the framework, dashers, etc., in yellow and gold.

The equipment also includes a sprinkling car of 2500-gal. capacity, capable of watering the streets to a distance of 10 ft. on either side of the center of the track.

All of the rolling stock was furnished by the J. G. Brill Company, and was shipped in sections which were assembled on arrival at Dunedin. The trucks used are No. 21-E, with 33-in. diameter wheels. The electrical equipment of each car is of Westinghouse manufacture, embracing two No. 68 motors, controllers and magnetic brakes.

POWER HOUSE

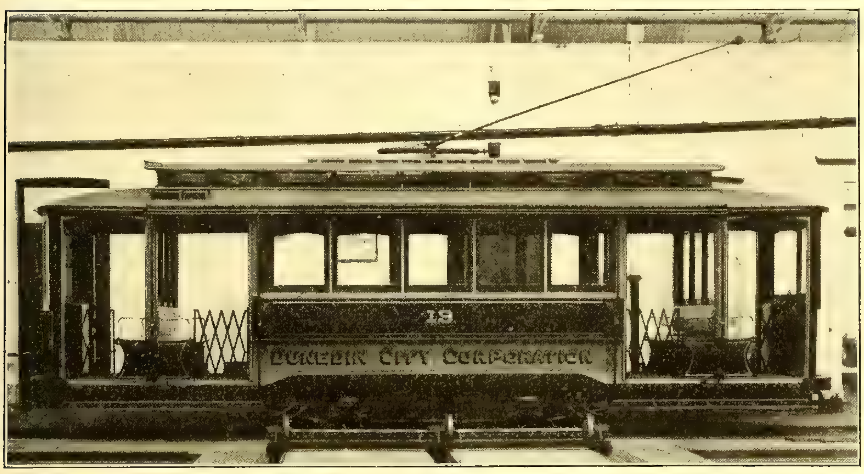
The power house is located on the site formerly occupied by the tramway stables in Cumberland Street. The old portion of the houses is used for the steam plant, while the part rebuilt is used for the engine room and converter station. The engine

room contains two 300-hp units, running at 380 r. p. m., each unit consisting of a Bellis-Morcom engine coupled to a Westinghouse generator. The steam piping is brought in from the boiler room overhead, and the exhaust taken away in underground conduits covered with iron checker plates. The boiler house contains four boilers of the Babcock & Wilcox type, with a heating surface of 619 sq. ft.

The converter sub-station, which adjoins the steam plant, consists of a converter room, transformer room, and an upper and lower battery room. The rotary converters will transform current received from an hydro-electric plant.

CAR HOUSE AND MACHINE SHOP

The car house is located on Market Street, and presents a striking appearance, owing to its somewhat military outlines. The ground floor covers an area of 165 ft sq., and receives abundant light through a saw-tooth roof of glass and iron. Four large lifting doors lead to the turnouts, and from these there are thirteen tracks, connected by a traversing track, so that a car can be run with facility from any part of the car house. Provision has been made for accommodating fifty-two cars, or nearly twenty more than ordered, to provide for future equipment. The floors are built of concrete and drained by channels. There are eight bricked car pits approached by steps.



COMBINATION CAR USED IN DUNEDIN

The machine shop, which is behind the car house, is equipped with American drills, lathes and planers, together with overhead traveling cranes and an hydraulic wheel press capable of a pressure of 100 tons.

Adjoining the car house are to be found the armature repairing shop, foreman's office, store rooms, a fireproof oil and paint shop, and a recess containing a gas oven for drying out coils. The executive offices also adjoin the car house. Gas piping has been laid throughout the buildings, so that in the event of an accident to the electric plant the buildings need not remain in darkness. The ground floor contains the cashier's office for receiving conductor's returns. A room behind this office contains separate lockers for the personal property of motormen and conductors employed on the lines.

The United Railroads of San Francisco report total earnings of $482,403 for the month of February, 1904, as against $445,161 for February, 1903, an increase of $37,241.

SOUTHERN OHIO TRACTION COMPANY WINS SUIT INSTITUTED BY CITY OF DAYTON

The Southern Ohio Traction Company won in a decision rendered by the Supreme Court in an error case from Montgomery County, in which the city solicitor of Dayton was plaintiff in error, and the traction company defendant in error. Judgment of the Circuit Court was affirmed. The city instituted proceedings in the Common Pleas Court for the inforcement of certain specifications of contract, claiming the company had violated its franchise in that it did not operate cars at sufficient intervals inside the city limits, that it did not have tickets for sale on its cars, and that it ran its cars at a higher rate of speed than permissible. The lower court held that the company specifically performed its contract with the city. The city appealed to the Circuit Court, which dismissed the case. The city then carried the case to the Supreme Court, and the judgment was affirmed. The Southern Traction Company is now the Cincinnati, Dayton & Toledo Traction Company.


SEMI-CONVERTIBLE CAR OPERATED IN DUNEDIN

The Northwestern Traction Company of Indiana has completed the first of the small depots which it will place along its lines. The first building is at Whitestown. It provides a waiting room which will shelter about fifty persons, and a storeroom for freight. Between these two rooms is the office of the agent. It is the intention of the company to put these depots in each town of 500 or more inhabitants. This is the first attempt of the Indiana interurbans to provide permanent passenger depots.


HEADQUARTERS OF THE DUNEDIN TRAMWAYS

ELECTROLYSIS AS CAUSED BY THE RAILWAY RETURN CURRENT

BY ALBERT B. HERRICK

In reviewing this subject to date, it will aid those who have not followed the matter carefully to commence with the fundamental laws governing electrolysis and then to bring out clearly the remedies that have been most successfully employed.

It will be assumed here that the trolley is positive, as this is the common practice, and that the ground return current is conducted back to the power station by all means of conduction presented to it. Each path of conduction will carry that portion of the whole current, which is exactly in proportion to the aggregate conductivity of all paths presented. When a current of electricity is delivered to the rails from the wheels of an electric car it seeks all paths back to the power station, and as the rails are in contact with moist earth in all city and most suburban construction, we have to deal with a conductor system of three kinds. The earth in contact with the rails is usually an auxiliary conductor system, but in city construction the normal resistance of this path is greatly reduced, and conductivity increased by the presence of iron piping systems buried in the earth. This causes a larger flow of current from the rails which is collected by these piping systems, and is conveyed back toward the power station at which it is generated. If no provision has been made the current will leave the surface of the pipe, ordinarily in districts adjacent to the power station, and in this way an electrolytic action may be effected.

Electrolysis, as known to the electric railway engineer, is the action set up when an electric current leaves a metallic surface buried in soil which holds moisture in suspension, but it does not follow that whenever these conditions exist electrolysis takes place. For instance, if the water that surrounds the metallic surface is pure, it acts as an insulator, or it may hold in solution solvent constituents, which, on being decomposed by the flow of current through it, produce an active ion which will not in turn act on the exposed iron surface or other metal. Furthermore, there must be a certain energy expended on a unit surface in order that the ion can be dissociated from its primary combination and become active in forming a new combination. Again, on the other hand, when the current density becomes very great per unit surface, electrolytic action practically ceases and all the energy appears as heat.

It is well known that one of the standard methods of determining the unit of current is by a deposition of silver in a silver bath containing a silver salt, but it will be necessary to remove the variables in order to appreciate what actually occurs in underground electrolysis. In standard practice the composition of the silver salt bath is precisely specified, the temperature in which it is to be used is also stated, and the current density per unit surface is fixed, thus eliminating the variables which are continually present in electrolysis arising from a stray earth current. This subject is not amenable to practical treatment from theoretical deductions.

It will be my aim in this article to give the outcome of investigations covering many of the largest cities in the United States relative to the methods of determining the conditions, causes and remedies for this trouble.

It has been assumed that there are certain characteristics on the surface of a metal which indicate electrolytic action. For instance, in cast-iron a pit in the surface of a pipe which is filled with a graphitic substance can be readily gouged out with a knife, leaving a greater or less depth of pit in the metal. In the case of wrought-iron, the developed fibrous structure of the metal is considered indicative of this action. Both of these conditions have been found also to be produced on metal surfaces by the corrosive action of the soil alone, and I have found no expert willing to state that these are of necessity indications of electrolysis. In lead, the indications are external to the surface itself in so much that the carbonate of lead, or the compound that is formed, migrates through the soil in veinings toward the receiving plate. Carbonate of lead without the seaming through the soil is not indicative, for ashes around a lead pipe will produce a compound identical in appearance, but adhering to the pipe. Iron pipe will show fibre structure when exposed to a natural or artificial gas leak, and also condensed water, or pure water, will eat iron pipe and develop its fibrous structure, as well as water bearing sulphurous acid. Steel pipe will show pitting identical with that caused by electrolysis when free particles of carbon have been incorporated in the surface of the metal during the process of rolling. Here the action is local, the carbon particle forming one pole and the surrounding metal the other, the moisture adjacent to the pipe surface forming an electrolyte. A very good example of this is found in the Rochester (N. Y.) main from Hemlock Lake. Numerous pits were found in portions of this pipe, some of which penetrated completely through the metal of the pipe, yet no current flowed over this pipe.

It is important, therefore, for the electrical engineer to determine whether electrolysis is actually taking place in a piping system where damage is complained of. A method has been devised of determining this, and differentiating between this action and that of natural corrosion which goes on with any metallic surface in the soil when exposed to moisture contaminated with the solvent constituents of the soil through which it percolates. The pipe on which the experiment is to be made should be exposed for about 8 ft. of its length. Cast test shields are made which will surround the pipe, as shown in Fig. 1. These plates should be cast approximately of the same composition of metal as that of which the pipes are composed. These shields are cast so as the two halves of the shield will enclose the pipe. The length is generally taken about three times the diameter of the pipe. The inside surface of two halves which go together and form one of the shields enclosing the pipe, are carefully cleaned on the inside and amalgamated. The surface of the pipe with which the shields come in contact is also cleaned and amalgamated.

Another shield, identical in every respect, is clamped around the pipe, but is insulated from it by a sheet of rubber packing or other equivalent non-absorbant insulator. Before these shields are placed on the pipe they are carefully weighed and a memorandum is taken of their weights and of the identification marks put on the shields. The pipe is then covered in the usual method, the paving is replaced, and the whole is left undisturbed for a period of six months. At the end of that time the opening is made again, and the shields are removed. They are then thoroughly scrubbed with a bristle brush and crude oil until all the deposit and dirt on these shields are removed. They are then dried and reweighed, and the loss of weight found by subtracting the previous weight of the pair of shields connected from their present weight, the difference between the previous and present weights of the shields will be that due to electrolysis.

It is important for railway companies to make this determination for their own protection when they modernize their ground returns and bring the system up to the present requirements, otherwise they may be held for losses which they did not cause. Often damages are discovered years after they have been produced; yet they are attributed to present conditions, under which no electrolysis will occur.

There are general relations existing between piping systems and railway systems which modify or increase the hazard of damage from electrolysis.

It has been found in those cities where the pumping station and street railway power station are located in the same neighborhood that the piping system has been immune from damage.

The reason for this is that the area of a piping system and the dimensions of the main, and the area of the surfaces exposed gradually diminish as they ramify away from the pumping center, and also the rails of the railway decrease in the current density which they are required to carry as they depart from the power station, the result being that the area exposed in the outlying territory of the piping system is less, and the normal resistance between the rail and piping system is greater where the potential difference is greatest. Also it is found that where the current flows from the rail to the pipe the resistance is

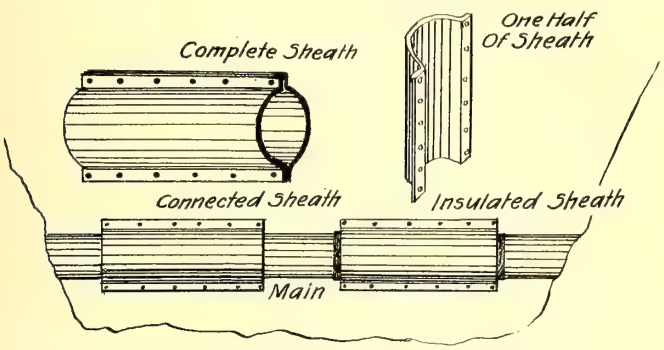


FIG. 1.—CAST-IRON SHIELDS FOR TESTING FOR ELECTROLYSIS

about four times greater for a given area exposed than where the current flows from the pipe to the rail, and, consequently, the volume of current on these outlying piping systems collected is much less under this relation of the railway and piping system. Again, when the current approaches the station, the area exposed for the dissipation of this current to the earth in its return path to the station is large and the resistance low, and in this case the condition is found of the energy per unit surface being too low to produce a disintegration of the metal surface.

In the case cited it will be found on measuring potential differences that they will average much higher over this system than where the power station and the pumping station are diametrically located in reference to the center of the city supplied. This would be considered unfavorable if the old method of establishing or predicting electrolytic hazard of the piping system were followed, but conclusions arrived at from potential surveys between the piping system and rails are of little value in determining the true electrolytic hazard, for the reason that the higher this earth resistance the greater the difference of the potential that can exist between the rail and the pipe.

The pavement over a street also offers protection to piping systems underlying where the pavement is impervious to surface moisture, such as asphalt, brick and belgian block, when laid with a sub-base of concrete 4 ins. to 8 ins. thick. Here the electrolyte against the pipe has not the circulation nor is it replenished, as in the case of an open street, and it is found that when the active constituents in an electrolyte surrounding a pipe have been reduced the chemical action ceases and will not be renewed until the voltage rises to approximately 1.5 volts between the surface of the metal and the electrolyte, and at this potential water can be decomposed, leaving pure oxygen to oxidize the metal of the pipe. Investigations made in regard to the rate of depreciation of a pipe have established the fact that the film of oxide formed on the surface of the pipe has a screening effect against the penetration of active constituents formed by the current flowing, and that the actual metal destroyed after the pipe has received this film of oxide rapidly decreases with time and current.

Again, the only potential that is active is the potential that exists between the pipe surface and the electrolyte immediately surrounding the surface. The difference of potential existing between the rail and pipe does not give us the criterion of what the potential may be between the pipe surface and the electrolyte. The potential fall, along this path of conduction, depends upon the resistance of the earth, the resistance of the electrolyte against the pipe and the resistance of the paving. Fig. 2 contains several curves showing how these conditions effect the distribution of potential along this path.

It will be seen that the normal earth resistance plays an important part in determining whether the critical potential at the surface of the pipe will rise to such a value at which electrolysis will take place. The following method of testing to find the actual potential adjacent the pipe is the only one in my experience that will give concordant and reliable results. The conditions under which this test has to be made are as follows:

First, the earth cannot be disturbed around the pipe; and, second, the instrument used to determine this potential must not introduce a resistance in this circuit which would disturb the normal difference of potential that exists between the electrolyte and pipe surface; and the test plate must not produce any local electromotive force which would disturb the true condition. To accomplish this a cadmium plate has to be used for the test plate, and the "Poggendorf" method must be followed. By this process the electromotive force measured is balanced against opposing electromotive force, whose value is known, and in this way the electromotive force existing between the surrounding electrolyte and the pipe surface is determined without disturbing the normal potential existing. Only a small opening is made exactly over the pipe in the street, and the test rods are driven through this opening until the cadmium plate is adjacent to the pipe and the other test rod is in contact with the pipe. Then the connections are made from these two rods, as shown in Fig. 3, and the measurements of

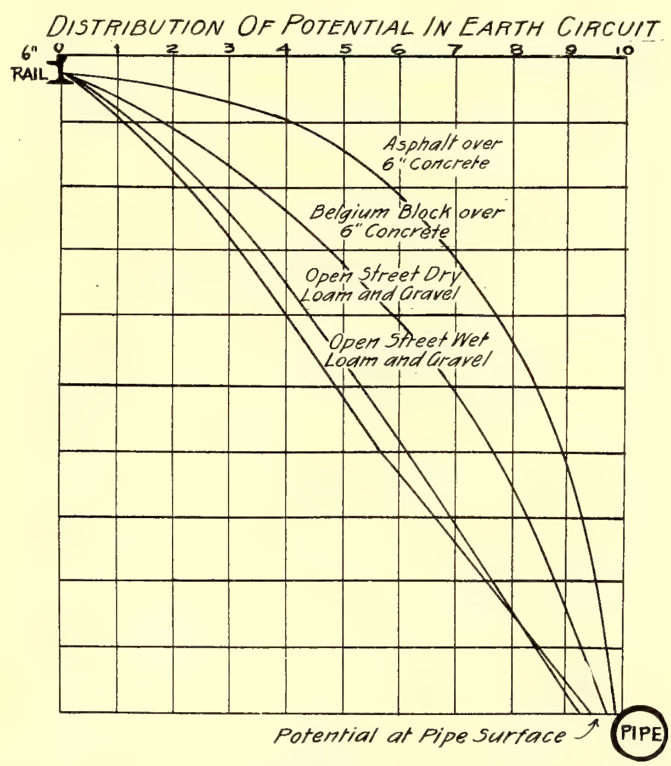


FIG. 2.—EFFECT OF MEDIUMS OF DIFFERENT RESISTANCE ON CURRENT FLOW

potential made. When it is desired to plot out the curve of potential between street surface and pipe the cadmium test point is driven in, and the potential is measured at several points as it approaches the pipe, from which data potential curves can be laid out.

Another condition common to systems affected by electrolysis is where a city is traversed by a river. This arises from the fact that the ramified piping systems on both sides of the river are brought to several mains crossing the river which connect these two piping systems. This also causes the current which

has been collected over large areas of the pipes to be concentrated on these few mains, and trouble has arisen especially where the power station is located on the bank of the river adjacent to this piping system. Here the current must be dissipated from small areas of piping, and electrolysis may take place due to this concentration. Another case of trouble arising from concentrated action is where services pass underneath the track where the potential of the service pipe is positive.

In reference to protection of these points, a number of methods have been used to remedy this local trouble. One is to enclose them in a box, which will clear the service pipe all around by half an inch. This box should be filled with hot asphalt, and should extend at least 5 ft. beyond the outside rails of the track. Do not use coal tar for this purpose, as it is charged with ammonia and will actually make the resistance much less than it was before. This has also been found the case with pipe coating used for the purpose of preserving the pipe from corrosion. This coating, if it contains ammonia or free acids, reduces the resistance of the pipe in its contact with the soil over that of a bare and uncoated pipe. Rubber hose has also been used, the practice being to slip it over the service pipe before the last connection is made and extend it 5 ft. beyond the outer rails of the track. An insulated service pipe has been used with success. The trouble in regard to these local remedies is that a plumber is generally called in to make the repairs, and as any method of permanently protecting them would mitigate against his having to make this repair again shortly, effective remedies are not generally advocated.

Engineers of piping systems have applied a number of methods successfully, by which stray current can be greatly reduced in volume. The first question that arises is whether the current has been diverted from the rails of the railroad company to the piping systems through a metallic contact. It has sometimes happened that where pipes are carried over metallic bridges and are in contact with the metallic structure of the bridge the rails of the railroad company are also resting on the same metallic structure, thereby forming a metallic connection between the rails and the piping system. The remedies that have been used for this pipe construction is to insulate the pipe from any contact with the metallic structure of the bridge with wood or other insulating material which can stand the stress of this weight. Another method is to use insulating joints at the two portals of the bridge. This can be applied where the piping carries a non-conducting medium. Metallic connections are also made between the rail and the piping system through gate boxes, which are of metal, or pipes resting on the main and terminating on the street surface with covers. This pipe may be connected with the rails through this means where the gate box comes in contact with the rail. The remedy for this trouble is to use a wooden box between the pipe and the end of the casting holding the gate-box cover, as is done in Philadelphia, or to break up the metallic continuity of this gate box by interposing earthenware or insulating pipe. The only function of this gate box is to leave an opening in the street above the gate of the buried pipe so that the gate may be operated. Other sources of connection have been found where gas pipe service has been brought in contact with the rail. In early electric railroading metallic connections were purposely made between the rail and the pipe, and many of these still exist. These, of course, should be located and disconnected when they are in territories where the current will flow from the rail to the piping system. Where several stations are operating in a city, one of them being used as a reserve station and all employing the method of taking the current from the pipe by a metallic connection, a switch should be provided on such pipe feeders and should be opened when that station shuts down; otherwise this would afford a path for the current from the rails through this pipe to the operating station. Accidental connections have been found where the water pipe has been connected to hydraulically-lifted bridges over which electric railways pass, affording a means of metallic connections between rails and piping systems. In several cases, also, it has been found in constricted spaces over stone-arch bridges that the water main and rails have been brought together in metallic contact. The question arises how to locate exactly these metallic connections.

This may be done by dragging metallic brushes over the tracks, mounted on a separate truck, whose two wheels are

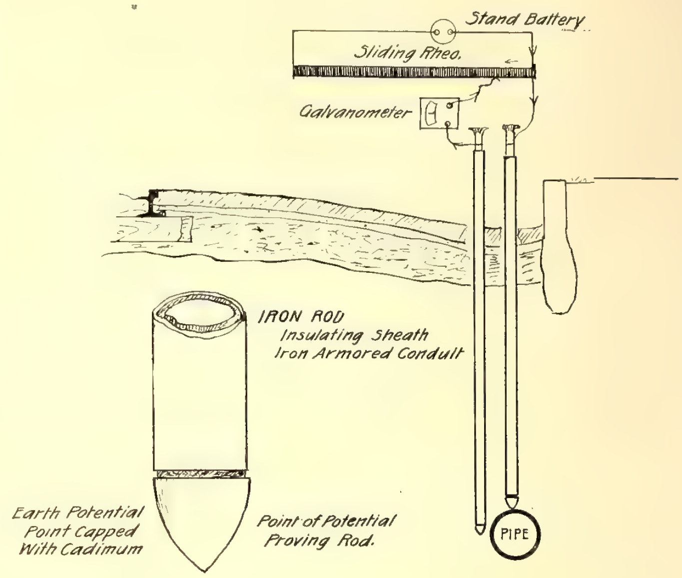


FIG. 3.—TESTING FOR ELECTROLYSIS BY THE POGGENDORF METHOD

insulated from each other on special test car. It has been the usual practice to place these brushes, a pair for each rail, 4 ft. apart, and connect them to a milli-voltmeter. The direction of the current will normally be toward the power station, but if there is a metallic connection with a pipe the current flow on the rail in this locality will reverse in direction from the power station until the point of connection is reached by the equipment carrying the drop brushes. The direction of the current will again reverse, and the local ground connection will be found between the equipment and the power station. A manually operated pop valve which will squirt paint or whitewash on the track is used to mark these points as they are discovered, and afterward these can be definitely located by measurement, but it is easy to spot ground connections, either visible, or otherwise, within 2 ins. It sometimes takes two or three runs over a track in order to locate these connections exactly. It is also necessary to carry in the test car a rheostat, which will give from 100 amps. to 200 amps., to be used when the normal current density on the rail is low, and in this way the circulation of the current on the rails can be traced and their deflection from the normal path to the power station followed up and the causes located. A ground return feeder connection to rails will give exactly the same indications as a metallic connection between piping systems and rails, but these feeder connections are known to the railroad company, and their locality need not be confounded with the ground connections. In making this test intersecting railways, both steam and electric, will divert and reverse the current on the rails, as a part of the current will follow back and pass over the best bonded part of the track to the power station.

Piping companies have successfully avoided electrolysis by using insulated joints in laying piping, thus breaking the continuity of the piping system as an electrical conductor. The East Ohio Gas Company, at Cleveland, uses insulated joints between the different sections of the pipes, and this practice is also followed successfully at Buffalo, N. Y. A rubber gasket is placed around the pipe over which a sleeve is slipped, so as

not to allow the metallic portion of the separate section of pipe to come in contact. The old cement pipe was a form of insulated pipe which made a non-conductor system of the piping system. I understand that the water-works at St. Johns, N. F., use wooden wedges or rings instead of lead successfully, and in this way produce an insulated caulking between adjacent sections of the pipe. There are also a number of cements used for joining adjacent sections of pipe which are insulators, but I do not know of a practical use of these cements in water-works of any size.

In several cases where the main is laid directly under the tracks of the railroad company, a shield plate of cast-iron has been placed between the water pipe and railway tracks. When the shield is connected to the water pipe electrically in this way, the action of the electrolysis, which would have taken place on the pipe without the protection, is transferred to the shield plate. This method is applicable to many strictly local conditions.

Any ground plate can be connected to the piping system and located much nearer to rails than the water pipe. A large volume of current will be dissipated from this ground plate instead of from the surface of the pipe. The interposition of insulated joints on mains under special conditions of piping system—such as a long main paralleling a railway track and having no lateral connections—would be efficacious if a sufficient number of these joints were put in the pipe at such locations along its route as would reduce the current to a small quantity. But, in a ramified piping system, as laid out for city service, it is very hard to locate these joints so that in an equilateral piping system there will not be another metallic by-pass in the piping system around this joint, thereby rendering the joint useless for the purpose intended.

It has been found where a number of different piping systems exist that one set will collect the current from a large area and deliver it to another set of pipes. Sometimes this is transferred through the earth where these two systems approach each other and a local condition of electrolysis is produced. This condition can be remedied by metallic connection between these two piping systems with a conductor large enough to take care of the current flowing between them. It has also been found where a number of street railway systems are located radially or parallel through a portion of a city that if one of these lines of rails forms a great deal better conductor for the return current than the others, a shuttling action takes place, the current leaving the poorly bonded tracks and entering the piping system, and using this as a short cut across to the tracks, which have high conductivity, and in this way back to the power station. Where this shuttling action occurs on the pipe the pipe paralleling the well-bonded track becomes positive to the rails throughout its length, and the current is found to be passing along the lateral pipes through the streets which intersected the poorly bonded tracks.

The best way to carry out bonding is to commence from the power station and go radially, carrying the improved track work out to the same distance on the several parallel tracks. This method of carrying out new construction work will prevent shuttling. Where two tracks terminate near each other, or adjacent, and where there is considerable distance to the power station and the piping system underlies these two railway systems it is best to connect these two railway systems together by a feeder, tapping both systems of rails, and in this way equalizing the potential and averaging the drop from this point back to the power station. It will also be noticed on interurban roads that the current will flow along the rails toward the city and enter the piping system as a distributing earth plate, and pass back by this path to the interurban power station through the earth where the soil is against the rail, or earth plates have been used at the interurban power station.

The following data will be useful in calculating the normal earth leak in railroad systems having different track constructions:

A rail on ties, with gravel ballast, the ties average 5 ins. x 8 ins., and seventeen per 30 ft. Resistance per mile per single track of 60-lb. rails of A. S. C. E. section.

A rail and tie having concrete sub-structure reaching up to the foot of the rail. Resistance per mile per single track of 60-lb. rail A. S. C. E. section.

A concrete sub-structure in which the concrete reaches up to within 1 in. of the head of the rail. Resistance per mile per single track of 60-lb. rail A. S. C. E. section.

A rail with a concrete sub-structure on dies with belgian block pavement. Resistance per mile per single track of 60-lb. rail A. S. C. E. section.

A concrete sub-structure and asphalt pavement. Resistance per mile per single track of 60-lb. rail A. S. C. E. section.

Under normal conditions, where a pipe is relieved of its current by a metallic connection with the ordinary street service construction, between 5 per cent and 6 per cent of the total output of the station is returned by the pipe. This is only true where no metallic connection exist between the rail and the pipe. It also depends upon the drainage of the sub-soil, the character of the sub-soil and character of pavement as well as the proximity of the pipe to the rail.

In order to increase the resistance between the pipe and the rails a number of cities are using a distributing main on each side of the street, and from this main the services pass directly to the premises of the consumer. In this way the distance is increased between the rail and the pipe, and the current is not passed under the rail by services, thereby producing local electrolysis.

In investigating any system it is very important to locate any ground connections existing between the pipe and the rail, and also their value as an auxiliary return circuit to the power station. It will be noticed in comparing the variations of an ammeter, so connected as to indicate the current flowing back from the pipe to the negative bus of a power station, that if the variations of these two meters are synchronous, or the variations of the meter connected to the pipe return cable lags slightly behind the main meter, it is safe to conclude that there are no metallic connections existing between the piping system and the rails, and, furthermore, if the total current return on this pipe feeder is in the neighborhood of 5 per cent it is safe to conclude that the returns are due to earth leaks and not metallic connections. By having this special meter on a portable stand, so that its variations can be read simultaneously with those of one feeder meter after another, taken in turn, it will be found that this special meter will vary synchronously with one or two feeders on the system, and these are the ones which are feeding current into the rails in contact with the ground connections. By following this up the portion of the system that is connected electrically with the water pipe system can be discovered, and by means of the trailing brushes, as before described, the exact location of these ground connections can be located.

The question arises, what can the railroad company do in order to minimize this trouble? Reducing the rail return resistance, of course, increases the flow of current on the rails, and, proportionately, reduces that portion of the current returned on the pipe, and affects the location of the ground return feeders from the power station to the rails. In reference to the railway systems it has a great deal to do with the focusing of current on the piping system. If these feeders are taken to the rails, at points electrically and symmetrically located in reference to the current they conduct to the power station, a large unipotential area can be formed in the vicinity of the power station. This arrangement of the feeders will bring the potential differences within this area between the pipes and rails in the locality of the power station, so that the potential will

not be sufficient to produce a destructive action on the piping system.

In a system where the station is located near the center of the city, or the ground return feeders are taken back to the power station from this center by designing and locating the ground return feeders in their connection to the different systems of rails interconnected at the center of the city, it will be seen that the neutral territory between the pipe and the rail floats over considerable distance, due to the load on that line of rail terminating at the common center.

To make this proposition as simple as possible, suppose a long stretch of railway passed by a station which was located near the center of the line of the road, and instead of tapping the rails immediately adjacent to the station and bringing the return back to the negative bus, two feeders were taken out, one being carried up the track and the other down the track for some distance. It will be found that the current on the rail lying parallel and adjacent to the station, and between the two feeders, will vary in its direction, depending upon the loads on the sections of track extending beyond these feeder taps. The potential, of course, between the pipe paralleling and underlying this rail would vary from positive to negative, or alternating-impressed electromotive force would be the potential to which this pipe would be subjected, and under this condition electrolysis would not occur.

Now, this same principle can be expanded to cover a ramified railway system where the rails are interconnected at the center of the city. Feeders can be so connected to different tracks that the center area in which the pipe before us was positive to the rail can be brought to an alternating potential by the interaction of the different currents entering this center, and the surging of electromotive force over this area due to the varying volumes of current entering this area and by care in adjusting these feeders in relation to the currents they have to carry and their return to the power station.

The prevalent method of protecting the pipes is the so-called "drainage system," where the current is taken off the pipes through a metallic connection and conveyed back to the power station. This method has been used in a large number of plants throughout the country with very fair results, but I find that in all cases it has not been intelligently done, and still a condition exists where damage may occur.

Before making this connection the piping system should be carefully studied, as it has been found that certain mains form an arterial system through which the majority of current returns; these are evidently the pipes which should be bled of their current, but in a number of cases a small pipe, or lateral, near the power station, has been selected, which has not sufficient cross section to carry the current delivered, thereby producing considerable fall in potential along this pipe, and creating a difference in potential through which electrolysis may occur. Again, in a number of cases it is not advisable to connect the pipe immediately adjacent to the power station, for in that case the resistance of the feeder would be low and would increase the normal flow of current over this pipe. But by locating this feeder in the territory where the pipe is practically neutral to the rails and carrying the maximum current, a point can be so selected, in most systems, on a main or large pipe from which all the other piping systems branch. Here a feeder can be connected, so that the amount of current carried back to the power station will reduce the local potential between the track and pipe in the positive area to a point below that at which the electrolysis can take place. The best method found to connect electrically this feeder with the water pipe is by making yokes to embrace the water pipe having the inside of the yoke amalgamated, also, the outside of the water pipe amalgamated where this surface comes in contact and to this yoke attach the pipe feeder by soldering or other means. It is also important to ascertain when locating this connection whether the potential between other piping systems at this point and the piping system connection has been raised to a dangerous point. In any case it is wise to connect all these piping systems together by means of a copper cable sufficient in capacity to carry the current they deliver and bring the potential the same in this location.

There are conditions arising, especially in small cities, where the connecting of a pipe to the station presents a constant resistance path, yet the tendency of the current flow through this pipe in outlined districts depends upon the current flowing on the rail and the aggregate drop of the currents flowing. In order to prevent the current flow on the piping system changing its value as a conductor for this return current, its resistance should be changed in relation to the output of the station, or compounded so that the relation between the rail and the earth's return resistances will remain constant for variations of load.

It can be readily seen that by connecting this ground return pipe feeder to the rails at the point where it is connected to the pipe an electromotive force drop equivalent to a resistance can be interposed between the rail and the pipe feeder, so that the current flowing from the rails and over this pipe feeder back to the negative bus, will raise and lower the potential at this point and maintain the resistance of the external distribution system between the rails and the pipe at a constant relation. In this way it will compound this feeder proportionately to the load on the system and not force the piping system to assume various relations in reference to current return depending upon the load of this system of rails. The degree of compounding desired is that when the load on the line of rails is at its terminal, or at such a point where the ground return drop is greatest, the current will not flow over this tie from the rail to the pipe. This would occur where there were other pipe connections of lower resistance nearer the station than the pipe tap made, or a very low ground resistance between rails and piping system in their positive territory.

It is often important to determine what is the actual current flowing through a pipe, and it has been found with cast-iron that the electrical resistance of different pipe, even made by the same manufacturer at different times, varies so much that reliable results cannot be obtained by assuming any specific resistance for cast iron.

The best method for measuring the current flow on a pipe is when the pipe can be exposed to take 4 ft. or 6 ft. of the pipe between drop points and around the drop point connect two clamps connected by a low-resistance cable, in which is inserted an ammeter and also a switch. If the milli-volts are read across the drop points on the pipe when the switch is open, and again when the switch is closed, and also the current shunted around the drop points read at the same time, it will be found, after a number of readings have been taken, that the difference in drop with the switch open and the switch closed will bear a constant relation to the current by-passed. In this way the pipe can be calibrated in milli-volts per ampere, and correct results can be obtained. This method is especially useful where the pipe has been eaten or corroded, and its true cross-section is not known.

In determining the flow of current along a water system, testing from plug to plug can be used, and the method just described can be employed, except that the leads in this case are long enough to reach from one plug to the next. In order to be assured that there is no high resistance between the plug and the main to which it is connected, a connection can be made between the rail and the plug with a low-resistance conductor, in which is inserted an ammeter and also a drop wire with a voltmeter and connected between the rail and the next adjacent plug, or other local water connections to this main, and this will give the resistance between the plug and the main by dividing the volts dropped by ampere flow. In this way the resistance of the connection between the water plug and the main can be

determined, but if this resistance is high, this plug should not be used in the determination of the current flow along the pipe.

This test will also locate bad electrical connections across the pipe joints along a section of pipe. The readings on this supplementary conductor between adjacent plugs will indicate whether the mains are continuous conductors or not, as a high initial potential will be obtained with the switch open and a low potential with large current flow when the switch is closed.

Very valuable data can be obtained, relative to the current distribution over the rails and piping system, by making tests from which a potential contour map can be laid out. This potential contour map can include the different piping systems as well as the rails of the railway system, and this test can be carried out as follows:

The different lines of street railway radiating from the center of a city present different resistance and also different volumes of current, depending upon the traffic condition, to the return current flowing through the rail.

This will give different distributions of potential relative to the power station for the various lines, and if the potential is measured from different points in the city, relative to the zero potential at the negative bus at the railway power station, the potential can be plotted out on a map or scale, and will give an electrical contour which can be expressed on the map exactly as the elevation contour of the city. To effect a pressure connection by which the difference of potential of the negative bus and the point to be tested, telephone wires can be used. A permanent connection is made through the telephone cable, from the negative bus of the power station to the telephone exchange test room. Then at the point of test in the streets a pair of telephone wires are tapped, and they were then located in the test room on the cable board by first ascertaining the number of the subscriber which they served. This pair of wires is then cut out from the exchange and connected by means of a jumper to the wires leading to the negative bus at the power station. This gives a pressure wire from the point of test to the negative bus, and when the rail is connected through a voltmeter to this wire it gives the loss in pressure from this point on the rail back to the negative bus at the power station. This connection is then taken from the rail and placed on a water plug or gas pipe or sheaths of cables. If a map is required of all underground structures the pressure may be read in each instance in the same manner back to the negative bus, corrections being made for the resistance of this pressure wire. A number of different stations are taken over the city, covering the different lines of electric road, and from these the contour map can be plotted. Solid black contour lines are usually the fall in potential on the rails, and dotted contour lines represent the distribution of potential on the water pipe system. Colors can be used for the other systems.

This data gives us graphically the relative ground resistance. Where two contour lines of the same potential coincide it indicates that a metallic connection exists, and if laid separately for each of the piping systems shows graphically at what location this difference of potential is sufficient to cause trouble. It is necessary to take a number of readings at each location that the results will be an average, and these readings are best not taken at peak loads, but when the station is giving average output.

From judicial decisions which have been rendered, especially in the Dayton case, it has been established that the railway company should use every endeavor to carry this current back to the power station and use all the modern improvements known to connect the different lengths of rail together, so as to make a continuous conductor and to use such supplementary ground return feeder systems so as to relieve the rail of any excessive volume of current which will produce a rapid fall of electromotive force along the track, as this condition is conductive to troubles with underlying piping systems. This article is written for the purpose of indicating to railway managers what has been done to remedy these troubles where they have arisen, and why some cities have had trouble while others are practically immune.

THE USE OF GROUP-SWITCHES IN LARGE POWER PLANTS*

BY L. B. STILLWELL

In a number of large electric generating plants recently designed in America, the feeder circuits are divided into a plurality of groups, and a switch designated a "group-switch" is connected into the circuit between the main bus-bars and each group of feeders. Obviously, no switch should be added to an organization of switch gear already very complicated and expensive, unless its practical usefulness fully justifies its adoption. As this subject has never been discussed by the Institute the writer avails himself of the opportunity presented by the invitation of the chairman of your transmission committee to introduce it.

In considering a subject such as this, accurate generalization is difficult if not impossible. Probably no one who knows what engineering means would affirm without qualification either that he approves the use of group-switches or that he does not approve their use. There are few hard and fast rules in engineering. If such matters as the use or non-use of group-switches could be settled once for all, and for all plants regardless of size, function, or attendant conditions, the purchasing agent would soon succeed the engineer, the pharmacist would take the place of the physician, and the capitalist investing his money in electric power development and use would have no occasion to seek among technical advisers for sound judgment resting upon broad experience and exercised in full knowledge of the existing state of the art, as well as recognition of its general direction and tendency. Instead of attempting a generalization, therefore, we may consider more profitably the arguments for and against the group-switch in the case of a typical plant, and then glance at some of the modifications of function and circumstance, which in the case of other plants would affect our conclusions. The group-switch first appeared in the plant of the New York City Railway Company, at Ninety-Sixth Street, but as the writer had nothing whatever to do with the design of that plant, he selects for consideration the plant of the Manhattan Railway Company. In this plant two complete sets of main bus-bars are used. Switches are provided by means of which each of these sets may be divided into two independent sets of bus-bars to each of which four alternators and four groups of feeders may be connected. Eight group-switches are provided, through each of which current is supplied to a set of auxiliary bus-bars, to which in turn the individual feeders are connected through their respective switches. One of the eight feeder groups is used to supply power to auxiliaries in the power house. The other seven groups supply power, respectively, to the seven sub-stations which receive power from this central source. All switches in the high-pressure alternating-current circuits are of the motor-operated oil type.

The arguments in favor of the group-switch as used in the plant of the Manhattan Railway Company are:

1. It affords an additional means of opening a feeder switch that fails to open its circuit when operated for that purpose. The advantages of the group-switch in respect to this function to-day appear materially less than they did five years ago, for the reason that the power-operated oil switch within the period named has demonstrated a high degree of reliability. However, it cannot be assumed that the feeder-switch is invariably reliable, and, therefore, opinion as to the weight of the argument

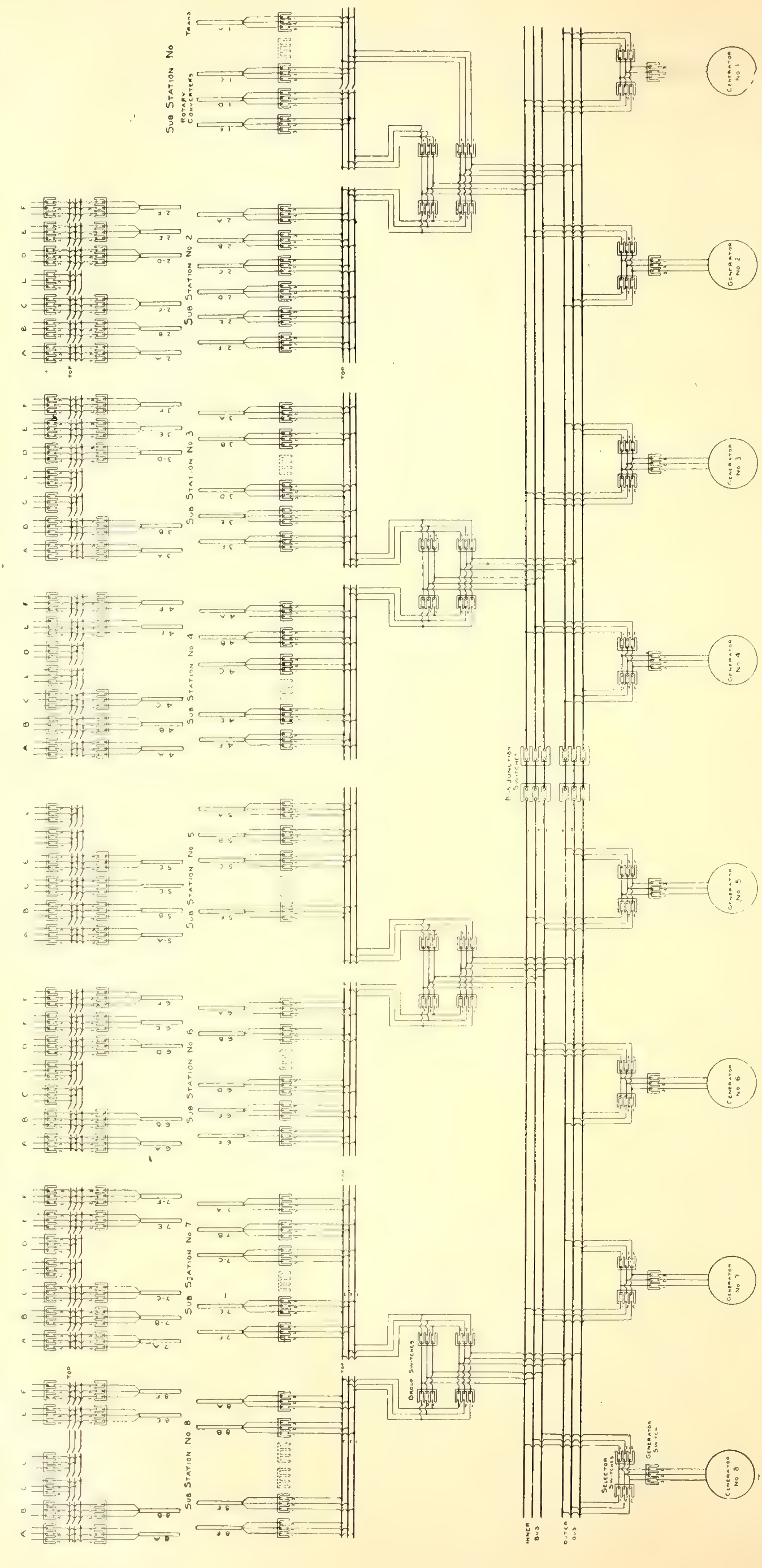
* Presented at the meeting of the American Institute of Electrical Engineers, March 25, 1904. Copyright, 1904, by A. I. E. E.

in favor of the group-switch, based upon its use as a reserve for the feeder-switch, becomes a question of judgment of the chances of failure of the feeder-switch on the one hand and the seriousness of total interruption of power supply on the other.

2. It affords means of reducing the aggregate load upon the power house in case of necessity, more rapidly and otherwise less objectionably than the usual method of cutting off individual feeders. It will sometimes happen in the operation of a power plant that it becomes necessary suddenly to shut down one of the generating units. If the load carried at the time be such that the shutting down of the generator implies reduction of the external load, this can be accomplished most conveniently by operating one or two group-switches.

3. Where duplicate main bus-bars are used it facilitates transfer of load from one set to the other, in case it becomes necessary suddenly in operation to make such transfer. As bus-bars and connections are now installed in our best plants, this necessity does not arise frequently; nevertheless, it is liable to occur, and obviously half a dozen group-switches may be used to affect the transfer in much less time than would be required were five or six times that number of individual feeder-switches used.

4. The grouping of the external feeder circuits in group units bearing a simple fixed relation to the generator units establishes a symmetry and proportion most useful to the operator, particularly in times of emergency. In the case of the plant under consideration, at times of full load, the power passing through each group-switch is substantially equal to the output of one generating unit. This relation, of course, does not exist under partial loads, but under such loads it is not difficult usually to keep in service generating capacity exceeding the load by a margin sufficient to make it possible to shut down one generator without cutting off feeders; and in cases where this margin of capacity is not kept in service it is, nevertheless, a more speedy and certain operation to cut off



ARRANGEMENT OF BUS-BARS, OIL SWITCHES AND A. C. FEEDERS AT THE SEVENTY-FOURTH STREET POWER STATION AND SUB-STATIONS OF THE MANHATTAN RAILWAY COMPANY, NEW YORK

the necessary number of groups of feeders than it would be to cut off a proportionate number of individual feeders.

The arguments against the group-switch are:

1. It introduces additional apparatus, and, therefore, in itself increases the risk of interruption due to failure in switch insulation, etc. The successful operation of many plants, particularly in America, has been interfered with by the introduction of too much switch gear and too many safety devices, automatic and other; these additions in themselves being responsible in some cases for more trouble than they prevent; and it is to be noted that the group-switch implies the auxiliary bus-bar. Here, again, it is impossible to dogmatize, for as the result of additional experience, the judgment of to-day may be reversed five years from now. As an expression of personal opinion, however, I may say that if the group-switch and the auxiliary bus-bars be reasonably well insulated and installed, the interruption originating in this additional apparatus should be almost negligible in the case of such a plant as that which we are considering.

2. The group-switch and its bus-bars imply, of course, an increase of cost of the plant. In case of the Manhattan plant this increase is about 10 per cent of the cost of the switch gear and measuring apparatus, and about four-tenths of 1 per cent of the cost of the plant. To put it another way, the cost of the group-switches and bus-bars for the plant approximates $20,000, and the annual cost, assuming this to be 10 per cent of the investment cost, is $2,000, which is about two-tenths of 1 per cent of the annual cost of operating the entire plant, including sub-stations.

In the plants in which the feeder unit equals or exceeds the dynamo unit of power, the group-switch, of course, disappears. In this case, however, it may still be advisable to use two feeder-switches in series in order to avoid the necessity of shutting down the entire plant in case of the failure of a single feeder switch.

Obviously, also, there is no reason for attempting to use group-switches in cases where the total number of feeders is small.

For plants comparable in magnitude to the plant of the Manhattan Railway Company, using a very considerable number of feeders, the group-switch is important and its use generally advisable.

GANZ SYSTEM FOR CANADIAN LINE

The Canadian Electric Traction Company, of London, has accepted the tender of Bruce Peebles & Company, Ltd., Edinburgh, for motor cars and power house equipment for the St. Thomas & Port Stanley Railway, which will operate between St. Thomas and Port Stanley (Canada). The equipment will comprise 1000-hp power station equipment, three-phase transformers, etc., ten 250-hp three-phase motor cars, each to seat fifty passengers, speed 30 miles an hour. The Ganz system will be used, and the entire plant will be built in Edinburgh. The contract price is £42,250.

CAR HOUSE FIRE IN CINCINNATI

Twenty-five summer cars, valued at $75,000, two double-truck closed cars, valued at $10,000, and two salt cars, which cost $2,500, were destroyed Saturday morning, March 26, by a fire which completely wrecked Barn No. 1, of the Hewitt Avenue barn system of the Cincinnati Traction Company. The architecture of the structure was such that the flames were given full vent, and, aided by the stiff wind, spread with remarkable rapidity. The adjacent barns had a narrow escape from destruction and the fire walls that were between them in all probability prevented the flames from sweeping from one end of the series of barns to the other. The total loss is estimated at $94,000, and is covered by the blanket insurance carried by the company.

SOME IMPROVEMENTS IN TRACK CONSTRUCTION IN PHILADELPHIA*

Rail-joints, especially those used in street railway tracks, may be divided into two distinct classes—those, which I will call ordinary joints, where the parts comprising them may be assembled and taken apart with ease and comparatively small expense, and those, which I will call permanent joints, where the parts are permanently embodied in the joint and cannot be taken apart. The first class comprises practically all of the joints at present in use, and are those that consist of fish or joint-plates of various forms held by bolts or keys. The permanent joints represent a very small percentage of those in use, as they have been introduced comparatively recently, and consist of so-called cast-welded and the electrically-welded joints.

The different kinds of fish or joint-plates used for connecting ends of rails are well known. The principle involved in all of them is two wedge-shaped plates, that are, by means of bolts or keys, forced on to the rails, the latter having a similar outline; and upon the thorough, continuous and tight contact of these inclined surfaces the solidity and permanence of the joint depends. In any form of rolled steel exact uniformity of section is never obtained; one end is invariably larger in cross-section than the other, even when new rolls are used. This is due largely to the difference of temperature between the ends of the steel when on its final pass through the finishing rolls; and, further, as the rolls wear down, the rolled section becomes larger. This is true even with the simplest section, as a square or round bar, and it is considerably more pronounced in the deep rail sections that are used in street railway construction. In consequence, when joint plates and rails are assembled, while theoretically true and exact in their complementary design, in practice they vary greatly—sometimes as much as 1-16 in. But, assuming that the section of plates and rail are correct, as per design, rolled surfaces of steel are not continuous or perfectly smooth planes, but consist of minute elevations and depressions. Therefore, when the two joint plates are forced by the bolts into the fishing sections of the rail, continuous contact is not obtained, but only an intermittent or point contact. In other words, only the protuberances of the surface of the joint plate come in contact with those in the surface of the rail. The object of a rail-joint is to bridge over the ends of the rails and hold them against vertical and lateral movements under the load. Were it only for those movements, I believe, joint plates would be effective for a considerably longer period than they are in practice, for the protuberances mentioned above would hold out considerably longer against flattening under the weight of the load. But, besides the vertical and lateral movements, there is a longitudinal or bodily movement of the rails, due, principally, to contraction and expansion, and also on account of the wave motion of the rail under traffic. This movement acts like a file on the minute irregularities of the surfaces. Although this linear movement is small, maximum ¼ in. to ⅜ in. in severe changes of temperature, yet those point contacts are so small as compared with the extent of the movement of the rails, that this movement acts upon them like a long-drawn file. The result is, that no matter how tightly the plates were adjusted originally, in a very short time they become loose, and the ends of the rails begin to hammer under the passing wheels. Moisture percolating between the contact surfaces, due to capillary attraction, or otherwise, oxydizes those surfaces and greatly facilitates this filing effect. In steam roads this necessitates constant, almost daily, tightening of the bolts.

I have not mentioned here the loosening of the plates caused

*An address given before the Philadelphia branch of the American Institute of Electrical Engineers, by C. B. Voynow, assistant engineer Philadelphia Rapid Transit Company.

by the nuts being jarred loose from vibration; the reason being that I wish to present the fact to you that a joint, even under ideal conditions of fit and construction, could not be maintained in perfect condition very long. In street railway track construction the movement of the rails, due to changes of temperature, is not as great as in steam tracks, because the rails are buried in the pavement, yet it is large enough to cause the same filing effect. On the other hand this burying of the rails in the pavement entirely precludes the constant tightening of the bolts, for the expense of the constant digging up and replacing of pavement would be prohibitive. The consequence is, that the joints are allowed to remain loose a considerable length of time before they are uncovered and bolts tightened. Moreover, the constant hammering of the loose ends of the rails on the plates causes a depression on the surface of the plate and rail to such an extent that the tightening of the bolts does not avail; and the plates first, and very soon the rails themselves, are in such a condition that a renewal is the only remedy. Even before the ends of the rails and the plates have become damaged, the loose joints cause the ends of the rails to droop, and in connection with the rolling action of traffic, which elongates the upper surface of tread, bend the entire rail in a vertical curve by forcing up the spikes or ties in the middle of the rail. This makes the track a continuous succession of waves, which necessitates, at intervals, the digging up of the entire pavement for the purpose of retamping and respiking it. When once these vertical curves are formed the track can never be brought to a good condition. As a matter of fact, rails, after they have been removed for renewal, could in many cases have been used for several years more, as far as the middle part is concerned, were it not for the battered ends. In other words, the life of the track is mainly dependent upon the life of its joints. I shall not discuss here the loss involved in the maintenance of the rolling stock and pavement, but any one taking a ride on old track will feel the effect on himself of low joints.

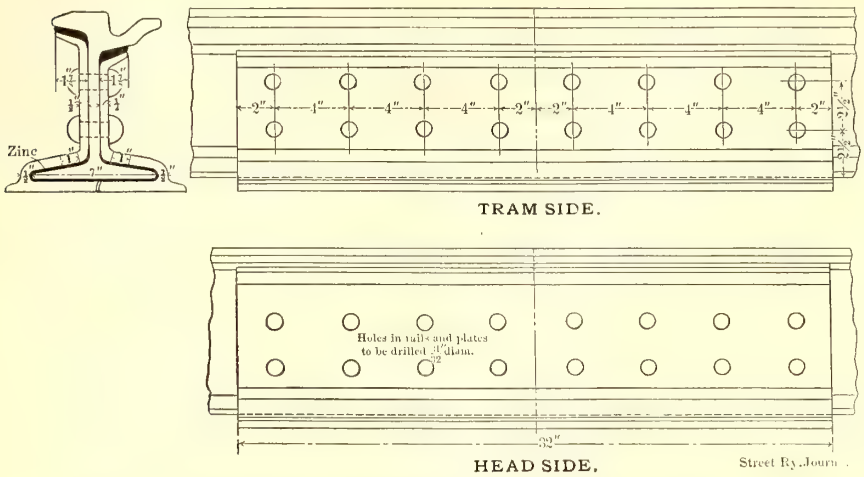


FIG. 1.—CROSS SECTION AND SIDE ELEVATIONS OF ZINC JOINT

Street railway track construction being a development of that of the steam roads, the idea prevalent in that branch was necessarily embodied in it, although there are radical differences between the two. The steam railroads, consisting of vast stretches in the open country, naturally do not require paving. The rail being entirely exposed on all sides, and, therefore, directly influenced by changes of temperature, great care must be taken that the expansion in the rails does not distort the alignment of the track. To prevent this, the rails are laid in short lengths, the joint holes in the rails are made considerably larger than the bolts, and spaces are left between the ends of the rails to allow free movement. This was also embodied in street track construction. But it has been gradually acknowledged that in street railways, where the rails are buried in paving, the changes of temperature in the atmosphere do not affect the rail proportionately; the friction between the paving and the rail exerts upon the latter such a force as to a great extent counteract the force of the stress due to expansion. Again, the material of the paving enclosing the rail on both sides, helps to keep the rail in permanent aligment and surface. This has evolved what I have called permanent joints, viz., the cast-welded joint, which is formed by pouring a mass of molten cast-iron around the abutting ends of the rails, and the electrically-welded joints, which is made by electrically welding two strips of steel plates to the sides of the webs at three or more points. While these joints have seemingly given better results, they also embody either defects or disadvantages which are quite important. In the cast-welded joint the comparatively large mass of molten metal anneals or otherwise affects, whether physically or chemically I do not know, the texture of the rail ends. This makes the track of an intermittent hardness, which is very soon shown in the difference in wear between the middle of the rail and at the joint. Moreover, on account of the sudden high temperature the rail ends expand vertically, and in cooling do not come back to their original cross-section. This causes either elevations or depressions at the joints. The elevations can be overcome by grinding or filing, but the depressions cannot be remedied, and they remain as permanent defects in the track. I am not as familiar with the electrically-welded joints, and therefore cannot give you the results that have been obtained with them. But the disadvantage that I know of is the fact that the transportation of the machinery and other expenses involved in placing them is considerable. The cast-welded joint does not give a perfect electrical connection, and I know of a railway in the neighborhood of this city where the management is judiciously using large copper plates in connection with this joint. Both of these joints have the further disadvantages that in case of changes in the track lay-out the joints can only be cut out and thrown in the scrap pile.


FIG. 2.—PORTABLE PNEUMATIC RIVETER AT WORK, SHOWING CRANE ARM FOR CARRYING RIVETER

The joints that are at present used in Philadelphia are supposed to remedy the above-mentioned defects and disadvantages. This will be seen from the following descriptions: The joint consists of what may be called two Z, or special bars (Fig. 1), which are riveted on to the webs of the rail. These plates are not made to fit the fishing section of the rail; on the contrary, spaces are left under the head, tram and around the foot of the rail. These spaces are filled with molten zinc, which enters into and fills out all the irregularities of the rolled surfaces, thus giving an absolutely continuous and perfect bearing throughout the whole length and width of the flanges of the plates. It is obvious that such a continuous contact could not be obtained by the most laborious machining or milling of those surfaces. The adhesion of the molten zinc to the rails and plates, together with the body-bound rivets, hold the joint permanently tight, and at the same time prevent expansion, thus making the rails continuous. The method of constructing the joint is as follows: After the material has been distributed and the rails placed on ties, but before the latter are spiked, both plates and rails are thoroughly cleaned by a portable sand blast. The plates are next placed on the rail ends and held in place by steel drift-pins, placed one in each end of the plate.

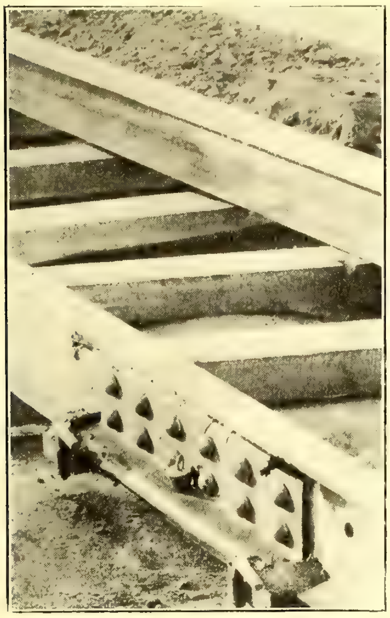


FIG. 3.—JOINT CLAYED UP AND CAULKED WITH ASBESTOS CLOTH, READY TO BE TREATED

FIG. 5.—POURING A JOINT WITH MOLTEN ZINC

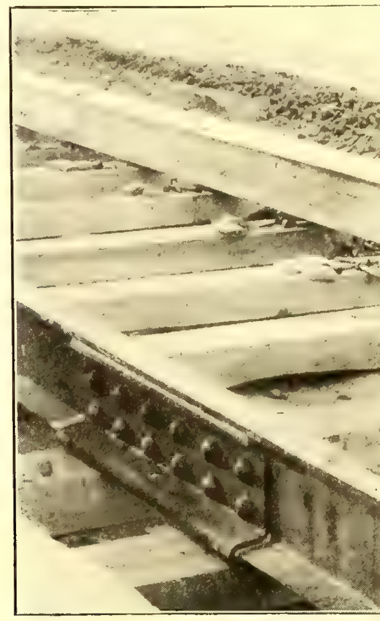


FIG. 6.—VIEW OF COMPLETED JOINT, HEAD SIDE

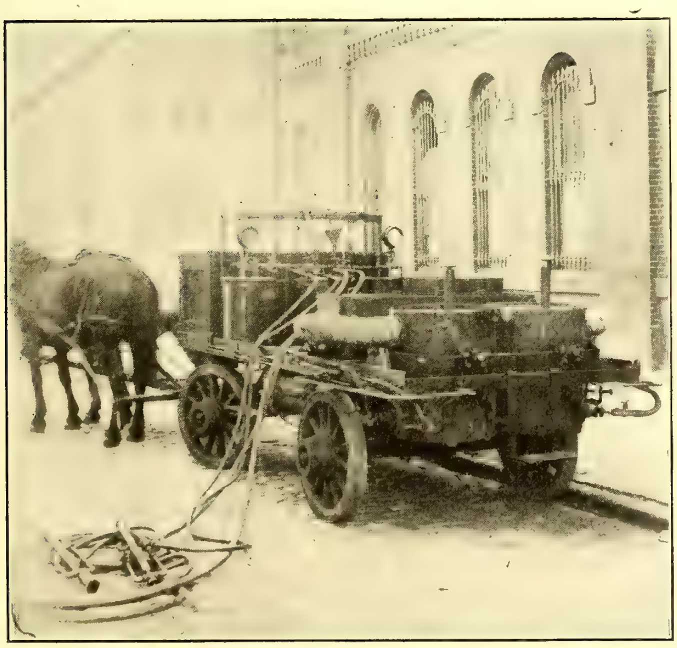


FIG. 4.—PORTABLE MELTER OUTFIT, WITH TWO MELTERS OF 100 LBS. CAPACITY EACH IN REAR; TANKS FOR FUEL OIL IN MIDDLE AND MOTOR COMPRESSORS IN FRONT OF WAGON, ALSO TWO FUEL OIL BURNERS FOR HEATING JOINT IN FOREGROUND

A steel straight edge is laid on the head of the rail, and the tread brought to a uniform surface by inserting wedges between the plates and the trams, or the plates and the head of the rail. The wedges are then driven in with a light hammer until the straight edge has a continuous bearing.

While the plates are held in place by four temporary bolts, the rivet holes are reamed to 1 1-32-in. diameter by a portable pneumatic reamer.* The twelve 1-in. steel rivets are then driven by a portable pneumatic riveter (Fig. 2). This insures the filling up of the holes by the rivets. The next step is to put in place the iron clamps for holding the asbestos cloth pads and clay on the bottom and at the ends of plate and above base of rail (Fig. 3). The spaces between the head and tram and plates are temporarily caulked with asbestos cloth. The plates are then warmed by fuel oil burners, operated by a portable compressor (Fig. 4), to a temperature of about 300 degs. to 400 degs., after which the molten zinc is immediately introduced through a 1-in. hole located in the center of the lower portion of plate, the remaining space underneath head and tram of rail being filled by the aid of dams (Fig. 5). These dams consist of aluminium castings padded with asbestos cloth. The completed joint is shown in Fig. 6.

From the above description it will be seen that this joint combines the characteristics and advantages of both classes of joints mentioned above, obviating their defects. While it is a permanent joint, in that it holds the ends of the rails permanently together, it can be easily taken apart and the parts replaced at a comparatively small expense. It does not distort the original cross-section of the rail, nor does it affect the physical or chemical nature of the metal. It not only obviates the initial defects in the fit of the rolled section, but also the aggravating cause—that of linear movement, due to expansion. As the plates and rails are thoroughly cleaned and heated before the molten zinc is poured in, the latter galvanizes on to the steel (this was proved on joints that were purposely opened

*Engravings illustrating the processes just described were published in the Street Railway Journal of March 1, 1902.

for investigation after having been in the ground for over two years), and, therefore, gives a thorough and continuous electrical connection. I know of very interesting data about the electrical bonding quality of this joint, but as this data is

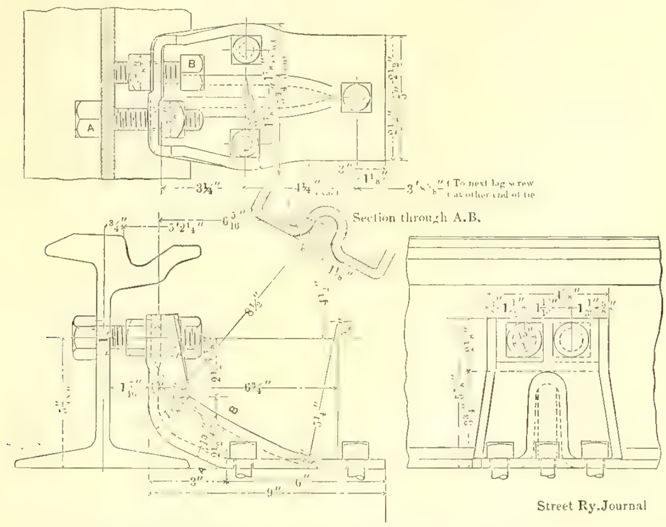


FIG. 7.—PRESSED STEEL RAIL BRACE FOR HOLDING TRACKS TO GAGE

the property of the Franklin Institute, I am not at liberty to divulge it at present. I will only say, that after a thorough test by an electrical expert of this city, of joints that had been in the ground over two years and under the heaviest traffic, the resistance was found to be less than the rails themselves. Another, and I think a very important, feature of this joint is the fact that its initial cost is practically a permanent investment. From the nature of its construction, having an intermediate soft metal between the surfaces of the steel, the plates cannot be affected by wear, and, therefore, practically the entire material that enters in the construction of the joint, that is, the plates and zinc, can be used over again after the rails have been worn out only necessitating new rivets.

Before describing the other improvements in track construction I think that it will be interesting to mention the novel idea involved in the construction of this joint. It seems, at first glance, rather an anomaly that malleable iron, cast-iron and even rolled steel plates of a high percentage of carbon have been used, or, in other words, different hard metal substances have been used as a support or foundation for certain vibrating loads, and they all proved more or less a failure. Yet, in face of these known failures it was proposed to support the same loads by means of a comparative soft metal, zinc. The fact is that this metal does form a better support. There is a well-known engineering principle which has a similar and close relation to this, and which will explain the seeming anomaly. Foundations of large and important structures are known to have been built on sand and even quick sand. It was only necessary to dam around the loose material under the foundations, and make the area of the latter large enough. The configuration of the plates forming wedge-shaped spaces under the head and tram of the rail, and the enclosed space around the foot is the damming, and the filling in under the entire width of base of rail, and of all the irregularities of the rolled surfaces is the enlarged area of the foundation.

The tendency in street railway track construction is toward a permanent roadbed of concrete, which should eliminate wooden ties entirely. There are many methods used in this so-called concrete construction of roadbeds, and a description of some of them would throw more light on the improvements introduced in similar construction in Philadelphia.

For the sake of brevity I shall confine myself to a description of the improved methods of holding the rails to line and gage temporarily, and of adjusting and holding the rails to per-

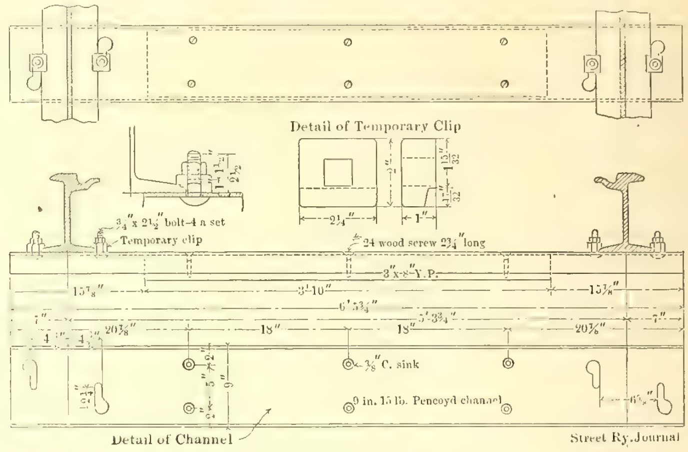


FIG. 9.—TEMPORARY TIE AND CLIPS FOR TRACK CONSTRUCTION

manent line and gage, which were adopted on the new tracks laid recently.

After the old rails and ties are removed, longitudinal trenches, 18 ins. wide by 20 ins. deep, are dug and temporary ties about 10 ft. apart are placed across them. These ties consist of 6-ft. long channels, to which short wooden planks are fastened by means of lag screws (Fig. 9). The channels have at each end two diagonally spaced holes of a bulb shape. The distance between the two pairs of holes is such that when the rails are bolted to the channels by means of cast-iron clamps, they are practically to gage. The rails are primarily laid on the ties between the two longitudinal trenches, and the joints formed, after which the rails are moved out toward the ends of the ties, and clamped to them by the clips. The cast-iron chairs are clamped to the base of the rails at intervals of 5 ft., they thus being suspended in the trenches (Fig. 10). U-shaped

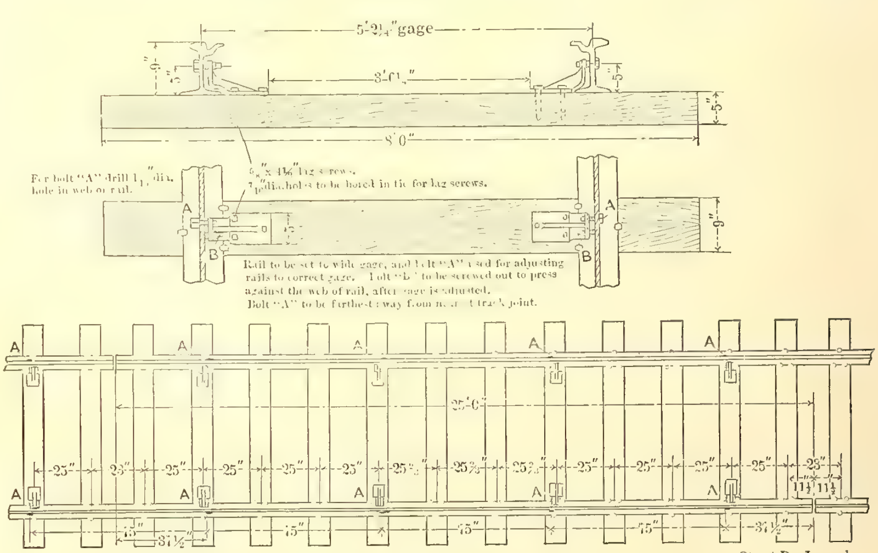


FIG. 8.—DRILLING AND TIE SPACING OF 50-FT. RAILS FOR RAIL BRACE CONSTRUCTION

round iron rods with the short U-legs downward, are also tied on to the base of the rail (Fig. 11). These are for the purpose of holding the concrete stringers against the possibility of spreading. The wooden parts of the ties, which come between the trenches, are then tamped so as to bring the track to a practically permanent line, and an absolute permanent surface. The trenches are then filled in with coarse concrete to

within about 1½ ins. of the base of the rail (Fig. 12), and the rail tamped with a finer concrete and allowed to set for several hours, so as to permit the chairs to sustain the rails. The temporary clips are then taken off, and the ties removed (Fig. 13). The cast-iron chairs (Fig. 14) have two sets of bolts, one set of two vertical bolts that pass through permanent clips, which hold the rails down on the roadbed. The other set

FIG. 10.—RAIL CLAMPED TO TEMPORARY TIES AND CAST IRON CHAIRS ATTACHED TO RAIL

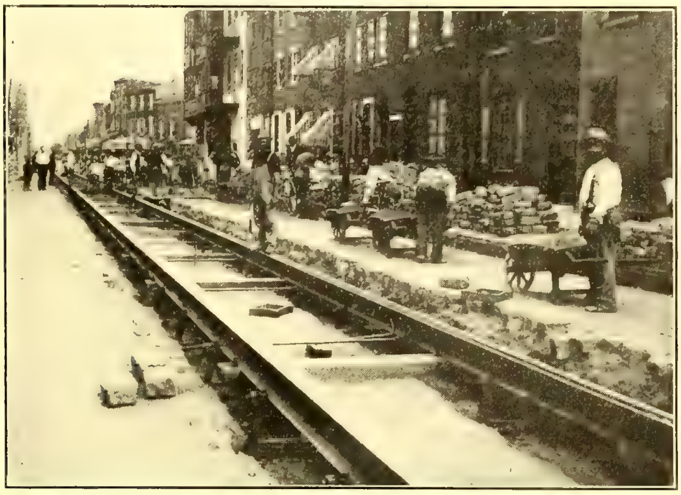


FIG. 11.—VIEW AFTER THE U-SHAPED TIE RODS ARE FASTENED TO THE RAILS

of two bolts press against the clips in a horizontal direction, and are for the final adjustment of the rails to gage and line. Before the chairs are attached to the rails, shims of about 1-16 in. thick steel are placed between them and the base of the rail. This is done for the following purpose: As the concrete shrinks slightly in setting, when these shims are removed and the vertical bolts tightened, it insures a thorough and continuous support for the base of the rails. A solid sheet of concrete is now filled in between the two rails, and for about 2 ft.

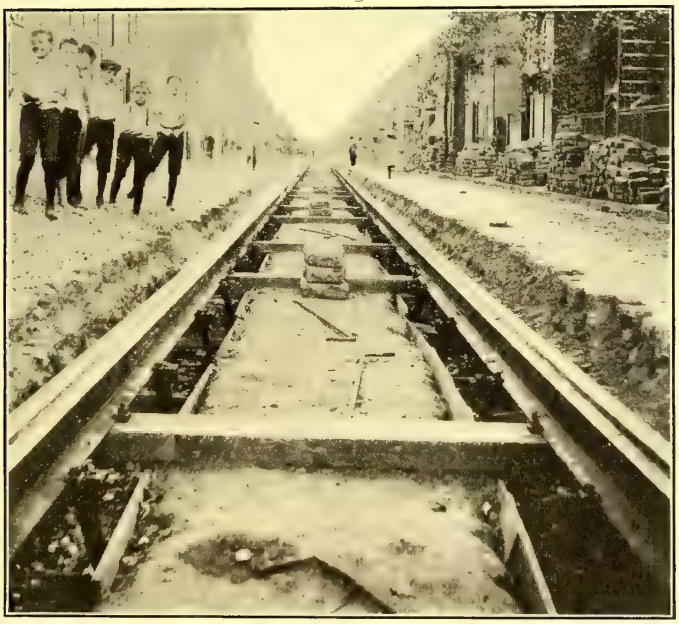


FIG. 12.—TRACK AS IN CONDITION SHOWN IN FIG. 10, BUT WITH TRENCH LINED WITH BOARDS

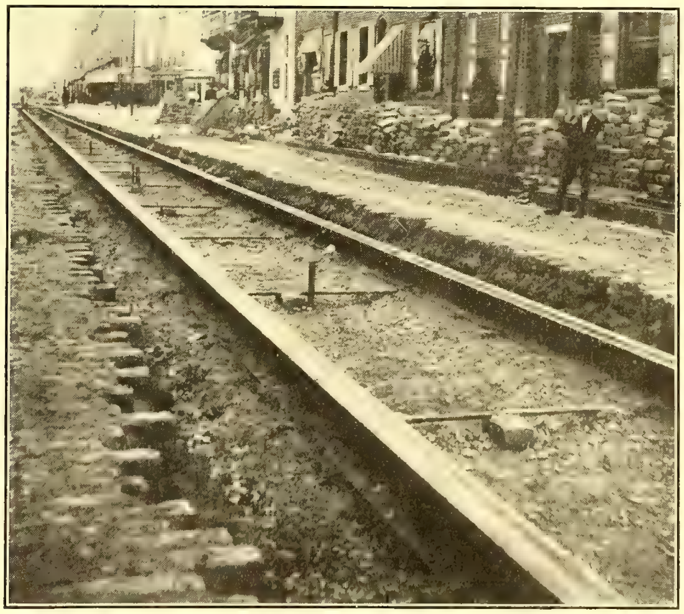


FIG. 13.—TRACK AFTER TEMPORARY TIES HAVE BEEN REMOVED AND CONCRETE FILLED UP TO BASE OF RAIL

outside of the rails, to form a permanent foundation for the paving. Concrete is also placed between the webs of the rails and the paving. Figs. 10, 11 and 12 show temporary wooden ties instead of the channels; the latter are of a later development.

In the track construction with ties, especially designed brace chairs are being used, which do away with the tie-rods. The latter stretch, and are generally inadequate to hold the rails to gage, and are in the way of paving. The ordinary braces were found to be inefficient, for the reason that the braces were generally spiked to the ties after the rail was spiked to gage, and the contact of the brace with the underside of the head, or web, or both, was depended upon to hold the rails to gage. But as neither the spiking nor the contact could be made sufficiently accurate they proved unsatisfactory. In the brace chair used in the Philadelphia construction, there are a number of novel improvements. The chairs are attached to the ties before they leave the yard by three lag screws, for which purpose a multiple machine drills the six holes simultaneously. The vertical legs of the brace have two holes. The rails are punched with single holes, as for tie-rods. When the rails are joined up they are set slightly to wide gage, and standard ⅞-in. bolts are passed through the holes in the web, and are engaged in a nut, which is locked by a corrugation in the brace; by tightening on these bolts the rails are brought to exact gage, when another ⅞-in. bolt is screwed into a nut, also locked by a corrugation in the chair, and when this bolt is tightened up it presses against the inside of the web, thus holding the rails permanently to gage. The track, after this, is ready for traffic without being spiked at every tie. This greatly facilitates construction. It will be seen that the brace not only holds the rails effectively to gage, but also has the function of adjusting

the track to exact gage, which operation in the old way of spiking required more men and could never be made as exact. The chair itself is also, practically, a permanent investment, for in case of removal only the two bolts have to be replaced. The brace is shown in Figs. 7 and 8; in the latter the brace is shown as made originally of cast-iron.

DISCUSSION

In reply to inquiries addressed to Mr. Voynow, after the reading of the paper, the following additional points in regard to the zinc joint were brought out.

The joint is the invention of Messrs. Voynow and H. B. Nichols, chief engineer of the track department of the Philadelphia Rapid Transit Company. About 63 miles of track have

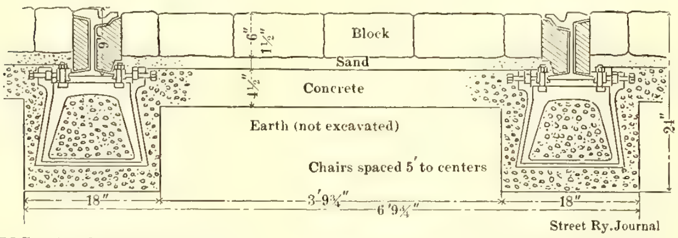


FIG. 14.—CROSS SECTION OF CONCRETE TRACK CONSTRUCTION

been laid with this joint. About 85 per cent of this mileage is laid with a 93-lb. rail, No. 206 section of the Lorain Steel Company, and the remainder with the new 137-lb. rail, section 371 of the Lorain Steel Company. The latter is the standard rail for paved streets of the Philadelphia Rapid Transit Company.

Zinc, the material selected for binding the joint, possesses a number of advantages for this purpose. It is particularly hard and crystalline in construction, but has at the same time a low melting point, and has given good service in special work where it has been used to hold steel plates in position at points of maximum wear and where the plates have been subjected to severe blows. Moreover, zinc keeps the iron from rusting by electrochemical action, as zinc is a more electro-positive metal. While some authorities claim that zinc does not expand on cooling others claim that it does, and as zinc is the only metal for which this property is claimed this feature is worthy of consideration.

Considerable experimenting was required before a satisfactory method of melting zinc was adopted. Originally an electric heater was tried. It consisted of a cast-iron kettle, on the outside of which four layers of German silver No. 14 wire were wound. This winding was originally covered with asbestos, but afterwards porcelain strips were used instead of asbestos. The resistance of the winding was designed so as to secure from 3 amps. to 5 amps. from the trolley circuit. The melting pot described was placed in another of larger diameter, and the space between the German silver wire and the outside jacket was packed with asbestos fibre. This apparatus would melt about 400 lbs. of zinc in 55 minutes, but was abandoned in favor of the hydro-carbon melter now used, because the German silver wire would burn out.

Zinc joints can be formed as rapidly as cast-welded joints. The Philadelphia Rapid Transit Company has at present three separate outfits for placing this joint, each with a capacity of from forty-five to fifty-five joints per day, depending on the conditions in the streets, and each requiring a working force of from sixteen to twenty-two men.

The steel joint plates are rolled, and are supplied to the Philadelphia Rapid Transit Company by the Continuous Rail Joint Company. A pair of plates weighs about 107 lbs., and the cost per pound of these plates is about the same as for other deep rail plates. The twelve 1-in. rivets used for each joint weigh about 12 lbs. From 22½ lbs. to 26 lbs. of zinc are required per joint, depending upon the section of the rail.

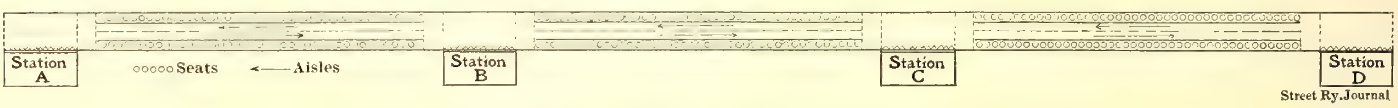
Adding to the price of this material the cost of labor, which is from 60 to 80 cents, depending upon the conditions in the street, and also adding 10 cents for depreciation of the tools used, gives the cost of the joint. The cost of the joint plates and zinc should be regarded as a permanent investment, as they can be used over again if the joint is taken up.

A considerable part of the track laid with this joint in Philadelphia has been used for three years, and no failures have yet been discovered. Where straight track is joined to special work it is the practice in that city to use ordinary rolled angle-plate for making the connection, as rail in special work does not last very long, and the question of joints is of secondary importance.

CONTINUOUS CORRIDOR TRAIN

Walter Wellman, of Washington, D. C., has submitted to the Board of Rapid Transit Commissioners, of New York, an ingenious modification of the moving platform plan as a solution for the rapid transit question in New York City. The novel feature in the plan proposed is the method of loading and unloading. The train is made up of cars very similar to those now in use, but, perhaps, of greater length, all vestibuled so as to form a continuous corridor. For loading and unloading it is proposed to dispense with all car-end steps, and to use instead platform cars, or transfer platforms, placed at regular intervals throughout the train, as shown in the illustration. The distance between these platforms is to be exactly the same as that between the station platforms and the train platforms, and station platforms are to be of equal length, with the exception that at stations where traffic is light the station platform need not be as long as the train platform.

The train or transfer platforms are to be without seats, and provided with gates or doors along the whole of one side, next to the station platform, these openings to be in charge of an ample corps of guards.



PLAN OF CONTINUOUS CORRIDOR TRAIN FOR ELEVATED RAILWAYS

The station platforms and train or transfer platforms are to be precisely equidistant, so that when the train stops at one station it stops at all simultaneously. The cars are to have two rows only, so that with a car 8½ ft. wide there would be an aisle 4½ ft. wide at the floor line and 5 ft. wide in the center of the car, giving opportunity for free passage at all times for walking through the train.

As the loading platforms and the train platforms are at equidistant positions it is not necessary to stop the train at every station. If, for instance, the train is stopped at every third station, as recommended by Mr. Wellman, when the stations are one-fifth of a mile apart, any passenger can dismount at his desired designation by selecting the train platform which stops at the station at which he desires to depart. To facilitate this all stations and their corresponding train platforms are in series of three, and all those in each series are to be painted alike—red, white or blue. All red train platforms will stop at none but red stations, white at white, blue at blue. On all time-tables, placards, etc., this color scheme will be used.

A passenger from a white station enters the train through a white platform. If he is bound for a white station he knows

he is to use that white platform for his exit. If he is bound for a red station he knows the red platform which he must use is the next to the rear, or the blue is the next forward. This scheme can further be impressed on passengers by placards, which will be placed conspicuously on station and train platforms, which will give the names of the red, white and blue stations.

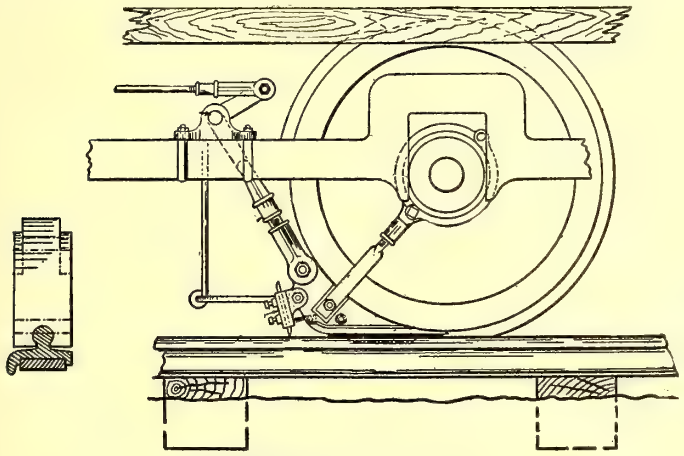
With all runs three-fifths of a mile long the inventor claims that with the same acceleration and retardation, as at present used on the Manhattan lines, a net speed of 24 m. p. h. could be secured, which would be equivalent to a seating capacity in each direction of 129,600 passengers per hour.

For locations where the traffic is not sufficient to warrant an endless belt train, with its very great capacity and many advantages, a modification is proposed, consisting of operating a few long units which would overlap at least three stations, so that the advantages secured by making few stops, but accommodating every passenger, as arranged in the plan already outlined, could be secured. This plan would be adaptable to the requirements of the traffic, as trains could be run close together, or even as an endless belt during the rush hours, and less frequently at other times.

As regards starting and stopping it is believed that with the entrance platforms 100 ft. long, as proposed, 300 persons could easily board the trains in 14 seconds from each station, and that the stops would not be longer than this. To avoid dangers in boarding platform gates would be used, but these would be supplemented by station gates, so that only those passengers would be admitted to a platform who could safely board a train. There would also be guards and an electric button signal at each station to insure safety.

EMERGENCY CAR-BRAKE

The accompanying cut shows the operating details and application of an emergency car brake, made by the Emergency



EMERGENCY CAR BRAKE

Car Brake Company, of Cumberland, Md. This brake is now in use on several cars of the Fort Wayne (Ind.) Traction Company. The brake-shoes are applied under the rear wheels, thus giving the front wheels more freedom in passing over curves and avoiding derailments.

The brake-shoes are operated by a roller bar, connected by a draw-bar to the brake-staff. To apply the brake for an emergency stop, the motorman gives the brake-handle half a turn, thereby unhooking the draw-bar from the brake-staff. The operation of the hanger and swing-bar swings the shoes under the wheels, getting the braking power from the weight and momentum of the car. Each brake-shoe is provided with a brace-bar, ice-cutter or track cleaner, and a detachable friction plate holder.

The ice-cutters are attached to the shoes with one bolt cushioned by a compression spring. The steel pieces, which are secured by set screws, remove all ice and dirt that might accumulate under the friction plates.

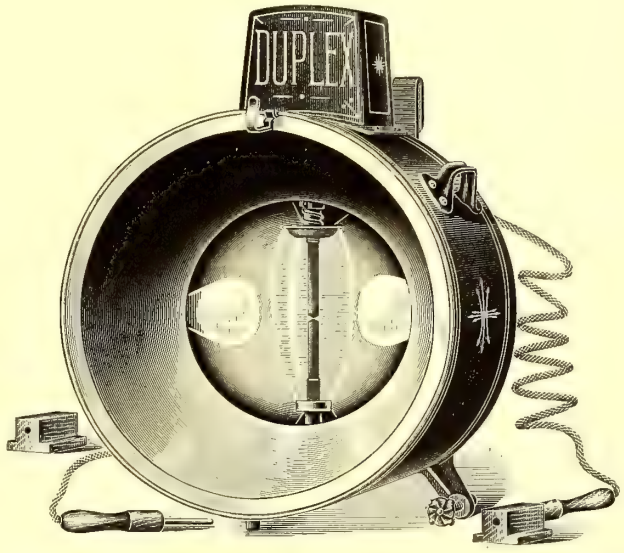
The friction plate holder is made of malleable iron, with a trunnion rib attached to the main shoe, secured by a cross bolt. By this means the friction plates are quickly replaced and adjusted to the rail. This holder is provided with a dove-tailed recess for the friction plates.

The friction plates are made of wool felt, which is compressed securely in the holder by a vise without the use of cement or rivets. This felt absorbs moisture and gives sure contact on wet or icy rails. It has been found that as many as thirty emergency stops can be made with one set of plates without renewal.

All the operating and connecting bars are adjustable, and can be attached to all styles of trucks.

COMBINATION HEADLIGHT

The combination headlight, illustrated herewith, is being placed on the market by the Duplex Headlight Company, of



COMBINATION ARC AND INCANDESCENT HEADLIGHT

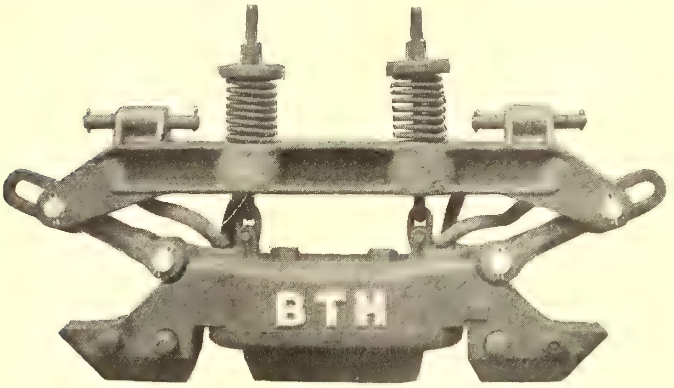
Cleveland, Ohio. This headlight combines both the arc and incandescent features, and will be known as the "Duplex." The lamp mechanism is very simple, so that rough handling or jarring will not derange it. The change from arc to incandescent, or vice versa can be made almost instantaneously, and is accomplished by throwing a two-point switch in the vestibule of the car, or by the insertion of an arc or incandescent plug in a receptacle provided for that purpose. The two incandescent lamps used can be removed and replaced without disturbing the case or front reflector. It is claimed that, owing to the peculiar design of the reflectors, more light is reflected by these two lamps than can be obtained from three ordinary headlights.

There are no rivets or solder in the case of this headlight. It is made in two parts, consisting of a substantial cast-iron back on which the lamp is built, and a steel casing. This casing is neatly finished and can be removed in a few minutes, which leaves the entire mechanism easily accessible. The simplicity of its construction permits the headlight to be easily cleaned and trimmed. By the use of ⅜-in. carbons, the travel of the arc is limited to the minimum, and the reflectors are so arranged that no shadow is thrown. This headlight is adjusted to operate on 1½ to 3 amps. It is 19 ins. high, 14 ins. in diameter and weighs 25 pounds.

NEW ELECTRO-MAGNETIC TRACK BRAKE

Considerable interest has been aroused by the report in England that the British Thomson-Houston Company was to put on the market an electro-magnetic track brake. The peculiar merits of this type of brake are well known, and some particulars of the form of the new brake are presented herewith:

Description.—This brake consists of a cast-steel shoe suspended from a bracket fastened to the side of the car truck. This bracket is well ribbed and braced, and provided with heavy lugs, which take the thrust of the brake through cast-steel links in compression.

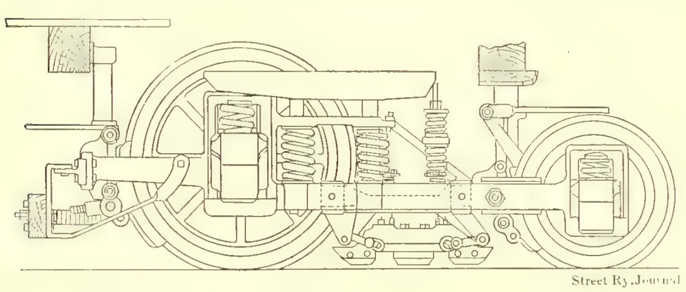


ELECTRO-MAGNETIC TRACK BRAKE

The bracket is formed to act as the seat for two compression springs, which support the brake proper by wrought-iron eye-bolts. These springs keep the brake-shoe free from the track when it is not in operation.

The brake-shoe itself consists of a heavy steel casting with a cored recess, into which the magnetizing coil, which is energized by current from the motors acting as generators, is placed. A brass cap or cover is placed over this coil, and so fitted as to form a water-tight protection to the coil. A steel core extends through the coil providing magnetic circuits, which are completed by sections of rail under the end of the coil.

The terminals of the magnetizing coil consist of insulated flexible wires, brought out through bushed holes in the top of the cast-steel frame of the shoe. They consist of two wires in duplicate, and are of sufficient length to extend from the end of the coil winding to the car underframing without a joint.



ELECTRO-MAGNETIC TRACK BRAKE ATTACHED TO TRUCK

Each shoe is provided with wearing plates for contact with the rails. These plates are steel castings, held in place by machined bolts, so placed that the plates may be renewed without removing the brake-shoe from the truck.

The brake has been developed in two different forms. The first consists of a large shoe with a bracket designed to suit the various types of single trucks. Two shoes of this type constitute a set, the windings being connected in parallel. This insures protection against failure due to an open circuit. The second is designed for double-truck cars, four shoes per car constituting a set, one shoe being attached to each side frame of each truck. The operating coils of the two shoes on one bogie truck are placed in series, and these are placed in parallel with the two on the other bogie truck. Thus in case of injury to any one shoe or coil only half of the braking effort of the car would be rendered inoperative.

The efficiency of the brake as an emergency and service brake has been demonstrated recently by a series of tests carried out under actual working conditions on one of the heaviest routes in England. A four-wheel double-deck car, with two motors, was used, and some tests were made with the magnetic track brake with the following results:

EMERGENCY STOPS

Speed on applying brake.	Time to stop.	Distance to stop.	Grade Down.
25 m. p. h.	4 seconds	25 yards	1 in 13
14 m. p. h.	1.6 "	5.3 "	1 in 14

SPEED REGULATION DESCENDING GRADES

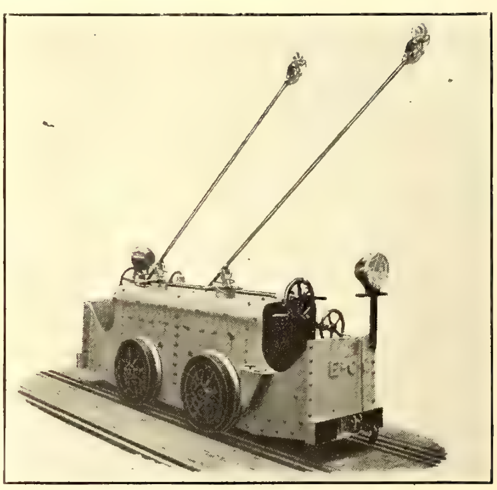
Speed maintained.	Grade.	Current per motor.
5 m. p. h.	1 in 13	4 amps.
5 m. p. h.	1 in 17	3.5 "
5 m. p. h.	1 in 45	2 "

The first test represents extreme conditions, such as a car running down a steep incline, and considering the grade and the high speed the stop was very rapid, being made in about two and one-half car lengths. The second test would correspond to the case of a car traveling at a moderate speed and obliged to pull up suddenly; it will be seen that such a stop can be made in less than a car length.

The second table is interesting inasmuch as it shows that a low and even speed can be maintained when the car is coasting down the steepest grades, so that it is always under perfect control. If necessary the car can be brought to a stop by further movement of the controller handle and held at rest by the wheel brake.

ELECTRIC LOCOMOTIVE

The accompanying illustration shows one of the latest locomotives designed by the Electric Construction Company, of Wolverhampton and London, to meet the demand for this convenient method of haulage both in mine and tunnel work. The great difficulty met with in this class of locomotives is, of course, the limited size of the tunnels through which they have to operate. In this particular instance the locomotives were specified not to exceed 3 ft. in width, 3 ft. 4 in. in height, as the tunnel is only 6 ft. high at its maximum point.



ELECTRIC LOCOMOTIVE

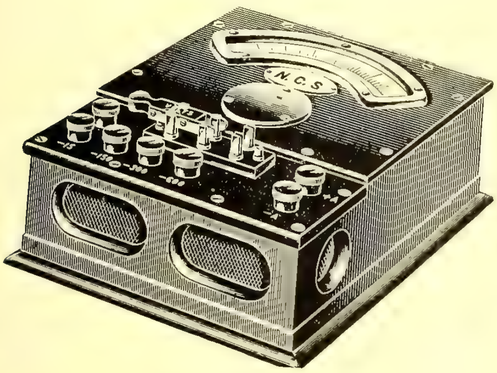
The total weight of a complete locomotive of this type is about 4½ tons. It is capable of hauling a load of 35 tons at a speed of 5 miles to 6 miles an hour, but when running light it can attain as much as 10 miles an hour. It is fitted with two motors, each having a normal capacity of about 12½ hp. They can be controlled from either end. Ordinary hand brakes and

also emergency brakes are provided, by which the locomotive can be pulled up in almost its own length when running at full speed.

Power is conveyed to and from the locomotive by two overhead wires, as it was decided in this particular case that this would be the most suitable method. This, however, is only one of many arrangements designed by the above firm.

PORTABLE TESTING SET

A portable testing set, which contains many novel points, has been placed on the market recently by Nalder Bros. & Thompson, Ltd., of London. It is designed to meet the demand for an instrument that can be used in an engine room, and placed anywhere without the danger of obtaining erroneous results through stray fields. The screening of the instrument has received very careful attention, and is stated to be so efficacious that it is almost impossible for the reading to be affected, even if it be placed quite close to a dynamo or motor. The instrument is of the moving coil type, being absolutely dead beat; it is fitted with a white enameled metal scale and a metal mirror.



PORTABLE TESTING SET

The voltmeter resistances are carried in the instrument itself, and the current shunts in another case. Measurements up to 1500 amps. and 600 volts can be made, and, as a double-pole change over switch is provided, resistances can be measured by the practically simultaneous observation of current potential difference. The pressure required to deflect the pointer to the top of the scale on the ammeter side (terminals AA) is .12 volts, and, as the scale is divided into 120 divisions, each division corresponds to .001 volts, so that the fall of volts on rail-joints, etc., can be tested conveniently. The current shunts are of a new design, and very convenient for connecting, in addition to which they are light. A complete set up to 600 amps. can be carried in quite a small box.

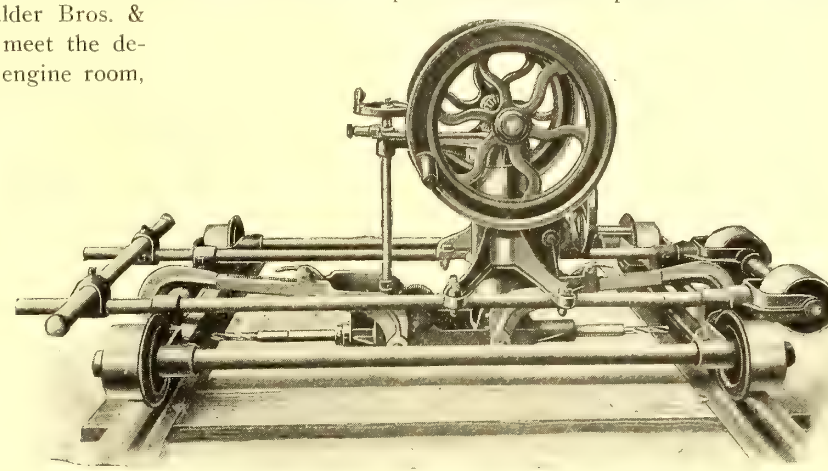
TRACK-DRILLING MACHINE

The accompanying illustration shows the new double driller now being placed on the market by the Ludlow Supply Company, of Cleveland, Ohio. In designing this machine the company has not only made such changes as a year's trial has shown to be necessary, but has added many improvements. The machine of last season was designed for new T-rail construction work only. This machine can be used on any class of rail work, and is especially adapted for paved streets where high girder rails are used, and where the machine has to be quickly removed from the track to allow cars to pass. With the roll-off attachment it takes but two men to remove machine in a few seconds.

As the machine drills either rail, it is especially adapted for tie-rod work. After drilling one rail it is only necessary to reverse the motion to drill the other rail directly opposite the first hole. This saves considerable time, beside requiring no expert to get holes exactly opposite.

A gage is placed on the side of the machine by which the operator can adjust his drill point as desired. The automatic feed is reversible, and will operate in either direction, or can be instantly changed to a hand feed. The clamps for holding machine to the rail are adjustable, so as to hold firmly at whatever position the machine may be in.

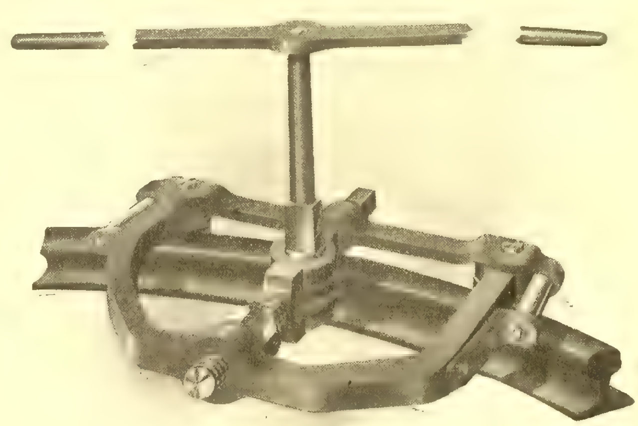
The motor provided this season is more powerful and will be placed in position, fully wired and equipped ready for instant service. It will be placed in a weather-proof box. It is stated that this machine, with the electric motor, will easily drill a girder-rail in 30 seconds, and by hand power in from 40 seconds to 50 seconds. It can be raised from the lowest point to the highest, which will bring the bottom of the machine 2 ins. above the top of the rail in less than 10 seconds.



TRACK DRILLING MACHINE FOR ANY KIND OF RAIL

RAIL BENDER AND STRAIGHTENER

The roller rail bender and straightener shown in the accompanying illustration has been brought out recently by the Buda Foundry & Manufacturing Company, of Chicago, Ill. It is a development of the old form of rail bender, and is adapted for use on all sizes of rails. The new rail bender is operated as follows:



RAIL BENDER IN OPERATION

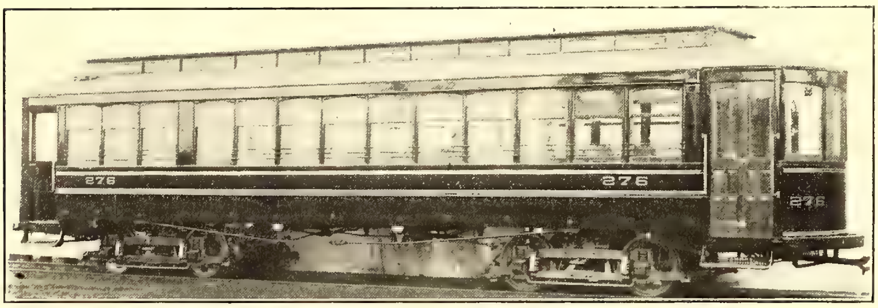
The bender is placed over the rail, and the nut on the center screws turned up with a long wrench, furnished with each machine, until set for the desired curve. The socket wrench is then placed on the pin in the center roller, the long lever put

on top of socket, and then one or more men at each end of the lever can turn the center roller, which causes the machine to move forward on the rail, bending the same as it moves. To straighten the rails the machine is placed on the opposite side of the curve and then operated as before. The number of men necessary to do the work is governed by weight of rail and curvature desired.

The introduction of improved machinery and new methods of manufacture have enabled the manufacturer of this roller rail bender to produce it at considerably lower cost than heretofore, making it a tool which should be carried by every work train and section gang.

HIGH-SPEED SEMI-CONVERTIBLE CARS FOR THE WILKESBARRE & WYOMING VALLEY TRACTION COMPANY

The car shown in the accompanying illustration is one of ten semi-convertible combination passenger and smoking cars



CAR EMPLOYED ON THE LINES OF THE WILKESBARRE & WYOMING VALLEY TRACTION COMPANY

lately delivered to the Wilkesbarre & Wyoming Valley Traction Company by the J. G. Brill Company. This is the second lot of large semi-convertibles of this type to be supplied to this system. The present cars are similar in dimensions and mounted on the same type of trucks as were those furnished two years ago.

The railway company operates all the lines in Wilkesbarre and in the Wyoming Valley. Wilkesbarre has a population of over 50,000, and the Wyoming Valley over 200,000. There are 65 miles of track, including divisions over which the cars are operated on fast schedules. The new cars are mounted, therefore, on No. 27-E-1 trucks, which are capable of very high speed. Wilkesbarre is 15 miles south of Scranton and is only second to that city in importance as an anthracite shipping center.

The cars are seated for fifty-two passengers, the seats being 37 in. long, and the aisles 24 ins. wide. A hard-wood partition with glass in the upper part, separates the smoking compartment from the rest of the car. The smoking compartment is 9 ft. 2 ins. long, and is furnished with longitudinal seats made of cherry slats. The window system is the builder's well-known semi-convertible type, including roof pockets. The tops of the window sills are 24 ins. from the floor, and protection for passengers' arms is provided by three-bar window guards. Cherry in natural color is the finish of the interiors and also of the platforms. The latter are very substantially supported by platform timbers reinforced with angle-irons and protected by angle-iron bumpers. The windows in the vestibules are arranged to drop into pockets in the wainscoting. The height of the platform steps is 18¼ ins. from rail to tread, and from tread to platform 14½ ins.. The side sills of selected long leaf yellow pine are 4 ins. x 7¾ ins., with 12 ins. x ⅜ in. plates on the inside. The white oak end sills are 5¼ ins. x 6⅞ ins. The needle beams are double trussed, and the plan of bottom framing follows the general practice of the builders in this type of car.

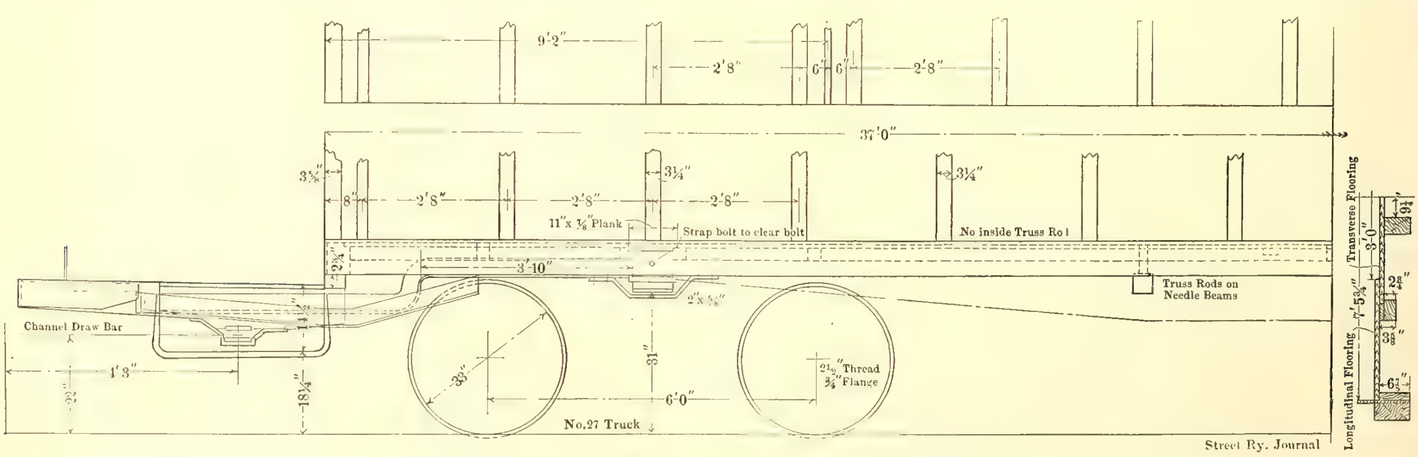
The length of the cars over end panels, 37 ft.; over vestibules, 46 ft. 5 ins.; from end panels over vestibules, 4 ft. 8 ins.; width over sills, 8 ft. 2½ ins.; over posts at belt, 8 ft. 6 ins.; sweep of posts, 1¾ ins. The cars are provided with sand boxes, channel-iron draw-bars, platform and conductor gongs, and other specialties of the builder's make. The trucks have a wheel base of 6 ft.; 33 in. diameter wheels and 4¾ in. axles. They are equipped with two 50-hp motors. The weight of a car and trucks without the motor is 30,920 lbs.

OIL CAR CIRCUIT BREAKERS

The use of circuit breakers as a means of protecting the car equipment from dangerous overloads has become quite general, and has led to the development of several different types of breakers designed especially for this class of service.

The oil car circuit breaker herewith shown, manufactured by the Hartman Circuit Breaker Company, of Mansfield, Ohio, is designed to take the place of the fuse block and hood switch on the car. It automatically opens the circuit in case of overload or short circuit, and it can be operated by hand as readily as the usual hood switch.

The switch and current-carrying parts are immersed in oil within a tight cast-iron case. The feature of oil insulation

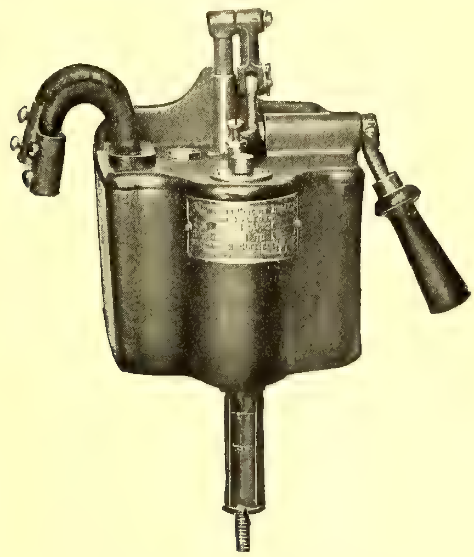


STRUCTURAL DETAILS OF CAR FOR WILKESBARRE & WYOMING VALLEY TRACTION COMPANY

permits of more compact and simple construction than is possible with the usual magnetic blow-out type. The distinctive feature of the circuit breaker, however, is the use of a series break, consisting of five double-break plug contacts, connected in such manner as to give ten breaks in series. The circuit is broken simultaneously at ten distinct points, and as the break takes place in oil there is no destructive arcing, and the circuit

breaker will open quickly and safely on the severest overloads.

The operating mechanism is very simple, and consists of a vertical rod, to the lower end of which are attached the movable bridging contacts. The rod operates in a brass bearing, and is controlled by a toggle. A slight turn of the handle will cause the toggle to straighten out, thus raising the contact rod and effecting the closing and locking of the switch. The tripping coil is immersed in oil within the case, and, when an overload occurs, the plunger or core operating within the brass tube of the solenoid, delivers a strong hammer blow against an



OIL CAR CIRCUIT BREAKER.

extension of the lower joint of the toggle, throwing the toggle out of center and effecting the opening of the switch.

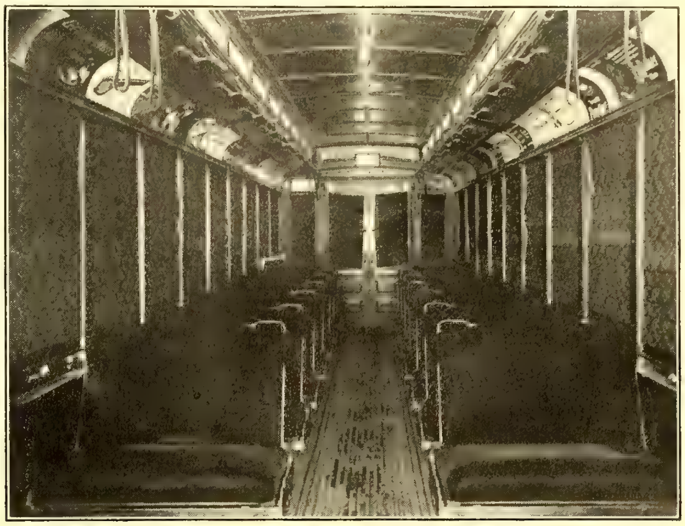
Ample space is provided between the live parts of the switch and the cast-iron case, and, as an additional precaution against grounding, the case is lined with insulating cement. Connection to the outside circuit is made within easy means of insulated cables. While the circuit breaker was primarily designed for car service it is also well adapted for switchboard use. It is usually placed on the back of the panel with the handle rod projecting through the board, and the circuit breaker is opened or closed by hand from the front of the board. The circuit breaker is also especially well adapted for the protection of motors in mills and factories, for the reason that it is not affected by damp and dirty locations, and as there are no exposed current-carrying parts the circuit breaker is never a source of danger to those who may be working in the vicinity.

SLIDEOVER SEATS USED ON THE BOSTON & NORTHERN STREET RAILWAY

The accompanying illustration shows the interior of one of the large cars now being operated upon some of the lines of the Boston & Northern Street Railway Company. These cars are finished in natural mahogany, with brass hardware, and are arranged to seat forty-eight persons. The seats are of the Wheeler "Slideover" type, manufactured by Heywood Brothers and Wakefield Company, of Wakefield, Mass., and are upholstered in a special grade of plain crimson plush made for the Boston & Northern Street Railway Company.

There are fourteen cross-seats to a car, each accommodating two persons. These seats are 34 ins. long, 18 ins. high from floor to top of cushion. The cushion is 17 ins. deep, and the back 19 ins. high. Each of the cross-seats is equipped with a bronze grab-handle for the convenience of standing passengers. This feature eliminates the necessity for overhead hand-straps, and prevents the wear on the aisle corner of the backs, occasioned by constant handling by passengers, and also by the conductors when reversing seats.

At either end of these cars there are two longitudinal seats,



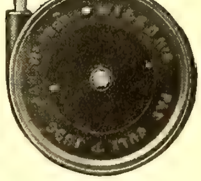
SEATING ARRANGEMENT USED ON BOSTON & NORTHERN STREET RAILWAY CARS

each seating five persons. These are identical in construction with the cross-seats, except that a grab-handle is not necessary. The backs being of standard height, project above the window sills, but as they are fully upholstered on both sides, this feature not only is unobjectionable, but is a decided advantage, as it gives the passengers who are unable to secure places in the portion of the car equipped with cross-seats, an equally comfortable position. This is not the case where the usual method is followed and a corner cushion with a narrow back is used.

It would seem that the Boston & Northern management has come to the conclusion that the comfort of the passengers and the appearance of the interior of its cars depends very largely upon the seats used, and with this end in view, it has taken precautions to secure first-class seats as well as the most convenient arrangement.

COMBINED RETRIEVER AND TROLLEY CATCHER

The Wilson Trolley Catcher Company, of Boston, Mass., has brought out a combined retrieving device and trolley catcher. This apparatus will instantly reel up the cord and pull the pole down below the wire as soon as the wheel leaves it, and after it has pulled the pole down the wheel may be immediately replaced by taking hold of the trolley rope and releasing the tension, as with the well-known Wilson trolley catcher. This feature saves valuable time and helps to avoid accidents, because the retriever need not be pulled back to a certain point before it can be released and the wheel placed on the wire.



COMBINED RETRIEVER AND TROLLEY CATCHER

The new mechanism cannot be added to to the company's standard catcher now in general use. The combination device is similar in form, and slightly heavier, as it contains an extra spring. It has been in operation for several months, and is reported to be giving excellent service in all kinds of weather. The company offers to make an allowance to purchasers of the new device for returned Wilson catchers now in use, and is also willing to furnish retrievers for trial.

TELEPHONE SYSTEMS FOR ELECTRIC RAILWAYS

With the development of electric railways beyond city limits, complications have arisen which necessitate some form of communication between offices, power houses and points along the lines. Without doubt the telephone offers the best means for such communication.

Where the telephones are operated under ordinary condi-

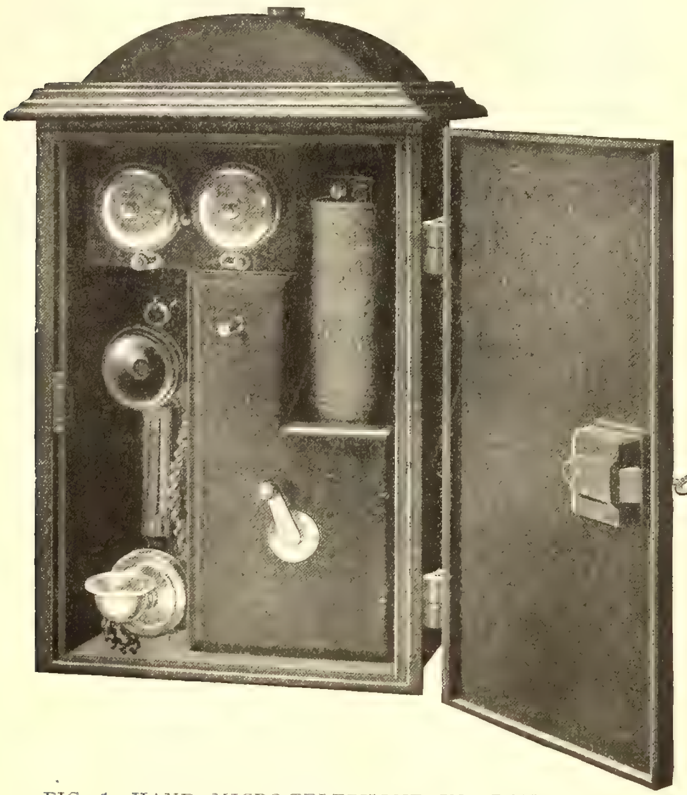


FIG. 1.—HAND MICRO-TELEPHONE IN IRON BOX

tions, standard magneto bell wall sets and desk sets are satisfactory when supplied with the proper generators and ringers for the lines upon which they are connected, but for communicating from outlying points to permanent stations there are three systems in use which are more generally applicable.

The first, most used, and perhaps the most satisfactory

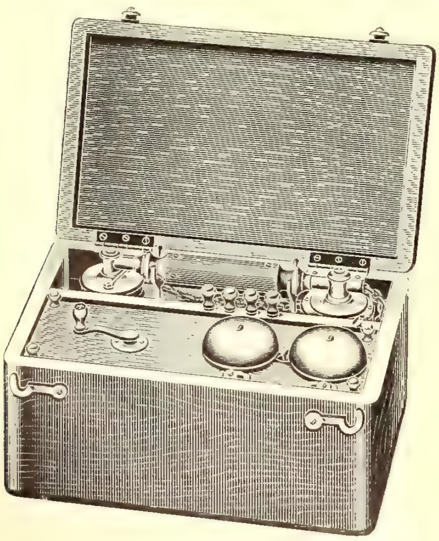


FIG. 2.—PORTABLE TELEPHONE SET

system, consists in the use of iron-box type instruments at varying distances along the line, especially at turn-outs.

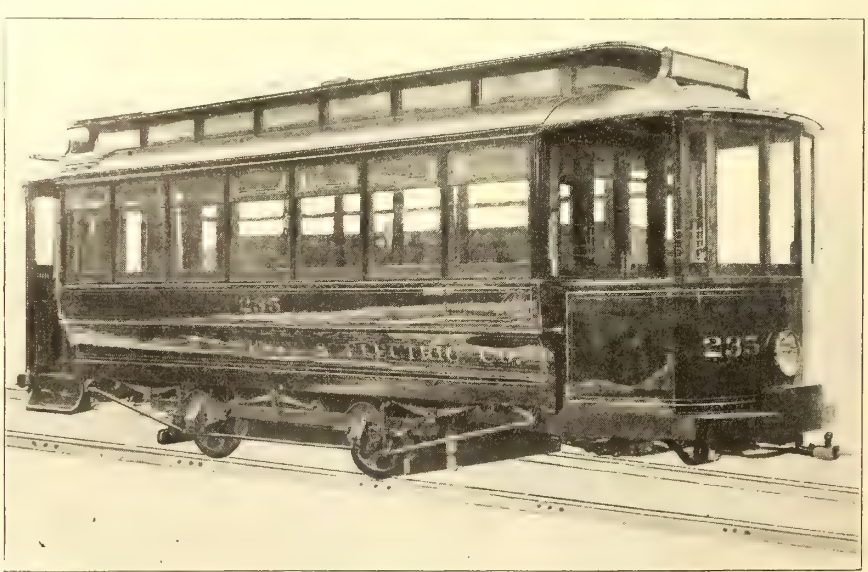
In the iron-box telephone, made by the Crouch & Seeley Company, of Boston, Mass., the talking part of the equipment is of the combined transmitter and receiver type known as a hand micro-telephone. It is shown in Fig. 1. The instrument is adjustable as regards the relative distance between the transmitter and receiver. When the receiver is placed to the ear of the party using it, the mouth-piece is in the proper position for speaking into it. This results in much greater efficiency than the old fixed transmitter type because the person using an adjustable instrument is always brought into the best speaking position, this condition being absolutely necessary to obtain satisfactory results where telephones are located in the open air. This instrument is usually cut in and out automatically by the opening and closing of the door. It is opened with a key.

The second method consists in using a portable telephone set like the above-mentioned company's instrument shown in Fig. 2. This is also provided with a hand micro-telephone for the talking circuit, and has a regular switchboard plug and cord, the whole making a neat, compact device for carrying on cars. Small iron jack-boxes are located on poles along the line, and whenever any car desires to talk, it is only necessary to plug into this jack at the nearest point, and when the conversation is finished, withdraw the plug. In addition, if there is a long delay and it is desired to call up this instrument from other points, it can be left in circuit until the requirement is accomplished. This telephone can be rung up like any other.

The third method is the use of portable sets like the foregoing, but instead of placing jack-boxes on poles, there is provided a jointed pole arrangement, usually in three sections, which can be quickly put together and connection made thereby with the wires running parallel with the trolley line. Where this method of connection is desired, it is better to run the wires perpendicularly one above the other instead of horizontally or on cross-arms. In fact, many lines are now using the iron-box instruments for outlying stations with standard equipment, but with the wires placed perpendicularly one above the other, so that these portable sets with jointed pole attachments can be carried on construction cars, snow-plows, or for the special use of others needing portable sets.

CARS FOR LITTLE ROCK, ARK.

The Little Rock Railway & Electric Company, for which Ford, Bacon & Davis are consulting engineers, has recently



CAR FOR LITTLE ROCK, ARK.

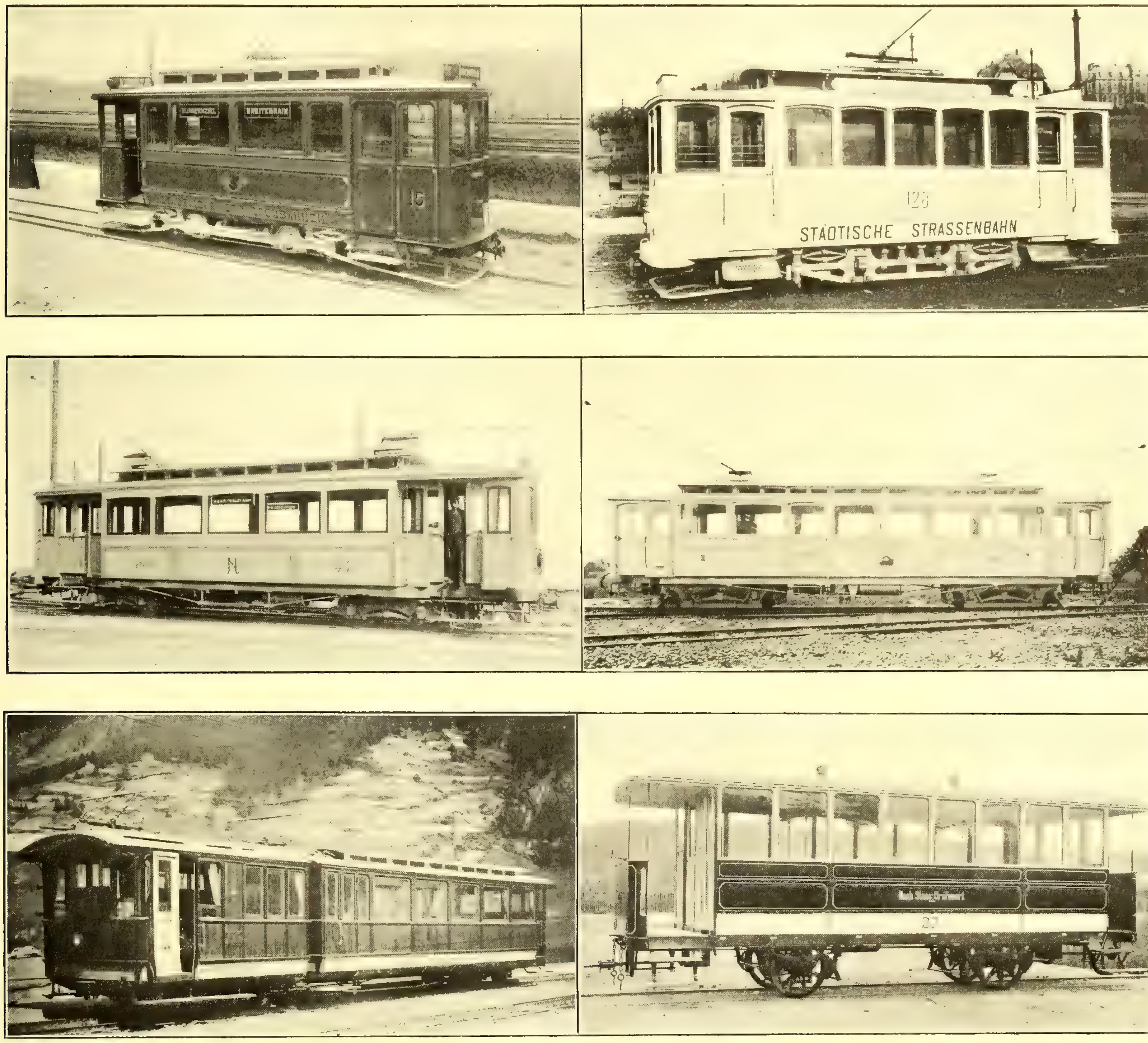
had built by the St. Louis Car Company a number of closed single-truck cars. These cars have 28-ft. bodies with 5-ft. vestibules at each end. They seat forty persons, having six reversible seats on each side of the aisle, and four longitudinal

end seats, each seating four persons. The upper sash is stationary, and the lower sash arranged to drop. St. Louis arc headlights have been put in these cars, which is notable in such a small car, as these lights have been previously used chiefly in long cars. These cars have the automatic twin door handle, which holds the sliding twin doors together except when the handle is pulled to force the door apart, when the movement of the handle releases the catch. The operation of the handle to the ordinary passenger is the same as that of any other handle, but it prevents the sliding open of doors when the car is going around curves.

RECENT SWISS ELECTRIC CARS

For several reasons the electrical industry has developed in Switzerland to a far greater extent in proportion to the size and population of the country than in any other part of Europe, and in many respects the rolling stock follows closely American lines. Some of the latest types of cars used in Switzerland are illustrated in the accompanying group of six engravings. The cars used exclusively for city service are, as a rule, short, owing to the narrow and crooked streets, but the interurban cars bear a very close resemblance, so far as the exterior of the cars is concerned, to American cars for the same service.

Taking these views up seriatim, Fig. 1 shows a standard single-truck vestibuled car for the city service in Berne, and Fig. 2 a similar car used in Zurich. Both roads are owned by the cities in which they operate. As will be seen, both cars are equipped with fenders, a somewhat unusual practice in Europe. In both, also, the platforms are made quite long, and give standing room on the front platform, while the motorman is placed well forward in the vestibule.



RECENT SWISS ELECTRIC CARS

Fig. 3 shows a double-truck vestibule car with steel underframing, and weighing, empty, 33,000 lbs. (15,000 kg). It is equipped with two trolleys, one for each direction of running, and Böker air brakes. It belongs to the Neuchatel & Boudry Electric Railway Company. Fig. 4 shows a somewhat similar combination baggage, smoker and passenger car on the Jorad Electric Railway line of Lausanne. This car weighs 41,400 lbs. (18,810 kg), and is equipped with Hardy vacuum and Schiemann electromagnetic brakes.

Fig. 5 shows a special type of car used for the Gornergrat Mountain Railway. It is a combination electric locomotive and passenger car, in which the locomotive is mounted on a single truck and the passenger compartment on one double truck, the other end being supported on the frame work of the locomotive. Fig. 6 shows a trail car equipped with the standard Continental flexible running gear instead of trucks, in use on the Stansstad-Engelberg three-phase electric line.

LEGAL DEPARTMENT*

IMPUTED NEGLIGENCE

The doctrine of imputed negligence is usually invoked in one of two well recognized classes of cases. If a young child be permitted to go into a dangerous place and be injured, the negligence of the parent or guardian may be, according to the law of New York, imputed to the child. A child may be permitted to recover if it be old enough to exercise some care, and it did exercise such care as was properly to be expected from one of its years. It is not chargeable with the exercise of the degree of care which would be required of an adult. If, however, the child be too young to have any judgment, its presence in a dangerous place will be considered the act of the parent or guardian in permitting it to go there, and such parental negligence will be imputed to the child so as to prevent a recovery in behalf of the latter. We have given the law of New York, and that of a few other States is similar. The courts of many of the States repudiate the theory of imputed negligence even as to very young children altogether. However open to theoretical criticism such doctrine may be, there is a good deal to be said, from the practical point of view, in its favor. As was remarked in this place on May 12, 1902: "The person injuring a child under such circumstances may have been guilty only of a very slight fault, and the principal contributing factor to the disaster may be the presence of an infant so young as to be unable to take care of himself in a place where he ought not to have been suffered to go. While the action for damages may be nominally in the name of the child, the substantial party in interest is frequently the very parent through whose negligence the child was permitted to be at large. Allowing recovery in such cases would tend to encourage the same neglect of children for speculation purposes, which has almost everywhere led to limitations upon the amounts for which insurance may be procured on childrens' lives."

The other condition of fact in which the theory of imputed negligence is invoked, is where a person riding with another as passenger or guest, is injured in part through the negligence of the driver. Collisions between street cars and other vehicles drawn by horses or driven by electricity, afford many cases in point. The law in many jurisdictions formerly was that the negligence of the driver of the vehicle would be imputed to the passenger with the same force as his own contributory negligence, so as to preclude a recovery against the owners of the street car. This phase of the doctrine of imputed negligence has now been repudiated by New York as well as other States. Two recent New York cases, which are fairly typical of the law throughout the country, may be cited:

In Waters vs. Metropolitan St. Ry. Co., decided by the New York Supreme Court, Appellate Term, in December, 1903 (85 N. Y. Supp., 1120) it was held that where the driver of a furniture van and his helper, who is injured in a collision with a street car, are not engaged in a common enterprise or joint adventure, but are merely fellow servants in the employ of the same master, but with distinct duties, the driver's negligence is not imputable to the helper, so as to prevent the latter's recovery. It was further held that the failure of a person riding in the rear of a van, who is injured through a collision with a street car, to jump off the vehicle on foreseeing the probability of a collision, is not contributory negligence as a matter of law, but the question is for the jury, dependent on whether, and when, a person of ordinary prudence would have jumped, and whether there was time enough left for the exercise of a deliberate judgment after the collision became imminent from the negligence of either the motorman or the driver of the vehicle, or both.

In Robinson vs. Met. St. Ry. Co., decided by the New York Supreme Court, Appellate Division, First Department, in February, 1904 (N. Y. "Law Journal," Feb. 19, 1904), the action had been brought by a child, 9 years of age, for personal injuries received in a collision between a car of the defendant and a truck, on which the plaintiff was riding with the driver. The evidence tended to show that when the horses on the truck were passing the easterly curb line the car was 100 ft. from the north crossing, approaching rapidly, and at that time the driver of the truck was urging his horses. There was no direct evidence that the driver looked or discovered the approach of the car. Neither the truck nor the car slackened speed. The car struck the rear end of the truck, and there was evidence that it was thrown against an elevated railroad post, with a crash. It was held that the negligence of the truck driver—if any—could not be imputed to plaintiff, and there was sufficient to support the jury's finding that defendant was negligent. It was further held that even if the plaintiff failed to call the driver's attention to the car or to jump from his seat, the question of contributory negligence was for the jury.

The Court in this case expressly laid down the rule that the standard for judging a boy of 9 is not the care that would be exercised by an adult, but only that to be expected of one of his age, of courage, intelligence and ordinary prudence.

It will thus be seen that as to passengers on vehicles the employment of ordinary care to escape injury from an impending collision is required, according to the circumstances of the case and age of the passenger. If a passenger ought to be expected to jump from the vehicle or move aside from the danger, and fails to do so, he will be guilty of contributory negligence on his own account, but the negligence of the driver is not imputed to him.

* Conducted by Wilbur Larremore, of the New York Bar, 32 Nassau Street, New York, to whom all correspondence concerning this department should be addressed.

LIABILITY FOR NEGLIGENCE

COLORADO.—Instructions—Street Railway—Injury to Alighting Passenger—Negligence—Evidence.

1. An instruction substantially covered by instructions given is properly denied.

2. A prima facie case of negligence is made against a street railway company by evidence that while a passenger was alighting, after its car had been stopped at a regular crossing for her to alight, the car suddenly started, throwing her to the ground and injuring her.—(Denver Consol. Tramway Company vs. Rush, 73 Pacific Rep., 664.)

GEORGIA.—Injury to Employee—Action—Pleading.

1. Where a petition shows the jurisdiction of the court; that the defendant was under a duty to the plaintiff, and the facts from which the duty arose; that there was a breach of the duty; and that plaintiff was damaged by such breach—the petition sets out a cause of action, and is good as against a general demurrer.—(North Augusta Electric & Imp. Company vs. Martin, 45 S. E. Rep., 455.)

GEORGIA.—Railroads—Dog Killed on Track.

1. This case is controlled by the decision of this court in the case of Jemison vs. Southwestern Railroad, 75 Ga. 444, 58 Am. Rep., 476, holding that a suit cannot be maintained against a railroad company for the negligent killing of a dog.

2. As the rule announced in the above-stated case has stood as good law since December 1, 1885, and the General Assembly has passed no act changing the same, this court is of opinion that the rule should not be now changed by overruling that case.—Strong vs. Georgia Ry. & Electric Company, 45 S. E. Rep., 366.)

MASSACHUSETTS.—Street Railroads—Injuries at Crossings—Children—Contributory Negligence—Failure to Look and Listen.

1. For a child six and one-half years of age to pass over a crosswalk leading from one side of a street to the other while on her way to school, through which street runs a street railway track, is not of itself negligence as a matter of law.

2. That plaintiff, a child six and one-half years of age, while on her way to school, crossed a street on which a street railway was operated, at a crossing, when she could have seen a car approaching had she looked, failed to look or listen before attempting to cross, did not constitute contributory negligence, as a matter of law, precluding a recovery for injuries sustained by her being struck by the car.—(McDermott vs. Boston Elevated Ry. Company, 68 N. E. Rep., 34.)

MICHIGAN.—Injuries Resulting in Death—Survival for Appreciable Time—Actions—Nature and Form—Damages—Elements.

1. Where a person injured by the wrongful act of another survived the injury for a moment, whether in a conscious or unconscious condition, the action accruing from such wrong was for injuries, under the act providing for the survival of actions for injuries, and not for wrongful death.

2. In an action for injuries which resulted in death, where the injured person survived the injury an appreciable length of time, his administrator was entitled to recover for the pain and anguish

suffered between the time of injury and death, together with decedent's loss sustained by being deprived, by his injuries, of the ability to labor during the time he would probably have lived had he not been injured.—(Olivier vs. Houghton County St. Ry. Company, 96 N. W. Rep., 434.)

MICHIGAN.—Street Railroads—Injuries to Animals—Contributory Negligence—Proximate Cause—Speed—Stopping Car—Distance—Presumptions—Common Knowledge.

1. Where plaintiff's cow was killed by a street railway car, plaintiff was not entitled to recover, notwithstanding his negligence in permitting the cow to be at large, on the ground that the cow stood on the tracks in plain sight of the motorman of the approaching car while it was going 150 ft. down grade at great speed, which was not lessened until after the collision, and that the car went nearly 100 ft. after it struck the cow before it was stopped, in the absence of evidence to show whether or not the car could have been stopped within the 150 ft. under the circumstances, or showing how much its speed could have been checked in that distance by the appliances at hand.

2. In an action for injuries to a cow in collision with a street car, it could not be assumed, as a matter of common knowledge, that the car could have been stopped, or its speed so checked as to prevent the injury, within 150 ft.—(Kotila vs. Houghton County St. Ry. Company, 96 N. W. Rep., 437.)

MISSOURI.—Street Railroads—Collision with Wagon—Duty of Motorman—Contributory Negligence—Expert Testimony—Cure of Error—Harmless Error—Instructions.

1. In an action against a street railway company for injuries, an ex-motorman was asked, as an expert, in what distance "he" could have stopped the car, to which he answered that "it could have been stopped" within a given distance. Held, that the error in question was cured.

2. As defendant's witnesses testified that the car could have been stopped in two-thirds the distance estimated by plaintiff's witness, and that it was actually stopped in one-third the distance, and this testimony and other evidence adduced fully advised the jury of the distance in which the car could have been stopped by a man of ordinary strength and skill, the error in the question was harmless.

3. A driver is not, as a matter of law, guilty of contributory negligence in turning into a street and driving along a street car track when he notices a car coming in the same direction, 500 ft. away.

4. When a driver turns onto a street car track 500 ft. ahead of a car, and drives in the same direction as the car is going, and the view of the motorman is unobstructed, it is the motorman's duty to check the car to avoid an accident, and if a collision occurs he is prima facie negligent.

5. Where the evidence showed that defendant's street car operator could have seen plaintiff driving on or close to the track for a distance of 500 ft. before reaching the street intersection just beyond which the collision with plaintiff's wagon occurred, the court properly refused an abstractly correct instruction that, though there was much variance in the evidence as to the exact distance from the street intersection to the place of the accident, plaintiff was conclusively bound by his statement that it was only a few feet, as the operator had sufficient time to stop the car and avoid the accident, even if it did occur near the street intersection.

6. An allegation that a street car collided with the rear end of a wagon is supported by evidence that the car collided with a hind wheel of the wagon.

7. While a street car is entitled to the right of way on its own track, this does not warrant the operator of the car in running into a vehicle that happens to be on the track, or excuse his failure to exercise ordinary care to avoid a collision with such vehicle.

8. Where the evidence in an action for negligent injuries showed that defendant's motorman had a clear view of plaintiff on or approaching defendant's track for a distance of 500 ft. before he ran into plaintiff's wagon from the rear, the court properly refused to instruct the jury to find for defendant if its motorman could not, by the exercise of ordinary care, have discovered that plaintiff was dangerously near the track in time to have avoided the accident.

9. The instruction was properly refused, even though defendant's showing was that plaintiff ran into defendant's car.

10. Where all the evidence in an action for injuries resulting from a collision with a street car with plaintiff's wagon showed that plaintiff looked for cars before driving on defendant's track, and saw the car 500 ft. away, and the court gave instructions fully covering the law as to plaintiff's contributory negligence, an instruction that plaintiff could not recover if he drove onto the track without looking was properly refused.

11. A requested instruction, in an action for negligent injuries against a street railroad, that defendant was entitled to a verdict if the accident was due to the negligence of both parties, was fully covered by an instruction that if plaintiff failed to exercise ordinary care to avoid the accident he could not recover, even though the defendant was guilty of negligence.

12. Plaintiff's petition alleged that defendant's car negligently ran into the rear end of his wagon, and the instructions to the jury made his rights to a recovery dependent on a showing that the collision occurred in that manner, and that it was due to defendant's negligence as charged. Defendant claimed that the collision was caused by plaintiff driving into its car, and requested an instruction that it was entitled to a verdict, if the jury found in accordance therewith. Held, that the refusal of the instruction was harmless error, as it only stated the converse of the proposition in the given instructions.—(Schafstette vs. St. Louis & M. R. R., 74 S. W. Rep., 826.)

MISSOURI.—Street Railroad—Crossing Accident—Negligence—Driver—Contributory Negligence—Duty to Stop—Ordinances—Proof—Evidence—Competency—Instructions.

1. In determining whether a sixteen-year-old boy, killed by a street car while driving over a crossing, was guilty of contributory negligence, his conduct is to be measured by the standard of an ordinarily prudent boy of his age, and not by that of a man of mature years.

2. Whether a sixteen-year-old boy, killed by a construction car while attempting to drive across a street car track at a street crossing, was guilty of contributory negligence, held, under the evidence, to be a question for the jury.

3. Where both parties to an action against a street railway for negligent death tried the case on the theory that defendant was not liable for a violation of the ordinances governing the running of street cars, unless it was shown that it had agreed to be bound by such ordinances, an ordinance showing such an agreement on the part of defendant was relevant.

4. By accepting St. Louis Ordinance No. 19,393, granting to defendant a franchise for a branch on condition that it complies with all the general ordinances and charter provisions in relation to street railroads then in force or thereafter to be enacted, and "applicable to its entire line of railroad, or any part thereof," defendant agreed to be bound by all the ordinances relating to street railroads, not only as to the branch, but as to its entire line, if such agreement was necessary.

5. Under the express provisions of Rev. St. 1899, section 3100, a volume of ordinances purporting to be published by authority of a city is admissible as evidence of an ordinance contained therein.

6. St. Louis Ordinance No. 15,954, granting to defendant a franchise to construct a line over certain streets and alleys, and authorizing it to run cars on that part at a rate of 20 miles an hour, is not in violation of City Charter, art. 3, section 28, providing that no special or general ordinance in conflict or inconsistent with a prior ordinance shall be valid until such prior ordinance, or its conflicting point, is repealed by express terms, as it does not attempt to repeal the general ordinance limiting the speed of street cars to 8 miles an hour, but only makes an exception to its operation, having it in full force as a general rule.

7. On a mere showing that a person had for twenty years the common experience of a city man traveling on street cars, he was not competent to give an opinion as to the speed of a car, based on the noise heard at a distance of more than 120 ft.

8. Where there was no evidence available to plaintiff in an action for negligent death to support the hypothesis that defendant's motorman failed to stop on the first appearance of danger to the deceased, it was error to instruct that, under an ordinance, defendant's motorman was bound to stop on the first appearance of danger, and was negligent if he failed to do so.

9. Where the evidence was conflicting as to whether defendant's street car had a headlight at the time of the accident, the court properly refused to instruct the jury to find in its favor if plaintiff's intestate was driving toward its track in a wagon which had no light, and defendant's motorman could not, by the exercise of ordinary care, have discovered the horse and wagon in time to avoid the collision after they came within range of the car.

10. Where, in an action against a street railway for the death of a driver at a crossing, there was no contention that defendant was liable notwithstanding the negligence of the deceased, the court properly refused to instruct that defendant was entitled to a verdict if the car was running at such a rate of speed that when the danger to the deceased could have been discovered the motorman could not stop the car in time to avert the accident, even though it was running at the highest rate of speed mentioned by any witness.

11. Whether a sixteen-year-old boy, killed at a street car

crossing, should have stopped to look and listen for a car before driving onto the track at a crossing on a dark and foggy night, held, to be a question for the jury; the evidence being conflicting as to whether the car had a headlight.

12. A requested instruction in an action against a street railway for the negligent death of a driver at a crrossing, that the deceased was negligent if he drove onto the track without looking and listening for a car, and could have seen or heard the car, had he done so, was not covered by an instruction that he was negligent if he failed to use ordinary care in driving across the track or looking out for approaching cars, and was improperly refused.—(Campbell et ux. vs. St. Louis & Suburban Ry. Co., 75 S. W. Rep., 86.)

MISSOURI.—Street Railways—Injury to Person on Track—Contributory Negligence—Discovered Peril.

1. A deaf person is guilty of contributory negligence in walking along a street car track without looking back frequently to see if a car is coming.

2. Plaintiff, who was deaf, was walking along the track of defendant's street railway, when a car approached him from behind; the motorman making no effort to check the car until he was within 10 ft. or 15 ft. of plaintiff, although he rang the gong, and at about the time he began to check the car shouted to plaintiff. The track was straight, and the motorman able to see plaintiff several hundred feet ahead. Held, that, though plaintiff was guilty of contributory negligence in walking upon the track, there was a question for the jury—as to whether the motorman was not guilty of negligence proximately causing the injury, in failing to sooner check the car after he became aware of plaintiff's dangerous situation.—Shanks vs. Springfield Traction Co., 74 S. W. Rep., 386.)

MISSOURI.—Street Railways—Negligence—Persons on Track—Duty to Stop Car—Signals—Contributory Negligence—Discovered Peril—Proximate Cause.

1. Where the motorman in charge of a street car sees a pedestrian about to cross the street a distance of eighty steps ahead of the car, he is not bound to put the car under control, instead of relying on an observation of the car by the pedestrian.

2. Where one crossing a street in front of a street car, the bell of which is being rung, does not stop or notice the car, but continues to go forward toward the track, apparently absorbed in a paper, such behavior should amount to a warning to the motorman to get ready to avoid an accident.

3. The fact that a person is deaf does not relieve him from care in crossing street railroad tracks, but imposes on him the duty of looking to learn whether he may safely proceed in crossing a track.

4. The negligence of a person in going on a street car track without looking for a car does not preclude recovery for an injury sustained by being run into by the car, if the motorman could have prevented the injury by reasonable efforts after negligence of the pedestrian.

5. The testimony showed that after plaintiff had heedlessly walked in front of an approaching car she turned around on the track, instead of clearing it, as she could have done by taking another step, and stood with her back to the car. Held, that she could not recover, since, though the motorman did not stop the car as quickly as possible, the conduct of plaintiff was the proximate cause of the accident.

6. It is not the duty of a motorman in charge of a street car to stop the car in anticipation that one going over a street crossing ahead of the car, and who has time to get over, may stop on the track.—(Aldrich vs. St. Louis Transit Co., 74 S. W. Rep., 141.)

MISSOURI.—Street Railroads—Vehicles—Collision—Injuries—Contributory Negligence—Discovered Peril—Actions—Instructions—Appeal—Harmless Error.

1. Contributory negligence of plaintiff in driving along a street railway track for a considerable distance without looking or listening for a car to approach from the rear, will not preclude a recovery for injuries sustained by a collision with a car so approaching, if the motorman in charge of the car saw, or by the exercise of ordinary care could have seen, plaintiff's peril in time to have avoided injuring her.

2. A person in a vehicle is entitled to use the track of a street railway line laid in a public street, subject only to the railway company's right of way over the same; and the latter is therefore bound to take all reasonable measures to avoid collisions, and to exercise a commensurate degree of care to discover the vehicle and prevent a collision.

3. Where a street car which collided with a vehicle in which plaintiff was riding carried no other agent of defendant except the motorman, error in an instruction construing a vigilant watch ordinance, in that it required such watch to be kept by both the conductor and the motorman, was harmless.

4. Where, in an action for injuries in a collision between a street car and a vehicle in which plaintiff was riding, plaintiff's negligence, if any, was not continuous to the instant of the collision, and did not directly concur in producing the collision, a provision in an instruction in favor of plaintiff on discovered peril, etc., limiting plaintiff's right to recover on a finding that, prior to and at the time of the collision, she and her husband were exercising ordinary care to look and listen for the approach of cars and to avoid injury, was superfluous and not prejudicial to defendant.—(Degel vs. St. Louis Transit Co., 74 S. W. Rep., 156.)

MISSOURI.—Street Railroads—Collisions with Vehicles—Injuries to Persons on Track—Negligence—Contributory Negligence—Excessive Speed—Ordinance.

1. Defendant's street car ran into plaintiff's hack while he was attempting to cross the track. He testified that he had an unobstructed view of the car, which was about 150 ft. away when he first saw it, and was approaching at a speed of 20 miles per hour; that he did not stop or whip up his horses until the car was within 40 ft. or 50 ft. of him. There was nothing to prevent him from stopping until it passed, and he could have crossed in safety, had he whipped up his horses when he first drove on the track. Held, to show contributory negligence, precluding his recovery.

2. Where plaintiff saw a car about 150 ft. away, approaching at a speed of 20 miles per hour, but did not stop or whip up his horses until the car was within 40 ft. or 50 ft. from him, and it struck his hack before he got across the track, and injured him, he had no right to assume that those in charge of the car would regulate its speed to conform to that limited by the ordinance.—(Ledwidge vs. St. Louis Transit Co., 73 S. W. Rep., 1008.)

MISSOURI.—Street Railways—Injuries to Passenger—Negligence—Contributory Negligence—Instructions.

1. Plaintiff's evidence tended to show that he was standing on the steps of the rear platform of defendant's street car while it was crossing a railroad track, having intended to get off before the car started to cross, and that the conductor, who had gone ahead to see that no railroad cars were approaching, boarded the car at the rear platform, while it was in motion, and in so doing collided with plaintiff and interfered with his footing, throwing him to the ground. The court instructed the jury that they must not infer the conductor's negligence from the mere fact that he struck plaintiff as the latter was getting off or standing on the car. Held, erroneous, as leaving out of view the fact that the conductor interfered with plaintiff's footing on the steps in boarding the car.

2. Where the perilous position of a passenger standing on the steps of the rear platform of a rapidly moving street car was seen by the conductor, who was attempting to board the car, it was negligence on the part of the conductor to mount the steps in such manner as to collide with the passenger and throw him to the ground.

3. In an action against a street railway for injuries to a passenger, defendant set up in answer that plaintiff was injured by reason of his contributory negligence in jumping off a moving car at an unusual place. The court charged that if plaintiff had taken a position on the lower step of the rear platform of the car for his own convenience in getting off at a point beyond the railway tracks which they were crossing, and knew that the conductor had gone ahead to signal the car when to cross the tracks, and would again get on, he was guilty of contributory negligence if he did not exercise ordinary care to avoid a collision with the conductor when the latter was attempting to board the car. Held, that the charge was not warranted by the plea.

4. Where plaintiff's evidence showed that he was on the rear platform of defendant's street car, in the act of getting off at a place where it had stopped before crossing some railroad tracks, but was prevented from doing so by the sudden starting of the car and its rapid motion, and there was no evidence to the contrary, it was error to predicate a charge of contributory negligence on the assumption that he had taken his position on the rear platform, not for the purpose of getting off before reaching the railway tracks, but for his own convenience in getting off at some point beyond them.—(Fleming vs. St. Louis & S. Ry. Co., 74 S. W. Rep., 382.)

MISSOURI.—Street Railroads—Collisions—Injuries to Motorman — Evidence—Trial—Demurrer to Evidence—Waiver—Question for Jury—Instructions—City Ordinances—Acceptance—Damages—Future Pain—Medical Expenses—Appeal—Review of Evidence.

1. A demurrer to the evidence at the close of plaintiff's testimony is waived by the subsequent introduction of evidence on defendant's behalf.

2. Where at the close of all the evidence defendant renewed a motion made at the close of plaintiff's case in the nature of a

demurrer to the evidence, and asked that the jury be instructed to find a verdict for the defendant, which was refused, defendant is entitled, on an appeal, to a review of the evidence as a whole.

3. In an action for injuries to a motorman sustained in a collision with a car of another company at a crossing, where the evidence tended to show that the collision was attributable to the negligence of defendants' motorman in the management of his car as it approached the crossing, and contained contradictory, inconsistent, and improbable statements of opposing witnesses, the case was properly submitted to the jury.

4. In an action for injuries to a motorman by a collision with a car of another company at a crossing, the court charged that it was the duty of defendant company to use ordinary care to prevent collision and to observe the provisions of the city ordinances which gave plaintiff's car the right of way, and that if defendant in the operation of the car which collided with plaintiff's car failed to give plaintiff's car the right of way and negligently collided with plaintiff's car, by reason of which he was injured, plaintiff was entitled to recover. Held, that such instructions were not erroneous as misleading.

5. The instructions were not erroneous as charging that defendant's mere violation of the ordinance was negligence per se.

6. In an action for injuries to a street railway motorman by collision with a car of another company at a crossing, the fact that plaintiff proved that defendant had accepted a city ordinance which gave plaintiff's car right of way at the crossing did not require an instruction on such subject, since the ordinance was binding on defendant without acceptance.

7. In an action for personal injuries, plaintiff's recovery is not limited to past bodily pain and suffering, but he is also entitled to compensation for such future suffering as will result from his injuries.

8. Where a street railway motorman injured by a collision with a car of another company at a crossing was taken to a hospital by his employer, which he thereafter left, and was taken to another hospital, at which he incurred and paid for medical treatment, he was entitled to recover for such expenses in an action against the owner of the colliding car for the injuries sustained. —(McLain vs. St. Louis & S. Ry. Co., 73 S. W. Rep., 909.)

MISSOURI.—Street Railways—Collision with Team Driving on Track—Contributory Negligence—Instruction—Damages.

1. The driver of a team which was struck by a street car from behind is not necessarily guilty of contributory negligence in driving along the car track, without looking back, where no warning was given, as should have been, if he was, or could by the use of ordinary care have been, seen, or if it was too dark to see him.

2. Failure of an instruction in an action for injury to several articles to limit the award for each article to the amount claimed therefor in the petition is harmless, the proof being that the damages were less than alleged, and the verdict being for a third the sum prayed for.—(Noll vs. St. Louis Transit Co., 73 S. W. Rep., 907.)

MISSOURI.—Carriers—Injury to Passenger—Prima Facie Case—Excessive Damages.

1. In an action for personal injuries sustained in a railway collision, the negligence charged was that defendant "did, by the servants in charge of said car, and its servants in charge of another of the cars, so carelessly manage and control said cars as to cause and suffer the same to collide." Held, that the rule that if, instead of pleading generally the relation of carrier and passenger, and the injury, and thus making out a prima facie case, plaintiff limits his right to recover to a specific act of negligence, he must prove such specific negligence, did not apply, and it was not necessary for plaintiff to show which servant so in charge of the cars was negligent.

2. The court, on appeal, will not set aside an award of damages as excessive unless the amount awarded shocks the judicial sense of right and justice.

3. In an action for personal injuries received in a collision between electric cars, plaintiff's evidence showed that his testicles, hip joint, kidneys, bladder, and spinal cord was injured, and that his abdominal wall was ruptured, compelling him to wear a truss. Held, that a verdict of $7,000 was not excessive.—(Malloy vs. St. Louis & S. Ry. Co., 73 S. W. Rep., 159.)

MISSOURI.—Street Railways—Injuries at Crossings—Negligence—Issues for Jury—Contributory Negligence—Look and Listen—Evidence—Credibility of Plaintiff's Testimony.

1. In an action against a street railway for injuries to a teamster, whether defendant was running its car at excessive speed, and neglected to slacken speed on approaching a crossing, or was guilty of negligence in not having a headlight and failing to sound the gong, held, under the evidence, to be questions for the jury.

2. In an action against a street railway company for injuries to a teamster, plaintiff's testimony that he stopped to look and listen for cars, but did not see the one that struck him, was not so incredible that it should have been disregarded, when the evidence of the motorman himself was that he could not see more than five feet ahead of his car, and there was evidence that the gong was not sounded.

3. Negligence of plaintiff which does not contribute to his injury will not bar a recovery.

4. There is no absolute duty incumbent on one who is about to cross a street railway track to stop, as well as to look and listen.

5. In an action against a street railway company for injuries to a teamster, an instruction that, in ascertaining whether plaintiff stopped to look and listen, the jury should consider all the facts and circumstances, and the testimony of other witnesses, as well as that of the plaintiff, was proper, without further charging that they were not bound to believe plaintiff's own testimony.

6. A party cannot complain of a clause in an instruction given of the court's own motion, which was contained in an instruction given at such party's request.—(Frank vs. St. Louis Transit Co., 73 S. W. Rep., 239.)

MISSOURI.—Carriers—Injury to Passengers—Negligence—Pleading—Evidence—Instructions.

1. The negligence charged by a petition in an action for injury to a passenger by derailment of a street car, alleging that the "running gear, that is to say, the wheels, axles, and other machinery, by means of which the said car ran along the said track, were defective and out of order, and unfit for the purpose of supporting the said car on the said track," and that though defendant knew, or should by the exercise of ordinary care have known, of such defective running gear, it "ran the said car along the said track, and into said curve at a high rate of speed," was general and not specific negligence, so that there was no failure of proof by want of evidence of defect in the running gear of the car.

2. Evidence, in an action for injury to a passenger by derailment of a street car, held sufficient to authorize the jury to find that the car left the track because of defects in the flange of a wheel, and because the car was run around a curve at the usual rate at which sound cars are run around it.

3. Any generality in an instruction as to negligence is cured by the other instructions, which limit plaintiff's right to recover to the specific negligence charged in the petition.

4. Defendant is not entitled to an instruction that the jury must be guided solely by the evidence, and should not be governed by sympathy for plaintiff, nothing having transpired to indicate that the jurors were unmindful of their sworn duty.—(Johnson vs. St. Louis & S. Ry. Co., 73 S. W. Rep., 173.)

MISSOURI.—Carriers—Collision—Injuries—Excessive Damages—Negligence—Instructions.

1. In a collision between electric cars, plaintiff was injured—sustaining a complete inguinal hernia, or rupture of the testicles—was compelled to wear a truss, and suffered great pain. Held, that a verdict of $3,900 was not excessive.

2. Plaintiff was injured in a collision between an electric car, on which he was riding, and a car on which the president of defendant company was riding. The court refused to instruct that if, shortly before the president's car reached a certain point, its motorman asked the motorman on a passing south-bound car if the latter car was the last car out, and was answered that there was one more car, and defendant's president understood the answer to be that the car was the last one out, and, relying on said advice, gave orders for his car to proceed, and if the collision was due solely to the president's misunderstanding of such answer, and such misunderstanding was purely accidental, and did not constitute negligence, the verdict must be for defendant. Held, properly refused, where the president himself testified that he knew there were nine cars on the road, and that only eight had passed.

3. The instruction was properly refused where the president testified that it was the duty of the manager of the road to regulate the running of the cars, and to notify motormen of the cars that were on the road.

4. The instruction was properly refused where the collision occurred on ladies' day at certain races, when the cars were crowded, and all the cars were needed to handle the crowds.

5. The instruction was properly refused; it appearing that the president's car was not a regular car on that part of the road, and there being nothing in the record to show that the manager or any motorman knew it was coming out.

6. As the president knew there was another car out, which would come in some time that evening, it was negligence for him to run his private car at a high rate of speed around a curve where a coming car could not be seen, or to run it over that part of the road without taking proper precautions to prevent a collision with such incoming car.—(Hennessy vs. St. Louis & S. Ry. Co., 73 S. W. Rep., 162.)

MISSOURI.—Street Railways—Personal Injuries—Care Required—Duty to Keep Lookout—Street Crossings—Ringing Bell—Res Gestæ—Expert Evidence—Testimony of Interested Party—Financial Interest—Instructions.

1. Whether the fact that a car ran about 125 ft. before coming to a stop after striking a child would indicate that it had been moving faster than 10 or 12 miles an hour, or that the motorman did not apply the brakes or reverse power properly, was a question for the jury, and not for expert witnesses.

2. Evidence that immediately after the stopping of a car which ran over a child the motorman came back to where the child was, and in answer to the question, "Are you blind, to run over a child like that?" replied, "I didn't see the child; I was looking at the car coming east," was not part of the res gestæ.

3. Rev. St. 1899, Sec. 4652, provides that "no person shall be disqualified as a witness in a civil suit by reason of his interest in the event of the same as a party or otherwise, but such interest may be shown for the purpose of affecting his credibility." Held, that the court erred in not requiring an attorney, who had testified as a witness for his client, to testify as to what financial interest he had in the suit.

4. If injury to a child results from failure of those in charge of an electric car to sound a bell or give other warning of the approach of the car to a crossing, or to keep a proper lookout for persons at that point, the company is liable, and it is immaterial that the petition does not allege negligence of such employees after becoming aware, or after they ought to have known of the child's danger.

5. An allegation "that the servants in charge of the car failed to keep a proper lookout for persons crossing" the tracks at a certain crossing does not present the issue that such servants were negligent in failing to see, when by reasonable care they might have seen, the person injured.

6. Where there is no law directing those in charge of a street car to ring a bell on approaching a crossing, failure to do so becomes negligence only when the circumstances render the ringing of the bell necessary, and is a question for the jury.

7. The motorman of an electric car approaching a crossing is bound only to use such care as a person of ordinary prudence and caution, according to the usual and general experience of mankind would exercise in the same situation and circumstances, in respect to keeping a lookout for persons crossing the track.—(Koenig et ux. vs. Union Depot Ry. Company, 73 S. W. Rep., 637.)

MISSOURI.—Street Railways—Personal Injuries—Duty of Public to Look Out for Cars—Negligence—Admissions—Evidence—Instructions—Triors.

1. The strongest admissions which a party makes against himself are those by which he must be concluded in determining the effect of his testimony, unless, before closing his evidence, he shows that there was some mistake or misapprehension in what he stated.

2. Plaintiff admitted that he was driving in the rails of a street car track, and was coming on a cross-track, when he first saw the car approaching on the cross-track, very near to him, and stated that he thought he had time to pass; that when he realized that the car was going to catch him his horses "were going toward the crossing on the track," and that he was struck before he got off. Held, to show a want of ordinary care, which precluded his recovery.

3. The rule that where defendant, by ordinary care, may discover and avert the peril wherein plaintiff has negligently placed himself, it is defendant's duty to exercise such care, does not apply where there is no testimony tending to show the facts essential to its application.

4. In determining whether or not plaintiff has a case to submit to triors of the joined issues, he is entitled to the benefit of every fact in evidence favorable to his contention, and of every reasonable inference therefrom.

5. Where, after giving plaintiff the full weight of every fact in evidence favorable to his contention, and of every reasonable inference therefrom, there is no testimony to support his contention on some material and essential feature of his case, the court may properly give a binding instruction to find for defendant.—(Cogan vs. Cass Ave. & F. G. Ry. Company, 73 S. W. Rep., 738.)

MISSOURI.—Street Railway—Maintaining Stump in Platform—Injury to Prospective Passenger.

1. A street railway which builds a platform for passengers around a stump placed by an electric light company in a street is not liable, on the ground of maintaining the stump, to one who, hurrying to catch a car, fell over it.—(Lucas vs. St. Louis & S. Ry. Company, 73 S. W. Rep., 589.)

MISSOURI.—Street Railroads—Injuries—Street Crossings—Sounding Gong—Negligence — Evidence — Instructions—Refusal.

1. Where, in an action for injuries in a collision with a street car, plaintiff alleged defendant's negligence in failing to sound the gong, and witnesses who were in a position to have heard the gong, if it had been sounded, testified that they did not hear it, such evidence justified a finding that the bell was not sounded.

2. Where, in an action for injuries sustained in a collision with a street car at a crossing, plaintiff testified that he saw the car coming toward the crossing, half a block away, the failure of defendant's motorman to sound the gong in approaching the crossing was not actionable negligence as to plaintiff.

3. Where, in an action for injuries in a collision with a street car, defendant's evidence justified the inference that plaintiff attempted to cross the track without looking or listening, and, if he had looked after he had passed in front of a furniture van in front of the car, he would have seen the car in time to have stopped before it reached him, it was error to refuse to charge that it was plaintiff's duty, before going on the track, to look and listen, and if by so doing he could have avoided the accident, by ordinary care, but neglected to do so, he could not recover.

4. The fact that the court, in an action for injuries, instructed that it was plaintiff's duty to use ordinary care for his own safety in attempting to cross a street car track, and then defined the term "ordinary care," did not justify the refusal of a requested instruction that if plaintiff failed to look or listen before going on the track, when, if he had done so, he could have avoided injury, he was guilty of contributory negligence.—(Murray vs. St. Louis Transit Co., 75 S. W. Rep., 611.)

MISSOURI.—Street Railroads—Injuries to Pedestrian at Crossing—Contributory Negligence—New Trial.

1. A decedent's contributory negligence in knowingly attempting to pass in front of an approaching street car at a street crossing, in such close proximity thereto as to make the danger of collision imminent, bars a recovery, though the street railway company was negligent in failing to sound the gong of the approaching car running at an excessive rate of speed, and even though it also failed to use proper care to stop the car after the dangerous position of the decedent became known to it.

2. Where the verdict of the jury is for the right party and in accordance with the law, it will not be disturbed, though the court gave erroneous instructions.

3. Plaintiff's decedent was killed by a street car at a crossing. The street was clear of obstructions, and there was plenty of light to see distinctly. There was no evidence that decedent looked or listened before going on the track, except that of the motorman, who tstified that when he saw her he hit his gong, but she continued until she got on the southbound track; that at that time the car, which was on the northbound track, was within probably 20 ft. from her; that she paused for an instant, and when the car got within 5 ft. of her she deliberately walked on the northbound track in front of the car and attempted to cross, when the car killed her. Held, as a matter of law, that decedent was guilty of contributory negligence.—(Moore vs. Lindell Ry. Co., 75 S. W. Rep., 672.)

MISSOURI.—Street Railways—Personal Injuries—Person Crossing Track—Failure to Look and Listen—Contributory Negligence—Discovered Peril—Evidence—Sufficiently—Demurrer to Evidence.

1. Where a demurrer is sustained to the plaintiff's evidence, every fact which the evidence tends in the slightest degree to prove must be taken as admitted.

2. In an action against a street railway company by a person injured while crossing the track, evidence held to require submission to the jury of the issue as to whether plaintiff was guilty of contributory negligence in failing to again look and listen when crossing the track immediately after a passing car.

3. In an action against a street railroad company for injuries caused by being struck by a car while attempting to cross the track, plaintiff's contributory negligence was not fatal to recovery where it appeared that defendant's servants could have stopped the car in time to have avoided injury to plaintiff had it not been running at a recklessly high rate of speed, in excess of that allowed by ordinance.

4. In an action by one injured while attempting to cross street car tracks, evidence held to require submission to the jury of the issue as to whether failure to stop the car in time to avoid injury to plaintiff was due to the operation of the car at a reckless rate of speed, in excess of that permitted by ordinance.—(Moore vs. St. Louis Transit Co., 75 S. W. Rep., 699.)

NEBRASKA.—Directing Verdict—Street Cars—Collision with Wagon—Evidence—Cross-Examination.

1. A trial court should not instruct a jury to return a verdict for either party where, under the evidence, there is any doubt about the propriety of such action; but, where the duty to do so is plain, it should be performed without hesitation.

2. Evidence examined, and held that a verdict for the plaintiff could not have been sustained in this case on any theory.

3. In a case where a verdict is returned for the defendant, and is the only one which can be sustained, errors assigned by the plaintiff

on account of giving and refusing instructions will not be considered.

4. Bill of exceptions examined, and held that the court did not err in restricting the cross-examination of a witness, and in striking out a part of such cross-examination.—(U. P. Steam Baking Company vs. Omaha Street Railway Company, 94 N. W. Rep., 334.)

instructions given to the jury by the trial court, unless it clearly

NEBRASKA.—Appeal—Harmless Error—Instructions.

1. A judgment will not be reversed on account of the number of instructions given to the jury by the trial court, unless it clearly appears that the party complaining is prejudiced thereby.

2. The giving of an instruction which places the burden of proof to establish some of the facts put in issue by the pleadings on the wrong party is reversible error.

3. It is error to give the jury instructions which contain inconsistent and conflicting paragraphs relating to the burden of proof. Farmers' Bank vs. Harshman, 50 N. W. 328, 33 Neb., 445, approved and followed.

4. A party is entitled to have his theory of his case, as disclosed by the evidence, submitted to the jury under proper instructions; and, where such an instruction is tendered to the court, the refusal to give it is reversible error.—(Omaha Street Railway Company vs. Boeson, 94 N. W. Rep., 619.)

NEW JERSEY.—Street Railroads—Injury to Pedestrian—Contributory Negligence.

1. Plaintiff attempted to cross, on foot, trolley tracks laid in the middle of an avenue with which he was familiar. The time was after 7 o'clock in the evening of Feb. 12. The night was very dark and rainy. He was struck and injured by a trolley car coming from the east. In that direction the avenue was straight for a long distance. The car carried a headlight at its top, and its interior was also lighted. From the configuration of the ground, all the lights of a car thus approaching could be seen for 650 ft. or 700 ft., and the headlight for a much greater distance. He testified that when he started to cross he did not see the car, but before he succeeded in crossing he was struck, though he "stepped as quick as he could." Held that, upon plaintiff's case, his negligence contributing to his injury so clearly appeared that it was error to submit the case to the jury.—(Brown vs. Elizabeth, P. & C. J. R. Company, 54 Atlantic Rep., 824.)

NEW JERSEY.—Fellow Servants—Employment by Agent—Transfer of Services—Consent of Servant.

1. If plaintiff, when injured by the negligence of defendant's servants, was employed and paid by one who in so doing acted as the mere agent of defendant, plaintiff could not recover, as he was a co-servant of those whose negligence caused his injury.

2. If plaintiff, when injured by the negligence of defendant's servants, was employed by one who had a contract to repair defendant's tracks, the question as to whether he had transferred plaintiff's services to defendant with plaintiff's consent should have been submitted to the jury.—(Norman vs. Middlesex & S. Traction Company, 54 Atlantic Rep., 835.)

NEW JERSEY.—Street Railroads—Injury to Passenger—Negligence of Motorman.

1. The motorman of an electric street railway car started his car at moderate speed to cross an intersecting steam railroad consisting of three tracks, after his conductor had gone forward upon the crossing and had used proper care to ascertain that no railroad train was to be expected. While thus proceeding over the crossing at moderate speed, the motorman became suddenly aware of a railroad train rounding a curve near by, and coming toward his car at a high rate of speed, without timely warning by bell or whistle. A collision seemed imminent, and was, in fact, narrowly averted. The motorman, on seeing the danger, instantly applied all power, and increased the speed of his car to the utmost, in order to escape the collision. It was claimed that in the lurch of the street car thereby occasioned a passenger was thrown to the floor of the car and injured. Held, that a verdict attributing negligence to the motorman on these facts cannot be supported.—(Corkhill et ux. vs. Camden & S. Railway Company, 54 Atlantic Rep., 522.)

NEW JERSEY.—Damages—Inadequate Verdict.

1. Where a verdict cannot be declared inadequate, plaintiff cannot have it set aside as too small, though a considerably larger sum would not have been declared excessive.

2. A verdict of $100 to a husband for deprivation of his wife's society, and for expenses necessarily incurred by him because of her injuries, will be set aside as inadequate, the undisputed evidence showing he has paid or is liable to pay considerably more than that for expenses rendered necessary by her injuries.—(Caswell et al. vs. North Jersey Street Railway Company, 54 Atlantic Rep., 565.)

NEW JERSEY.—Injury to Child—Sui Juris—Contributory Negligence—Allowing Case to be Opened.

1. Whether a child seven years old, run over by a street car, was sui juris, and, if so, whether, considering his years, he was guilty of contributory negligence, are questions for the jury.

2. Allowing plaintiff, after closing his case, to open it and introduce evidence, is matter of discretion, and not reviewable.—(Vogel vs. North Jersey Street Railway Company, 54 Atlantic Rep., 563.)

NEW JERSEY.—Street Railroads—Injury to Person on Track—Directing Verdict—Rights in Highway.

1. Plaintiff's driver was driving at midnight a team of horses, attached to a loaded truck wagon, along the public road, upon the left-hand track of defendant's street railway, when he was met by one of the defendant's cars moving on that track. In turning to his right to avoid that car, he drove upon defendant's right-hand track, where another of defendant's cars, approaching from the opposite direction, overtook and ran into the back of his wagon, causing injury. He testified that when he "pulled off" on the right-hand track he looked back, and there was no car in sight, and that no bell was sounded, nor notice given, before the collision. The motorman in charge of the colliding car, in his testimony, made contradictory statements respecting the distance from him at which he first saw the horses "pulling over" on the track in front of him, and admitted that he gave no signal.

Held, that the trial judge properly refused to direct a verdict for the defendant.

2. The right of street railway companies to use the highways by their cars is not superior to the rights of others in the customary use thereof, and it is not an act of negligence, per se, for the driver of a carriage, whether of burden or pleasure, in passing over the public roads of this State where the tracks of an street railway company may be laid, when either met or overtaken by the cars of such company, to keep to the right, upon other tracks of said company, even though such carriage, by turning to the left, might have avoided both meeting, and being overtaken by the company's cars.

3. The defendant was bound to take notice that the law required other carriages or vehicles using the parts of the highway covered by its car tracks, upon meeting its cars coming from an opposite direction, to keep to the right, except it was perilous to do so, and to control its overtaking cars, in anticipation that such other carriages might so turn upon its car tracks, in obedience to the law, at any instant; and it was the duty of the motorman of the colliding car in this case to use reasonable care to observe any vehicle ahead of him, and to govern his car so as to prevent collision. Whether he used such care, or not, was a question for the jury to determine from the evidence.—(Adams vs. Camden & Suburban Railway Co., 55 Atlantic Rep., 254.)

NEW JERSEY.—Street Railroads—Injury to Passenger— Evidence—Non-Suit.

1. A motion to non-suit having been based solely upon the ground of contributory negligence, the question of the absence of evidence of negligence on the part of the defendant is not open for consideration upon error.

2. Plaintiff, while seated in a street car with his arm resting upon the frame of an open window, was injured in a collision between the car and a part of the load of a passing wagon which overhung the side of the wagon and struck the plaintiff's arm. The trial judge instructed the jury, in substance, that, if any part of the plaintiff's arm protruded beyond the line of the car, and but for this fact he would not have been injured, then the plaintiff had failed to establish negligence on the part of the defendant company, and the verdict must be in favor of the defendant. Held, unnecessary for the judge to go further, and charge the jury that the position suggested for the plaintiff's arm evidenced negligence on his part.—(Zeliff vs. North Jersey Street Railway Company, 55 Atlantic Rep., 96.)

NEW JERSEY.—Master—Servant's Injuries—Declaration—Sufficiency—General Demurrer—Defects Reached—Motions to Strike.

1. A declaration, for servant's injuries, alleging that it was defendant's duty to use due care in the selection of competent persons to operate its cars, and yet, neglecting its duty, it did not use due care in that behalf, but negligently employed incompetent persons, and so negligently managed a certain car being propelled towards the car upon which plaintiff was, that by reason of said negligence, and by reason of the car being in control of incompetent persons negligently employed by defendant for that purpose, a collision occurred, etc., does not charge defendant as an insurer, but states a good cause of action.

2. A declaration founded on separable demands, some of which are good and some bad, will prevail against a general demurrer, and, since the abolition of special demurrers, an objection thereto must be made on motion to strike out.—(Peter vs. Middlesex & S. Traction Company, 55 Atlantic Rep., 35.)

NEW JERSEY.—Carriers—Street Car Company—Injuries to Passenger—Contributory Negligence.

1. Evidence in action by a street car passenger for injuries examined, and held to show that the accident was occasioned by plaintiff

alighting from the car after it had started, and without notifying the conductor of her intention, and hence not to sustain a verdict for her.—(Lee vs. Elizabeth, P. & C. J. Railway Company, 55 Atlantic Rep., 106.)

NEW JERSEY.—Injuries—Damages—Elements—Exclusion.

1. Plaintiff, who was injured by defendant's negligence, was confined to the house for fourteen weeks after the accident. His place of business adjoined his residence, and, beginning about five weeks after the occurrence, he was able to attend to the most important part of his business without going outdoors. He employed an extra man for four days each week during a period of a year or longer, but admitted that during such time plaintiff was actively engaged in the business of his firm, and was not devoting as much attention as he had previously done to his outside work. Held, that such facts justified the jury in excluding loss of earnings and the wages of plaintiff's employee so hired in ascertaining plaintiff's damages.—(Schreck vs. Jersey City, H. & P. Street Railway Company, 55 Atlantic Rep., 650.)

NEW JERSEY.—Trial—Order of Proof—Evidence—Cross-Examination—Personal Injuries—Excessive Verdict.

1. The order of proof is always discretionary with the trial judge. He may reopen the case on rebuttal if he so wills, if no injury will follow to the defendant by way of surprise or otherwise.

2. An engineer called by the plaintiffs testified that he had made a map of the locality of the accident for the defendant. On cross-examination the defendant produced and the witness identified the map, and stated that it was made from actual measurements made by himself upon the ground, and that it was drawn to a scale. The defendant had the map marked for identification. The defendant did not offer the map in evidence. Upon the defendant's resting, the plaintiffs called for the map, and offered it on rebuttal. The court admitted it. Held, that in this there was no error. Nor was there error in the court's allowing the witness to subsequently testify to pertinent questions as to the map itself, and to locate certain points thereon.

3. Where the verdict is clearly excessive, in view of the character of the injury and sufferings of the plaintiff, when injury and sufferings are the only questions submitted to the jury, it may be set aside.—Foley et ux. vs. Brunswick Traction Company, 55 Atlantic Rep., 803.)

NEW YORK.—Carriers—Passenger—Negligence—Street Car—Question for Jury—Instructions—Anticipation of Danger—Preponderance of Evidence—Negligence—Cause of Accident.

1. Evidence in an action by a passenger on a street car for injury caused by a collision of the car with a truck examined, and held to present a question as to want of care on the part of the street car company for the jury.

2. While plaintiff was a passenger on defendant's street car, as it was turning a corner, the rear of the car collided with a truck, and a trunk fell therefrom against a window of the car, injuring plaintiff. There was no evidence of negligence on the part of the motorman. The court instructed that if the motorman, knowing that the truck was approaching, and about to turn into the avenue, did not use that ordinary care that a man of his position should have exercised, then the plaintiff has established, by what would be known to the law as a "fair preponderance of the evidence," negligence on the part of the defendant company. Held, error, in assuming that the mere turning of the truck into the avenue called on the motorman to anticipate that there might be a collision, though there was room for them to pass safely.

3. The instruction was also erroneous in declaring, as a matter of law, what would constitute a preponderance of evidence to establish defendant's negligence.

4. The instruction also erred in stating to the jury, in effect, that the omission to exercise ordinary care on the part of the motorman would render the defendant negligent, and, by reason thereof, liable to plaintiff, even though such lack of care did not contribute to the accident.—(Suse vs. Metropolitan Street Railway Company et al., 80 New York, Suppl., 513.)

NEW YORK.—Street Railroads—Injuries to Pedestrians—Witness—Cross-Examination—Scope.

1. Where plaintiff claimed that the killing of his infant intestate by one of the defendant's street cars was caused by the negligence of the motorman in not looking ahead, and his failure to stop the car in time to prevent the injury, while defendant claimed that the motorman was looking ahead and that the child ran suddenly in front of the car, so close that it could not be stopped, plaintiff, on cross-examination of the motorman, was entitled to inquire as to his method of operating the car at particular places; the rate of speed at which he ran; his obedience to orders relating to the operation of his car before a schoolhouse within a short distance of the place of the accident; the crossing by people on the street; the application of his brake; statements which he made concerning the accident; what he had testified to on a former trial; and whether or not his present version of the transaction was not different from his previous testimony.—(Willsen vs. Metropolitan Street Railway Company, 80 New York Suppl., 414.)

NEW YORK.—Street Railroads—Injury to Traveler—Assault by Motorman.

1. A boy 14 years old, riding on the front platform of an electric car, was thrown or kicked from the car by the motorman. He walked back a short distance somewhat lamely, and while in the act of crossing the further track was struck by a car, and died from the injuries received. The place was well lighted by electric lights, and the car was well lighted, and about 125 ft. distant, when he attempted to cross the tracks. There was no evidence that he looked or listened, or that he was so injured as to be unable to use his powers of sight and hearing. Held, that the railroad company was not liable for his death.—Binder vs. Brooklyn Heights Ry. Co., 66 N. E. Rep., 406.)

NEW YORK.—Injury to Employee—Assumption of Risk.

1. Plaintiff's intestate was conductor on a street railway, and was killed by coming in contact with a tree near the track. He had been over the road about 160 times as conductor and about fifty trips as motorman, and was familiar with the situation. Held, that, by continuing the employment with the knowledge of the facts, deceased assumed the risk, and it was error to submit the question of defendant's negligence to the jury.—(Drake vs. Auburn City R. Co., 66 N. E. Rep., 122.)

NEW YORK.—Street Railroads—Injury to Child—Crossing Track—Contributory Negligence—Intervening Cause.

1. An action against a street railway company for the killing of a child while attempting to cross the company's tracks, an instruction that, if the jury found the child was guilty of contributory negligence, the question remained whether defendant's driver, by the exercise of reasonable care and prudence, might have avoided the consequence of the child's negligence, was erroneous, where there was no intervening circumstance, and the only issue presented were the negligence of the defendant and the contributory negligence of the child with respect to one set of circumstances.—(Delkowsky vs. Dry Dock, E. B. & B. R. Co., 79 New York Suppl., 1104.)

NEW YORK.—Infants—Wrongful Death—Care Required—Instructions—Capacity of Infant.

1. Where, in an action for the negligent killing of a boy, the court charged that the boy was required to exercise such care as a boy of his age and of good intelligence would exercise under like circumstances, and also such care as others in a like situation would exercise, an instruction that it was his duty to exercise such care as a boy of his age and of good intelligence would exercise under such circumstances, "and deem adequate thereto," was not erroneous, as making the degree of care to be exercised depend on the operation of deceased's mind.

2. An infant over the age of 12 is presumed to be sui juris, and hence, in an action for his wrongful death by being struck by a street car, the same degree of care that is required of an adult should be required of him in the absence of proof as to his mental capacity.—(McDonald vs. Metropolitan St. Ry. Co., 80 New York Suppl., 577.)

NEW YORK.—Railroad Crossing—Threatened Collision—Negligence—Question for Jury—Carriers—Railroad Crossing—Threatened Collision—Negligence—Question for Jury—Contributory Negligence.

1. A train approached a grade crossing of a street railway, through the thickly populated district of a village, around a curve where the view was obstructed. The engineer did not ring the bell or sound the whistle, but applied the brakes, so as to barely escape collision with a trolley car. A passenger on the trolley car jumped therefrom to avoid injury and was hurt. Held, that the question of the engineer's negligence was for the jury.

2. A trolley car approached a railroad crossing to within a couple of lengths, when the conductor got off and went forward, looking for trains. He motioned to the motorman to start, and after the car started, evidently becoming aware of an approaching train, motioned again to the motorman to stop, which the latter failed to do. The car crossed the track barely in time to avoid a collision. A passenger on the car jumped therefrom to avoid injury, and was hurt. Held, that the question of the carrier's negligence was for the jury.

3. Evidence in an action by a passenger on a trolley car against the street car company and a railroad company owning an intersecting track, for injuries occasioned by jumping from the street car to avoid a threatened collision with an approaching railroad train, considered, and held to render the question of the passenger's contributory negligence one for the jury.—(Robson vs. Nassau Electric Ry. Co. et al, 80 New York Suppl., 698.)

LONDON LETTER.

(From Our Regular Correspondent.)

Kincaid, Waller, Manville & Dawson estimate the cost of reconstruction of the Perth Tramways at £46,000. In addition to this there has to be added £21,800, the price already paid for the tramways, and along with the engineers' fees and Parliamentary expenses the total cost will be about £70,000. The engineers further recommended that the tramway line be extended on the north side of the city to Dunkeld Road at a cost of £1,500. The report goes on to recommend that the gage should remain the same, but that a number of additional passing places will require to be added. The present concrete under the rails will require strengthening, and the present rails lifted and heavier ones put down. Twelve double-decked cars are proposed. When the extensions that will be necessary at the electric station owing to the reconstruction and the extension of the tramways proposed have been completed, along with the additional extra expenditure that will arise, the reconstruction scheme and purchase of tramways will have involved an expenditure of close upon £100,000.

A new series of trials in connection with the running of the new electrical trains by the North Eastern Railway on the Tynemouth line has been commenced, and will be continued every day until further notice. Since the first trial was run on the Riverside line in September last, electrification has been so rapidly pushed forward that the public are now within measurable distance of seeing this new era in railway traveling definitely established. The third rail placed in each 6-ft. way has been practically laid the whole of the circular tour between Newcastle, Tynemouth, and New Bridge Street. The cables on part of the line to New Bridge Street have not been completed, and the intricate crossings into the Central Station have not yet been rearranged, but in other respects the road has been practically electrified over some 80 miles of single track. Along with the rapid progress of the new system several complete trains of the handsome new rolling stock have been built at the company's works, and it is to test these trains, as well as to familiarize the men who have been selected to drive them, and also to form accurate bases for a time-table, that the present series of experiments were commenced.

Campbeltown's Council and the Kintyre district committee are both inclined to look with favor upon the scheme for the laying of a light railway, or electric tramway, between the capital of Kintyre and Machrihanish. The syndicate which is promoting the scheme estimates that the line will cost between £20,000 and £30,000. Assuming the correctness of this estimate, and taking £25,000 as the probable cost, it is not easy to see how such a line can be worked to a profit. Golf is the only industry of Machrihanish; and people who go there in summer, settle down to the serious business of the place for a month, or a fortnight, or at least a week.

Hewitt & Rhodes, engineers, and the Llandudno & Colwyn Bay Light Railway Company have entered into a contract for the construction of the line from the Northwestern Hotel, Mostyn Street, Llandudno, through Craigydon, to Rhos-on-Sea.

The Leeds Corporation lighting committee proposes to substitute electricity for gas in the illuminating of all tramway routes within a radius of one mile from the junction of Boar Lane and Briggate, opalescent and clear globes to be used for such lighting at the discretion of the superintendent. The tramways committee have given permission for the using of tramway poles in connection with this extension of electric lighting.

At the next meeting of the Holborn Borough Council a statement will be presented respecting the proposal of the London County Council for the electrification of the tramways within the borough. The works committee is of opinion that the overhead or trolley system if far preferable to the conduit system on the grounds of economy and efficiency. The committee will therefore recommend that the board of trade be requested to withhold its approval of the proposal of the London County Council to instal the conduit system.

The highways committee of the London County Council has decided to recommend the Council to accept the tender of J. G. White & Company (Limited), of London, for the reconstruction of electrical traction of the Streatham cable tramways and the construction of tramways in Tooting High Street and Defoe Road. The amount of the tender is £95,005.

Parliament has decided that in the case of the London United Tramways bill the standing orders should not be dispensed with, and the bill, therefore, will not be allowed to proceed. Many comments, favorable and otherwise, have been made on the remarkable character of the demands which the various local authorities sought to impose as the "price" of their assent to the bill, and it was owing to the nature of these demands that the company felt compelled to abandon more than half of its proposals. The company's proposed expenditure on the road and bridge widenings alone amounted to £217,932, but this was not regarded by the local authorities as sufficiently generous, so a further demand for £642,630 was made. The company points out that both these amounts would have to be paid before it could proceed to construct the additional 21½ miles of extensions.

As an example of these demands, the company states that it proposed to construct half a mile of new tramway at Brentford, and in return for this concession the Urban District Council demanded a further expenditure of £520,000. The company intended by means of this link to run electric cars direct into the District Railway stations at Hammersmith and elsewhere, and so set down and take up passengers immediately alongside the platforms. "The outcome of the situation," says Clifton Robinson, the managing director of the company, "is that the great scheme admirably conceived by Mr. Yerkes has been set back two years, and the question now arises whether such a condition of affairs should not be practically considered by the Royal Commission on London Traffic."

The Underground Electric Railways Company, of London, Limited, has given the contract for electric elevators over all the "Yerkes" system of "tube" railways to the Otis Elevator Company, of London. The value of the work is about £350,000, which is the world's record for passenger lift contracts. Three hundred and forty motors have been ordered for this contract from the General Electric Company, Limited, of London, by the Otis Elevator Company, which will be required for 170 elevators to be distributed over three of the Yerkes tubes. These tubes are the Baker Street & Waterloo, the Charing Cross, Euston & Hampstead and the Brompton Road & Great Northern & Strand. A very large amount of the work will be English, though necessarily a few Otis specialties will have to be brought from America.

At a meeting of the electric lighting and power committee of the Liverpool Corporation, held recently, special interest attached to the proceedings owing to the presentation of an important report and recommendation by the consulting electrical engineer, A. Bromley Holmes. This reviewed the financial position of the electric works, and recommended that the price for electrical energy charged to the tramways committee should be increased from the present rate of 1.05d. to 1.12d. per unit, subject to the existing sliding scale to meet variations in the cost of coal. Mr. Holmes supported his recommendation by pointing out that as the Glasgow Corporation entailed a cost of nearly £100,000 last year for 13,000,000 units of energy for tramways, while Liverpool only paid about £80,000 for 17,000,000 units, the charge to the Liverpool tramways committee was manifestly much too low. The increase he proposed would only on the present consumption by tramways add about £4,500 to the £80,000.

The General Electric Company, Limited, of London, gave its annual staff dinner last month and invited a large number of its friends to be present at the Trocadero, where a most excellent dinner was served and an enjoyable entertainment provided afterward. Gustav Byng was in the chair for the first time for some years, as he has had to be absent in Switzerland for a number of years on account of his health. Some excellent speeches were made by Mr. Byng, Mr. Hirst, Mr. Roger Wallace, Mr. Manville, Mr. Max Byng and others, though Gustav Byng had a hard time preventing himself from indulging in his favorite topic of Protection. As an offset, however, against the well-known views of the chairman, each guest was presented with a copy of the "General Electric March," written for the occasion, and which on examination was found to have been "Made in Belgium."

The annual staff dinner of Dick, Kerr & Company, Limited, was held this month in the Holborn restaurant, John Kerr, M. P., in the chair. As the dinner was a private one and extended to only a few of the company's friends, no account will be given of the toasts. Suffice it to say that the toast to the Staff of Dick, Kerr & Company, was able proposed by the chairman and cordially responded to by W. A. Rutherford and Mr. Connor. Later on a special toast was proposed to George Flett, managing director of the company, which was most enthusiastically drunk, all present realizing what an important part he had played in the wonderful success which this company has achieved. The toasts were interspersed with songs and other entertainment and a most enjoyable evening spent.

The Lancashire & Yorkshire Railway and Dick, Kerr & Company, Limited, have every reason to congratulate themselves on the success which they have achieved in having ready for service the first electrically operated trains in Great Britain for main line railway work. Full details of this great work will be found on another page. A large number of gentlemen connected with the

technical press and the electrical engineering profession made a trip to Liverpool recently for the purpose of inspecting the electrified section of railway between Exchange Station, Liverpool and Southport, together with the power house at Formby and one of the sub-stations at Birkdale. The trip was a most successful and enjoyable one in every way, thanks to the courtesy of J. F. A. Aspinall, general manager of the Lancashire & Yorkshire Railway, and his staff, and the usual hospitality of the staff of Dick, Kerr & Company. The electric train ran to Southport without a hitch at the rate of about 60 miles an hour, and the working of the whole system, including the power house, was perfection itself.

ANNUAL REPORTS FROM BERLIN AND HAMBURG

The recently issued annual reports of Germany's greatest two street railway systems—the Grosse Berliner Strassenbahn and the Hamburger Strassen-Eisenbahn—show an encouraging traffic development which is typical of the large European cities and nearly all German street railways. That the business situation in Germany is enjoying steady improvement is shown by the fact that since April, 1903, the income of the Berlin company has increased 6.24 per cent and of the Hamburg company 8.37 per cent. One disagreeable feature of this additional traffic, however, to the companies, is the abnormal increase in the use of commutation tickets, which amounted to 13.4 per cent in Berlin and 15.1 per cent in Hamburg. It is estimated that if all the passengers were to use commutation tickets the companies' operating expenses would be almost double the income. At present 18.5 per cent of the paid traffic is carried at commutation rates in Berlin and 18 per cent in Hamburg.

The increase in car kilometers was 4 per cent in Berlin and 5 per cent in Hamburg, which is very satisfactory considering the additional traffic handled. In Berlin the revenue per car kilometer, which had suffered a gradual reduction since the electrification of the system, increased for the first time, namely, from 10 cents to 10.25 cents (40 pfg. to 41 pfg.). In Hamburg the increase per car kilometer began a year earlier, namely, from 8.2 cents to 8.4 cents (32.9 pfg. to 33.7 pfg.), and the income per passenger (except commuters) increased from 2.9 cents to 2.92 cents (11.62 pfg. to 11.7 pfg.).

It is well known that the Hamburg company is one of the very few privately-owned traction corporations which has not adopted the policy of giving a 2.5 cent (10 pfg.) fare within the city limits. In Hamburg the fare to the city limits is 5 cents (20 pfg.) and runs up to 11.25 cents (45 pfg.) on the suburban extensions. This plan permits a much better service than is possible with lower fares, and has been followed by most of the municipal lines, who have therefore not found it necessary to readjust their rates to a higher level—a process which is now the order of the day on both German and French street railways. In Berlin, where everybody pays but 2.5 cents (10 pfg.) fare, there has been no increase in the income per passenger.

What would an American railway company say to a fare of only 2.5 cents for any desired distance up to 13 miles (20 km), with universal transfers and when the franchise expires (say in twenty-five years after electrification) to surrender to the municipality for nothing its track and overhead construction and perhaps even its power stations and rolling stock; and in addition, to pay during the life of the franchise up to 10 per cent of the gross earnings and 50 per cent of whatever surplus remains after the payment of a 5 per cent or 6 per cent dividend? And further, as in some cases, to be obliged to purchase power from the municipality at 3.75 cents (15 pfg.) per kw-hour when it could generate its own power for 1.5 cents (6 pfg.) per kw-hour at most? The Berlin company is comparatively fortunate in paying 2.25 cents (9 pfg.) per kw-hour. The Hamburg company pays 2.5 cents (10 pfg.) in Hamburg proper, and in the suburb of Altona up to 3. 75 cents (15 pfg.). It is true that the municipality bases these charges upon power delivered to the trolley wire—but is that an equivalent? The effect of this policy on the development of street railways in Germany has been disastrous. All 2.5 cent (10 pfg.) lines, and especially those under municipal ownership, have carefully avoided building extensions, no matter how needful they were for the benefit of the community.

But to return to the subject of the Hamburg and Berlin companies, both corporations, like most German roads, have followed the policy for a long time of using their increased earnings for the betterment of their lines rather than in paying high dividends. The Berlin company has been paying an 8 per cent dividend for the last two years instead of 7½ per cent as formerly, while in Hamburg the dividend rate has been 8½ per cent for the last four years. Large sums have also been transferred to sinking funds, so that when the franchises expire and the railways become the property of the respective municipalities the former owners will have the full value of their lines in cash.

Both companies have given large amounts for the benefit of their employees, the Berlin and Hamburg companies spending respectively amounts equal to 6½ per cent and 6 per cent of the wages paid to their employees. It is probable that in no country but Germany do such peculiar conditions obtain relative to employees' benefits and pensions. The compulsory contributions required by the government cover insurance against sickness, invalid and old-age insurance, and insurance against accidents to employees. In addition, however, the companies make voluntary contributions in the form of maintaining a benefit fund for indigent employees, and also a pension fund.

Both companies have also always endeavored to purchase competing lines. In Berlin the company has succeeded in securing control of all the important electric surface railways in the city, with the exception of a line over 11 miles (18 km) long, which is operated by the municipality at an enormous loss. Beside this line, however, there are 8 miles (13 km) of elevated and underground lines, a municipal steam line which crosses and girdles the city and finally the omnibus companies, which do an enormous business.

Beside the Hamburger Strassen-Eisenbahn-Gesellschaft, Hamburg has another privately-owned railway. This second company is known as the Hamburg-Altonaer Centralbahn-Gesellschaft. It operates a single line about 5 miles (8 km) long which runs through the middle of Hamburg and Altona. It is considered the best-paying line in the empire, its business amounting to $38,400 (160,000 marks) per km., while the larger Hamburg company and the Berlin company must be satisfied with $18,240 (76,000 marks) and $28,800 (120,000 marks) per km, respectively. This fortunate line has remained independent. The city of Hamburg owns a competing steam line, but there are no omnibuses.

The annual report of the Grosse Berliner Strassenbahn presents the following figures: Passengers carried in 1903, 312,410,000, and in 1902, 294,800,000, an increase of 5.97 per cent; gross earnings from passenger business, $6,933,158.88 (28,888,162 marks) in 1903 and $6,525,985.44 (27,191,606 marks) in 1902, an increase of 4.08 per cent; revenue per car kilometer increased from 10 cents to 10.25 cents (40 pfg. to 41 pfg.); gross earnings from all sources, $7,085,082.96 (29,521,179 marks) in 1903, against $6,630,480 (27,627,000 marks) in 1902; total expenses in 1903, $3,817,340.88 (15,905,587 marks), against $3,681,210.48 (15,318,377 marks) in 1902; expenses in 1903, 53.88 per cent of gross earnings, against 55.41 per cent of gross earnings in 1902. It will be noted that the percentage credited to expenses has decreased after having gradually risen for several years. Up to the present time the company has given most of its attention to the electrification and extension of its system, but it will now have the opportunity to devote its energies to internal improvements. Undoubtedly the operating expenses will continue to decrease when all the cars have been equipped with wattmeters.

A large expense item is that caused by the conduit branch of the system. Although it is only 1.8 miles (3 km) long, the cost for repairs in 1903 was fully $19,920 (83,000 marks)! The greater part of the expense is caused principally by the rapid deterioration of the asphalt along the track. The total number of employees was 7841. The amount paid out for labor in 1903 was 46.03 per cent of the total expenses, and in 1902 was 45.73 per cent. The system has been increased only 1.2 miles (2 km), exclusive of turn-outs, sidetracks, etc.

The rolling stock consists of 1289 motor cars (916 single-truck cars and 373 double-truck cars, the latter including 51 convertible cars); 882 trailers, including 575 closed cars (of which 119 have top seats and 70 are convertible) and 307 open cars; and 66 horse cars. There are also 16 tower wagons for repairs and inspection, 71 track-salting cars, 5 cars for carrying money, 15 lowrys, 4 sprinklers, 12 fire engines, and vehicles for transporting material. Of the motor cars, 518 are arranged for trolley and conduit systems.

In 1903 the company instituted on all lines headways of 7½ minutes and 15 minutes. It is necessary to have a headway of 25 seconds with a 2.5 mile (4 km) radius of the common center from which the lines start so that the above schedule can be maintained. The car-kms run in 1903 included 53,300,000 motor car-kms and 16,860,000 trail car-kms—an unfavorable proportion for German city traffic. The low number of trail car-kms is due in large measure to the action of the municipal authorities who do not permit trailers to cross prominent boulevards like "Unter den Linden." The cost of a trail car-km is about one-half that of a motor car-km. The accident list for 1903 shows that 13 people were killed, 184 seriously injured and 1397 slightly injured, the greater part of whom were hurt through their own negli-

gence. The expenses in connection with these casualties amounted to $52,878.96 (220,329 marks).

The Hamburg company, although doing but one-third the business of the Berlin company, ranks next to the latter. The Hamburg system covers over 96 miles (155 km) of streets and has in all 183 miles (300 km) of track. The rolling stock consists of 558 motor cars (50 double-truck), 439 trailers and 29 sand, salting and repair cars. The company also owns the largest car-building shops on the Continent. It has for several years past turned out 500 cars annually for other companies. The total number of employees was 3550, of whom about 550 worked in the car shops. The traffic personnel received $615,740 (2,566,000 marks) in wages.

The gross earnings, including the car business, for 1903 were $2,867,368.80 (11,947,370 marks), against $2,652,869 (11,053,621 marks) in 1902. The total operating expenses in 1903 were $1,941,335.52 (8,088,898 marks), including $5,899.92 (24,583 marks) for accident payments. The surplus for the year was $826,033 (3,858,471 marks). In 1902, the total number of car-km was 30,846,936. and in 1903, 32,409,924, including 23,655,454 motor car-km, 8,659,497 trail car-km and 94,972 horse car-km. The average income per train-km was 11.5 cents (46.2 pfg.) in 1903, against 11.1 cents (44.5 pfg.) in 1902; per car-km, 8.4 cents (33.7 pfg.) in 1903, against 8.25 cents (32.9 pfg.) in 1902; and per passenger, 2.9 cents (11.7 pfg.) in 1903, against 2.8 cents (11.62 pfg.) in 1902. All the motor cars have been equipped with wattmeters.

LEGAL VICTORY FOR ELECTRICS IN NEW YORK

The Court of Appeals has affirmed the right of the Auburn & Syracuse Railroad Company to extend its line from Skaneateles to Syracuse, N. Y., without a permit from the State Railroad Commission. The plaintiff in the litigation now ended was the New York Central Railroad. The suit was brought to restrain the Auburn-Syracuse Company from operating the section of its road from Skaneateles to Syracuse, on the ground that the extension had been made without the authority of the Railroad Commission. The issue which the New York Central presented to the court in this case was largely of a technical nature. Back of it was the more sweeping and far-reaching proposition of the Central that under the general railroad laws of the State the construction of parallel railroad lines is inhibited save under the stress of public necessity, to be duly certified by the Railroad Commissioners. It is on this plea that the Central has endeavored to block the construction of interurban electric railway lines paralleling its own roads, and the technicality raised against the Auburn & Syracuse Company was simply a means to that end.

EXTENSIVE CUBAN ELECTRIC RAILWAY PROJECT

The Cienfuegos, Palmira & Cruces Railroad & Electric Power Company, which was organized last fall for the purpose of constructing some 40 miles of electric traction system and lighting a number of towns in Southern Cuba, has decided to considerably enlarge its plans. In all nearly 90 miles of electric railway will be built.

Four and a half miles of track will be constructed in Cienfuegos, one of the most flourishing seaport towns in Cuba, where at present there are no tramways of any description. The line will run from there to Caonao, thence over a private right of way to Palmira, Horringuero and Cruces, then on to Ranchuelo, and from there to Santa Clara. There will be a branch, also over a private right of way, from Caonao eastward 15 miles through Los Guaos to Cumanayagua. From the harbor of Cienfuegos to Caonao there will be a second line on a private right of way built to carry freight exclusively. All the lines will be standard gage. Owing to the number of sugar and coffee plantations along the proposed route the company expect to do a very large freight business.

The power plant, which will have a capacity of upwards of 10,000-hp, will be located about 26 miles from Cienfuegos at Hanabanilla, where the Hanabanilla Falls, which are known as the Niagara of Cuba, are situated. It is proposed to divert the Rio Negro by closing a subterranean passage through which it discharges its water southward toward Trinidad. By this means its entire discharge will be added to the Hanabanilla. The available head will then be nearly 700 ft.

Bruno Diaz, a Cuban tobacco leaf merchant, is president of the company. The capital has been subscribed by Cubans and Germans. Cornelius C. Vermeule, 203 Broadway, New York, who has just returned from Cuba, is the consulting engineer of the company. T. W. Bennett is the chief engineer. He is expected to arrive from Cuba this month. Contracts for equipment will be awarded inside of three months.

BRAZILIAN ELECTRIC TRACTION PROJECT

An extensive electric traction system is to be built in Santos, a Brazilian seaport town of about 10,000 inhabitants, located some 35 miles from Sao Paulo. James Mitchell, general manager of the Sao Paulo Tramway, Light & Power Company, Ltd., is primarily interested in the project.

SCALE FORMATION IN BOILERS

That nearly every water used for producing steam contains solids which form boiler scale, is well known, but it does not appear to be so well known how scale is formed, or what chemical reactions take place to cause the formation.

These solids may be classed separately as sulphates and carbonates. The carbonates consist of calcium carbonate and magnesium carbonate, both of which are held in solution by reason of their excess of carbonic acid. From about 180 degs. F. to the boiling point and above this the excess of carbonic acid is driven off, and the carbonate of lime, or magnesia, robbed of its solvent constituents. An exceptionally high temperature is not necessary to effect this separation, and it is for this reason that carbonates are found deposited in feed-water heaters and economizers, as well as at the point where the feed-water enters the boiler.

The carbonates when existing in water without calcium sulphate being present form a porous accumulation, varying from a crystalline to amorphous formation, and even occurring as a fine powder. The latter is more often the case when the feed-water contains in solution a considerable quantity of sodium chloride (common salt).

Calcium sulphate (plaster of paris), which is held in solution by nearly every natural feed-water, and especially in England, is not precipitated at the comparatively low temperature mentioned. In an experiment made in the laboratory of the Geo. W. Lord Company, of Philadelphia, a water heavily saturated with calcium sulphate was heated to a temperature producing 10 lbs. of pressure, but no precipitation was caused of the calcium sulphate.

Some authorities claim that the separation, or the change of the calcium sulphate from solution to suspension, takes place on the surface of the water in the boiler. If this were a fact, the calcium sulphate scale would accumulate in those parts of a boiler nearest the water surface. The contrary, however, is the case, as scale of this nature invariably forms at the parts of the boiler which are exposed to the highest temperature. It is for this reason that the Geo. W. Lord Company claims that the actual separation from a certain quantity of water takes place the minute that quantity of water is changed into steam, and that this change occurs at the point where the heat is transmitted through the iron of the boiler into the water.

When a molecule of water reaches a sufficiently high temperature to become steam it forms a minute globule and rises through the water to the surface, where the slight coating of water covering the globule breaks. At the point where this globule is formed, that is, at the heating surface, there being nothing to hold the calcium sulphate either in suspension or solution, it must separate, and form a very small crystal. If the ebullition of the water permits it to do so, it will adhere to the iron at the point where it had its origin, or it may be carried by the circulation until it finds something to which it can adhere. The scale which is formed of calcium sulphate alone is very hard, but a formation of this kind is rare, the great majority of scales consisting of the three substances mentioned, as well as other mineral and vegetable substances. These latter substances, which are held in suspension instead of solution, become part of a body of scale only mechanically; that is, they become part of a scale as sand becomes part of mortar when mixed with cement. The cementing substance in scale is first of all calcium sulphate; magnesium and calcium carbonate being secondary.

From the very nature of scale-forming substances their accumulation is a source of trouble to the engineer and expense to owners of plants. The problem is a rather difficult one, as not only does each source of water vary greatly in the scale-forming solids, but each individual source varies from time to time. One can readily see, therefore, that the analysis of a single gallon of water does not give much information, but the analysis of a sample of scale does give complete information, as each represents the residue after the evaporation of large quantities of water. The company, therefore, contends that if a sample of scale is divided and separated into its various ingredients, chemical treatment can be undertaken successfully. Without such determination, however, it is an impossibility to provide reagents which on the average can be assured to give satisfactory results.

THE ABUSE OF TRANSFERS IN CLEVELAND—LOW-FARE TICKETS ABOLISHED

As heretofore intimated in these columns, the plan voluntarily adopted by the Cleveland Electric Railway at the time of its consolidation with the Cleveland City Railway, of giving universal transfers on all lines, has been found very unsatisfactory, owing to the flagrant abuse of the privilege. Some time ago the company decided that it would be necessary to institute more stringent rules relative to the use of transfers, and as a first step in this direction has recently required passengers to ask for their transfers when they pay their fares, instead of securing them at transfer points. This change reduced the number of transfers somewhat, but did not do away with the practice of circling the city on one fare, as it was then possible to secure a transfer on a transfer on the Wilson Avenue crosstown line, which intersects more than half the lines in the city.

Before the universal transfer system went into effect about 8000 transfers per day were issued on the Wilson Avenue line. Lately, however, on days when traffic has been heavy as many as 25,000 transfers have been issued. A careful investigation was made, and it was discovered that a large percentage of the passengers were systematically swindling the company. At some crossings there was open trafficking in the slips. Two inspectors of the company stationed at St. Clair Street and Wilson Avenue one day recently negotiated for sixty-eight transfers in one hour, while another inspector of the company, stationed at Central Avenue, where conditions are somewhat similar, secured fifty-eight transfers in one hour. It is even stated that saloonkeepers near the corner of St. Clair Street and Wilson Avenue increased their trade by selling beer for 4 cents if the purchaser turned in a transfer, and by giving a transfer with beer for 5 cents. This was rendered possible by the fact that there are numerous large factories in this district which operate both night and day shifts. In the evening the night men coming on would ask for transfers and a few minutes later they would be handed out to day men going home.

As a result of investigations of this kind extending over several weeks, the company became convinced that it was being swindled out of thousands of fares, not only in the manner described, but through the practice of pleasure-seekers who are enabled to ride continuously for one fare. A new rule, which went into effect last week, provides that transfers on transfers will not be given on Wilson Avenue; in other words, transfers from this line will be given only to those who pay cash or ticket fare. It seems quite probable that the company will institute further modifications of the universal transfer system, as it is claimed there are other portions of the city where it is possible to swindle the company by securing transfers on transfers.

Another important change by the company is the return to its old plan of selling eleven tickets for 50 cents, instead of six for 25 cents, as it has been doing since the consolidation. This action was taken at a meeting of the directors of the company, held Monday, March 22. President Andrews has made a statement to the public in which he intimates that the lower fare and universal transfers were adopted as an experiment to test the claim that lower fare would stimulate business and increase the earnings of the company. The experiment has cost the company an actual loss in earnings of approximately $200,000 in eight and one-half months, while the operating expenses have increased during that time, owing to the increased cost of wages, power station equipment, rolling stock, electrical equipment and fuel. It had been hoped that some settlement of the street railway question would be effected between the company and the city, but there is at present no evidence of a disposition on the part of the city to make such an adjustment, hence the company finds it necessary to restore the rate of fare established by the ordinances under which it is now operating.

As a matter of fact, Mayor Johnson has taken another tack in the campaign to secure lower fares in the city. The latest plan is to request the State Legislature to pass laws giving cities the right to regulate street railway fares. At its last meeting the City Council adopted a resolution petitioning the Legislature to enact a law on the subject mentioned. The action of the Mayor is taken to indicate that he does not expect the courts to decide the McKenna ordinance as being constitutional. This ordinance established a zone within which the Cleveland Electric Railway Company was required to grant a three-cent fare.

The color line as ordained by the City Council of San Antonio, Tex., was drawn on the street cars for the first time in that city on March 15. The negroes resented the innovation by boycotting the cars.

TWO INGENIOUS COMBINED FARE REGISTERS AND SERVICE INDICATORS

As is well known, the Ohmer Fare Register Company, of Dayton, Ohio, has manufactured registers of various sizes for registering and indicating, separately, different classes of fares collected, and printing a record of each class at the finish of each half-trip, together with the register number, trip number, day and date, and the badge number of conductor. The Ohmer Company now has added to these two new machines, known as the No. 5 and No. 6, for use, exclusively, on city lines. United States and foreign patents have been issued for both of these machines.

The No. 5 register is arranged to register and indicate, separately, three or four different classes of fares, and at the end of each half-trip it prints a record of each fare collected, registered in its own specific class, and it also prints a record showing the total of all the fares collected on each half-trip, irrespective of the class. Besides printing the month and the day, it prints the time in hours and minutes that each car is put into service, the time in hours and minutes that both the conductor and the motorman take and leave the car. The time in hours and minutes is printed at the termination of each half-trip. The direction in which the car moves is also printed, as "Up" and "Down," "East" and "West," etc. If the car should be an extra, the record will print "Extra"; if a special or chartered car, the record will so indicate. It also prints perfectly the condition of the weather, and makes a notation of other miscellaneous data as may be desired to record. The detailed list includes the following: Extra, Special, Chartered car, Hot, Cold, Rain, Snow, Hail, Sleet, Fair, Baseball, Circus, Work train, Late, Accident, Collision, Off track, Motor impaired, Fuse out, Wires down, Washout, Railroad blockade, Railroad crossing, Passenger put off.

The No. 5 machine is so complete in its operation that with its use the ordinary trip slip used by conductors may be dispensed with, and all data pertaining to the service by the conductor be recorded and indelibly printed with this ingenious machine. This printed report cannot be tampered with nor removed, save by the inspector or car starter in authority, who removes the statement in duplicate at the end of the car run. One copy of this record is sent to the treasurer or auditor of the company, or, if desirable, the conductor may be permitted to remove his own record, in which case the inspector would remove the duplicate record showing all the totals for the entire day by one or several conductors. The No. 5 register, with all its accomplishments, is simple in operation, and is stated to be no more complicated than the other registers made by the company.

The Ohmer Fare Register Company's No. 6 register is similar to the No. 5 in most respects, with the exception that it has a limitation for two kinds of fares, and is particularly designed for large city properties collecting universal 5-cent cash fares and transfers only. Both registers are arranged for operation with cord or rod, and the operating devices to either can be attached to the ordinary register rods.

THE REPORT OF THE AURORA, ELGIN & CHICAGO RAILWAY

The annual report of the Aurora, Elgin & Chicago Railway Company, presented to the stockholders of the company by President L. J. Wolf is very complete, giving a general review of the work of the company since the line was placed in operation, and telling of the difficulties of operation that have been successfully overcome and the outlook for the future. The entire road is now in complete operation, and when entrance to Chicago is secured over the lines of the Metropolitan West Side Elevated Railroad, a determined effort will be made to capture the commuter business now handled almost exclusively by the Burlington, Northwestern, St. Paul and Great Western Railroads. The branch of the Aurora, Elgin & Chicago from Elgin to Wheaton was opened on May 26, 1903, and the prediction that the gross earnings would double was verified. The earnings of the Aurora-Chicago branch from Sept. 1, 1902, to Feb. 1, 1903, were $78,216. The earnings of the entire property from Sept. 1, 1903, to Feb. 1, 1904, were $160,262. (Miscellaneous earnings for January, 1904, were estimated to be the same as those of December, 1903.) During the winter 1902 the earnings of the company suffered severely from interruptions of service due to snow and sleet storms, but modifications of the equipment made the service of the past winter even more efficient than that of the competing steam lines. For 1902 the earnings by months were as follows: September, $21,450; October, $18,895; November, $16,663; December, $11,205. For the first five months of 1903 the earnings were: January, $10,001; February, $9,002; March, $14,706; April, $16,265; May, $28,010.

CHICAGO UNION LOOP OFFER.

The Union Elevated Railroad Company has made an offer to the city of Chicago whereby increased compensation to the city is provided for if an ordinance is passed which will put aside all questions as to the validity of the Union Loop franchises, which the city recently attacked in the courts. The following are the principal items in favor of the company in the proposed agreement:

Dismissal of the suit by the city attacking the validity of the franchise for the Van Buren Street line because frontage consents were purchased.

Approval of all lines as at present constructed.

Extension of the franchise of the Northwestern elevated, north of Wilson Avenue.

Extension of the platforms of Loop stations.

Extension of the Northwestern elevated platforms at Kinzie Street, with the privilege of constructing two tunnels to the Northwestern Railroad depot.

The privilege to elevate the tracks at Lake Street and Fifth Avenue on the Loop, to eliminate the crossing of elevated tracks at the same grade.

Altogether, 5420 ft. of platform on the Loop is elevated. This, of course, includes platforms already in place. This, together with elimination of delays caused by the grade crossings at the entrance to the Loop, should increase the capacity of the Loop to provide for traffic for several years to come.

PERSONAL MENTION

MR. FREDERICK STARBAUGH has been appointed master mechanic of the Ohio Central Traction Company's shops at Galion, Ohio. He was formerly with the Western Ohio Railway at Lima.

MR. W. P. HAZEN, for some time chief engineer of the Central Market Street Railway, of Columbus, Ohio, has resigned to become chief engineer of the Cincinnati, Georgetown & Portsmouth Railway, of Cincinnati.

MR. FRANK COPELAND, bridge engineer for the Columbus, Delaware & Marion Railway, of Columbus, Ohio, has resigned to take up a similar position with the Joliet, Plainfield & Auror Railway, which is now in course of construction in Illinois.

MR. ARTHUR C. RALPH, retiring general superintendent of the Boston & Worcester Street Railway, was entertained at a banquet at Marlboro (Mass.) March 11, by seventy-five of his former employees. Mayor Frederick R. S. Mildon and other city officials were present and spoke. Mr. Ralph was presented with a handsome Knights of Pythias watch-charm. His headquarters formerly were in Marlboro.

CAPT. ROBERT McCULLOCH, who was recently elected vice-president and general manager of the St. Louis Transit Company, is expected to assume his new duties within the next few days. Capt. McCulloch's resignation from the Chicago City Railway Company was to have become effective March 15, but the officials of that company requested him to continue with the company until arrangements were made for his successor.

MR. M. E. McCASKEY has been elected second vice-president and general superintendent of the Pennsylvania & Mahoning Valley Railway Company, of Youngstown, Ohio. For the past two years Mr. McCaskey has been superintendent of the New Castle division of that company. Before going with this company he was superintendent of the Pittsburg & Birmingham Traction Company and superintendent of construction of the Pittsburg, McKeesport & Greensburg Railway Company. He has been in street railway work for twenty-two years, and earlier in his career was connected with roads in Rochester and Buffalo.

MR. OSCAR T. CROSBY, of Washington, D. C., the distinguished electric railway engineer and explorer, delivered a very interesting lecture on March 23 before the New York Electrical Society upon his recent trip to Turkestan and Thibet. Mr. Crosby with one friend, a French officer, crossed the western portion of Thibet, entering that largely unexplored region from the frontier of Chinese Turkestan and emerging in India. The expedition was one of great hardship, owing to the natural difficulties presented, but Mr. Crosby had the satisfaction of visiting a large region hitherto untrod by the foot of civilized man, of correcting some previous opinions as to its geography and topography and of adding greatly to the scientific knowledge on Western Thibet.

CAPT. ALEXANDER R. PIPER has been appointed to the position of general superintendent of the American Railway Traffic Company, which was organized in the interest of the Brooklyn Rapid Transit Company for the purpose of transporting freight over that company's lines and assuming the city ash handling contract. Capt. Piper formerly was Second Deputy Police Commissioner of New York, and prior to that was superintendent of final disposition of the Street Cleaning Department. Capt. Piper is about forty years old and a graduate of West Point. He has served in the Eighth and later in the Second Infantry. Under General Miles he was in several Indian campaigns, and in May, 1898, he was appointed captain in the volunteer service. He served in Porto Rico and about five years ago he was retired on account of the loss of his arm.

MR. MILLARD B. HERELEY, an interesting interview with whom is given elsewhere in this issue, is a recent acquisition to the field of street railway management, having been appointed general superintendent of the Chicago Union Traction Company last November. His appointment was remarkable in that prior to that time, he had no direct connection with the operating department of the company, although in his work as traffic manager of the same company, for three years previous investigating conditions, he had an excellent opportunity to become familiar with the work. Mr. Hereley's success in winning the co-operation of his employees and reducing accidents, is referred to in the article just spoken of. He declares, however, that the guiding hand of General Manager Roach, and the support given by Receivers Fetzer, Eckels and Sampsell, have enabled him to make much of the progress he has been credited with in his new position. Conductors and motormen of the company express themselves as having a keen interest in Mr. Hereley's welfare, and as having confidence that they will always receive fair treatment at his hands, relations in the past having been such as to justify this confidence.


M. B. HERELEY

MR. WILLIAM S. TURNER, of J. G. White & Company, has just returned to New York from Auckland, New Zealand, where he has been since 1901 installing an electric tramway plant for J. G. White & Company, Ltd., of London. The line is owned by the British Electric Traction Company, has 30 miles of track and was described in the Street Railway Journal for Sept. 26, 1903. Mr. Turner is one of the pioneer builders of electric railways in this country, having been engaged in this work since 1888. He is a graduate of Cornell University and received from that institution in 1886 the degree of M. S. The same year he entered the employ of the Westinghouse interests, for whom he installed a number of electric lighting plants, among others an alternating plant at Carbondale, Pa., one of the earliest of its kind. The following year he joined the forces of the Edison Electric Light Company, at New York, and assisted in designing and supervising a portion of the early lighting system of that company in New York. In 1888, in connection with Mr. J. Lester Woodbridge, he formed the firm of Woodbridge & Turner, engineers and contractors, whose business was continued as the Woodbridge & Turner Engineering Company until 1895. Some of the electric railway plants installed by this company were that at Salem, Mass., the first electric railway in New England, a portion of the West End system in Boston, Hartford, Augusta, Nashville, Chattanooga, Quincy, Ill., Providence, Portland, Me., and Chester, Pa. Between 1896 and 1899 Mr. Turner was engaged in New York as an independent consulting engineer, but in the latter year he joined J. G. White & Company, for whom he supervised the installation of a number of railway plants, among others, the Elizabeth & Plainfield Street Railway and certain of the suburban lines of the Washington Traction & Electric Company, also a three-phase, high-tension lighting system for the Long Island City Electric Lighting Company. Mr. Turner left Auckland last fall, after the completion of his work in that city, spent the winter in London and arrived in this country March 19. He has been a member of the American Institute of Electrical Engineers since 1887.


W. S. TURNER

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. *a* Including all lines operated.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Feb. '04	56,884	34,154	22,729	22,667	63
	1 " " '03	54,701	32,414	22,287	22,226	61
	2 " " '04	116,491	71,252	45,239	45 134	105
	2 " " '03	113,488	67,257	46 231	43,192	3,039
AURORA, ILL. Elgin, Aurora & Southern Traction Co.	1 m., Feb. '04	33,132	21,999	11,132	9,133	1,999
	1 " " '03	30,023	18,913	11,105	9,216	1,889
	8 " " '04	10,087	184,339	125 748	73,507	52,240
	8 " " '03	287,154	165,929	121,225	72,730	48,495
BINGHAMTON, N. Y. Binghamton Ry. Co.	1 m., Feb. '04	15 864	10,982	4,882	------	------
	1 " " '03	15,371	40,487	4,884	------	------
	8 " " '04	160 815	85,985	74,830	------	------
	8 " " '03	148 406	85,539	62,867	------	------
BUFFALO, N. Y. International Trac. Co.	1 m., Jan. '04	296,970	201,389	95,581	136,703	†41,122
	1 " " '03	291,190	166,051	125,440	129,195	† 3,756
	7 " " '04	2,471,735	1,366 166	1,105,569	933,147	172,421
	7 " " '03	2,215,179	1,165,705	1,049,474	903,750	145,725
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., Feb. '04	18,047	10,582	7,463	------	------
	1 " " '03	10,645	5,817	4,827	------	------
	2 " " '04	37,034	21,397	15,638	------	------
	2 " " '03	22,680	12,388	10,292	------	------
Metropolitan West Side Elevated R. R. Co	1 m., Feb. '04	172,656	------	------	------	------
	1 " " '03	168,831	------	------	------	------
	2 " " '04	346,896	------	------	------	------
	2 " " '03	343,626	------	------	------	------
South Side Elevated R. R. Co.	1 m., Feb. '04	130,978	------	------	------	------
	1 " " '03	128,348	------	------	------	------
	2 " " '04	266,759	------	------	------	------
	2 " " '03	262,635	------	------	------	------
CINCINNATI, O. Cincinnati, Newport & Covington Light & Traction Co	1 m., Jan. '04	99,320	*59,899	39,421	21,412	18,009
	1 " " '03	94,212	*57,937	36,275	20,986	15,288
CLEVELAND, O. Cleveland & Southwestern Traction Co	1 m., Feb. '04	27,456	22,499	4,957	------	------
	1 " " '03	25,235	17,459	7,776	------	------
	2 " " '04	55,307	45,056	10,251	------	------
	2 " " '03	52,183	37,073	15,110	------	------
Cleveland, Painesville & Eastern R. R. Co	1 m., Feb. '04	27,456	------	------	------	------
	1 " " '03	25,235	------	------	------	------
	2 " " '04	55,307	------	------	------	------
	2 " " '03	52,183	------	------	------	------
DETROIT, MICH. Detroit United Ry	1 m., Feb. '04	288,346	*205,928	82,418	89,788	†7,370
	1 " " '03	285,683	*177,106	103,577	81,048	27,529
	2 " " '04	599,787	*432,031	167,756	177,354	†9,598
	2 " " '03	606,828	*373,044	233,784	162,205	71,579
DULUTH, MINN Duluth Street Ry. Co.	1 m., Feb. '04	41,883	27,754	14,129	11,445	2,684
	1 " " '03	39,747	26,923	12,824	10,161	2,663
	2 " " '04	87,426	56,548	30,878	22,820	8,058
	2 " " '03	83,435	52,837	27,598	20,340	7,258
FORT WORTH, TEX. Northern Texas Traction Co	1 m., Feb. '04	35 333	22,807	12,527	9,333	3,193
	1 " " '03	25,797	15,017	10,780	9,018	1,762
	1 " " '04	72,964	48,275	24,688	18,667	6,022
	1 " " '03	55,747	31,330	24,417	17,952	6,466
GRAND RAPIDS, MICH. Grand Rapids Ry	1 m., Feb. '04	52,100	30,513	21,587	------	------
	1 " " '03	47,468	26,923	20,545	------	------
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., Feb. '04	14,430	12,921	1,508	3,080	†1,572
	1 " " '03	13,140	12,267	873	2,929	†2,056
	12 " " '04	190,694	123,495	67,199	35,084	32,115
	12 " " '03	173,307	115,300	58,006	31,575	26,431
HARRISBURG, PA. Central Pennsylvania Traction Co	1 m., Feb. '04	34,634	35 529	†895	------	------
	1 " " '03	32,734	34,692	†1,958	------	------
	2 " " '04	70,792	63,868	6,924	------	------
	2 " " '03	71,086	52,224	18,862	------	------
HAZLETON, PA. Lehigh Traction Co	1 m., Feb. '04	9,570	9,797	†227	------	------
	2 " " '01	19,587	17,595	1,992	------	------
HOUSTON, TEX. Houston Electric Co.	1 m., Jan. '04	27,437	20 604	6 833	7,154	†321
	1 " " '03	31,049	19,753	11 296	6,250	5,046
	12 " " '04	412,512	273,415	139,097	85,560	53,536
	12 " " '03	367,438	216,412	151,027	75,000	76,027
LONDON, ONT. London St. Ry. Co	1 m., Feb. '04	9,316	9,532	†216	2,049	†2,265
	1 " " '03	10,716	7,684	3 032	1,920	1,112
	9 " " '04	133,464	88,162	45,283	20,716	24,587
	9 " " '03	126,132	74,915	51,217	18,803	32,414
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co	1 m., Feb. '04	240,724	135,565	105,159	71,734	33,425
	1 " " '03	218,906	115,351	103,554	68,087	35,467
	2 " " '04	500,138	275,116	225,021	146,453	78,568
	2 " " '03	463,375	244,753	218,621	139,185	79,436
MINNEAPOLIS, MINN Twin City Rapid Transit Co	1 m., Feb. '04	313,359	159,752	153,607	72,198	81,409
	1 " " '03	282,601	140,450	142,151	60,900	81,251
	2 " " '04	644,771	316 254	328 517	142,218	186,299
	2 " " '03	594,439	289,025	305,414	121 800	183,614
MONTREAL, QUE. Montreal St. Ry. Co	1 m., Feb. '04	168 685	131,420	37,265	16,941	20,325
	1 " " '03	141 800	108,803	32 997	15,716	17,281
	5 " " '04	937,822	618 258	319,564	85,788	233 775
	5 " " '03	845,589	533,379	312,210	81,706	230,503
OLEAN, N. Y. Olean St. Ry. Co	1 m., Feb. '04	6,401	3 826	2 574	2,438	137
	1 " " '03	5,316	2,859	2,457	3 896	†1 439
	8 " " '04	68,665	32,774	35 892	18,533	17,354
	8 " " '03	47,256	25,142	22,114	12,756	9,359
PHILADELPHIA, PA. American Railways	1 m., Feb. '04	93,675	------	------	------	------
	1 " " '03	81,713	------	------	------	------
	8 " " '04	945,215	------	------	------	------
	8 " " '03	811 617	------	------	------	------
ROCHESTER, N. Y. Rochester Ry. Co	1 m., Feb. '04	109,752	68,809	40 942	26,220	14,722
	1 " " '03	96,464	49,529	46,935	25,371	21,564
	2 " " '04	223,206	139,674	83,531	52 345	31,186
	2 " " '03	198,376	104 049	94 327	50,957	43,370
SAN FRANCISCO, CAL. San Francisco, Oakland & San Jose Ry.	1 m., Jan. '04	30,049	14,247	15 801	6,912	8,889
SAO PAULO, BRAZIL. Sao Paulo Tramway, Light & Power Co., Ltd	1 m., Feb. '04	118,000	39,000	79,000	------	------
	1 " " '03	99,319	36,014	69,305	------	------
	2 " " '04	241,354	77,512	163,142	------	------
	2 " " '03	201,906	62,033	139 873	------	------
SAVANNAH, GA. Savannah Electric Co.	1 m., Jan. '04	39,735	24,947	14,788	10,563	4,224
	1 " " '03	38,522	25,532	12,990	9,583	3 407
	12 " " '04	520,987	307,114	213 872	120,306	93,566
	12 " " '03	485,593	272,539	213,054	115,793	97,261
SEATTLE, WASH. Seattle Electric Co	1 m., Jan. '04	189,813	137,880	51,933	23,187	28 746
	1 " " '03	174,066	138,503	35,563	23,443	12,120
	12 " " '04	2,112,474	1,497,282	615,191	280,119	335,072
	12 " " '03	1,916,110	1,364,313	551,797	264,119	287,678
SYRACUSE, N. Y. Syracuse Rapid Transit Co	1 m., Jan. '04	67,171	42,541	24,630	20,296	4,334
	7 " " '04	489,614	288,496	201,118	133,002	68,116
	7 " " '03	433,108	236,622	196,486	163,175	63,311
TACOMA, WASH. Tacoma Ry. & Power Co.	1 m., Jan. '04	40,810	33,091	7,718	7,771	†53
	1 " " '03	34,833	26,914	7,919	7 356	563
	12 " " '04	499,564	351,306	148,258	107,550	4),708
	12 " " '03	446,578	337,221	109,357	80,701	28,656
TAMPA, FLORIDA. Tampa Electric Co.	1 m., Jan. '04	24,987	17,917	7,070	2 028	4,942
	1 " " '03	22,579	13,516	9,063	1,970	7,093
TERRE HAUTE, IND. Terre Haute Elec. Co.	1 m., Jan. '04	41 188	29,867	11 322	9,530	1,792
	1 " " '03	33,535	25,564	7.971	6,542	1,429
	12 " " '04	481,904	316,386	165,517	90,372	75,145
	12 " " '03	338,324	264,494	73,830	76,466	†2,630
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Feb. '04	124 037	*71 951	52,086	41,590	10,496
	1 " " '03	115,148	*61,114	54 034	39,564	14,470
	2 " " '04	261,554	*145,908	115,647	82,902	32,745
	2 " " '03	240,642	*123,512	117,130	79,022	38,108
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Light Co.	1 m., Feb. '04	36,065	*22,310	13,755	------	------
	2 " " '04	73,012	*46,156	26,855	------	------

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, APRIL 9, 1904. No. 15.

Published Every Saturday by the

McGRAW PUBLISHING COMPANY

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: 929 Chestnut Street.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues)............................... $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................... $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

St. Louis for the Convention

The decision of the executive committee of the American Street Railway Association to hold the annual convention of that body at St. Louis this fall, will meet with general satisfaction. This decision was reached only after a very careful consideration of all the circumstances of the situation. At the meeting of the executive committee held in New York on Feb. 29, and mentioned in our issue of March 5, the St. Louis situation was thoroughly discussed. It was agreed that St. Louis, especially this year, with the Louisiana Purchase Exposition, presented a great many advantages as a convention city. The only question was in regard to hotel accommodations, and it was decided that this could not be satisfactorily determined without a personal visit. A meeting of the executive committee was accordingly held in St. Louis on March 26, and the decision to hold the convention in that city on October 12 and 13, next, was reached. The headquarters of the Association will be at the Southern Hotel. The other details in regard to the meeting which have been decided upon are printed elsewhere in this issue. The secretary of the Association will also issue a circular in a few days announcing the arrangements for hotel and other accommodations.

We have strongly advocated the selection of St. Louis as the meeting place in 1904, ever since the Saratoga convention, and a return to October as the date of the annual meeting, believing both to be the wishes of a large majority of the members of the American Street Railway Association. An attempt to hold the convention in the same city at which a World's Fair is in progress is an experiment on the part of the American Street Railway Association. At the time of the Chicago World's Fair the objections to this course were considered so great that the 1893 convention was held in Milwaukee. While this was probably a wise course to pursue at that time, the example could not be followed this year of holding the convention in a neighboring city, because there is no city in the vicinity of St. Louis corresponding to Milwaukee which could accommodate the American Street Railway Association at one of its annual conventions. To hold the convention in a distant city would have defeated the object of the executive committee, which was to afford an opportunity to visit the World's Fair and also attend the annual convention to those members of the Association who could not very well absent themselves from their business for two extended trips. Again it is believed that the street railway system of St. Louis will itself repay a visit to that city, as it has been brought to a high state of efficiency, and under the experienced management of Capt. McCulloch will afford, during the present summer and fall, an object lesson in the handling of large amounts of traffic which will be worthy of study. The time selected for the convention, that is, October, will be a very attractive month in St. Louis, and one well suited for the meeting of the Association.

Of course, the principal, and really the only argument which can be urged against St. Louis is the supposedly crowded condition of the hotels, but this, we believe, will be found more of a sentiment than a reality. During its trip to St. Louis this question was carefully investigated by the executive committee, and assurances were secured that there were sufficient provisions for accommodating the attendants. A number of new hotels have been and are being erected in the city; many of these are now ready, and all will certainly be completed long before the date set for the convention. Indeed, the American Street Railway Association is by no means the only large body which will hold a convention this year in St. Louis, and that the question of hotel accommodations has been considered satisfactory is evidenced by the decision of other bodies to meet this summer and fall in or near the Exposition Grounds. To mention no other, the Electrical Congress, with which many of the members of the American Street Railway Association are connected, especially those who are also members of the American Institute of Electrical Engineers, will hold its sessions in St. Louis during September. In addi-

tion the National Electric Light Association, the Engineering Congress, the American Institute of Electrical Engineers and other bodies have also decided to meet this year in St. Louis.

Fire Risks and Remedies

An Institute discussion, particularly if it waxes a bit fervid, generally brings to the surface facts which do not otherwise transpire. The discussion last week was no exception to the rule, and the information regarding danger to station apparatus, particularly the transformers, from fire, which was made public, will bear careful consideration. It has been pretty well understood that oil, such as is used in the transformers and oil switches, is far from easily inflammable, but few, even among engineers, have fully comprehended how far this immunity from danger extends. Of course, oil under which an arc can be broken with impunity is decidedly different from oils of the ordinary sort, and although even this can be set on fire, it becomes a real element of danger only under very unusual conditions. The general opinion seemed to be that oil insulated transformers, when properly installed, were considerably safer than those of the air-blast type, although there were wide differences of opinion as to what constitutes proper installation. Transformer oil generates explosive vapor only with very great heat, and probably would not generate it in any ordinary fire to an extent which would cause serious results. Yet several speakers were decidedly in favor of making the transformer cases solid enough to stand, in case of the ignition of explosive vapor, an internal pressure of 100 lbs. per square inch or so. This seems to us like an excess of caution, for it forces the use of water-cooling or other forced system of circulation, and after all, an ample relief valve at the top of the case, even a hinged lid which would fall back by its own weight, would afford ample protection against the trivial explosions possible. The self-cooling form of transformer case, especially in the medium sizes, is too valuable to be put aside for the less simple and more troublesome water-cooling, good as the latter may sometimes be.

In very high voltage work, the oil-insulated transformer is a necessity, as is the oil-switch, and cannot be put aside. The general opinion, as expressed at the meeting referred to seemed to be that oil transformers should be installed in such wise that their contents, even if set free by melting the solder of the cases, could not flow anywhere to meet inflammable material. This means installation either in a separate room or in a space set apart by a wall or by depression of the floor, so as to keep leaking oil out of the rest of the plant. Drainage from this transformer space to the outside of the building would certainly be desirable. As between a separate room and a protected space there is little to choose in large stations, but in those of more moderate size, it seems to us that the advantage lies with the latter alternative. For the wiring is thereby naturally simplified, and what is more, the whole equipment can come under the eye of the regular attendants without setting a man apart to watch the transformers. One instance mentioned in the debate, in which an attendant let a short-circuited transformer go on burning until the superintendent could be telephoned for and come down on his bicycle, deserves particular comment. A management that will put so helpless an attendant in charge of a sub-station richly deserves to be burned out, and has no claim for sympathy. The time has not yet come in which sub-stations can be left to run themselves, and when anything happens, it is likely to be serious. Therefore, the man in charge must know his business thoroughly and have full power to act on the instant. In most cases of trouble with heavy apparatus seconds count, and if an attendant has to telephone or even to ask questions, the mischief is already done. There is altogether too much dependence placed on cheap and incompetent men in a good many recent plants, and the result of this sort of negligence is pretty certain to be serious.

Another horrible example brought to light in the discussion was a serious fire caused by the installation of a wooden framework to support high-tension wires over the transformers. The amount of work cut out for the fool-killer about high-voltage electrical plants is something shocking. We have seen over and over again 10,000 volt wiring laid out in a wooden station almost as one would wire for an annunciator, simply from sheer shiftlessness. Even in supposedly fireproof construction there may usually be found danger points which have entirely escaped attention. In electric railway work in particular where sub-stations are freely used, complete continuity of service is of the utmost importance, and it behooves the engineer to get down to business and to see to it that the stations are safe from danger of fire from sources within and without. Brick, cement and iron are safe things to fall back upon, and when arcs find only these to feed upon short-circuits lose their terror. There is no excuse for anything but the most limited use of wood in the construction of high-voltage sub-stations, and a management too parsimonious to use fireproof construction had better go out of business. We would not dare to say how many small stations and sub-stations have oil-soaked wooden floors, and are finished in oiled or varnished sheathing, but one does not have to look far to find them. It is high time to inaugurate a campaign against these needless and reckless fire risks. The dangers are mostly preventable by simply following the precedents long since set in fireproof construction for general purposes. Apparatus which may become involved in short-circuits, is, of course, a fire risk of a somewhat uncertain character, but when it is installed with ordinary regard for common sense, it becomes relatively harmless. At any rate, a station built with a view to safety, is a far better risk than it is often supposed to be, and may be made as effectively fireproof as a building for any other purpose.

The Gas Turbine

In line with the rapid and promising development of the gas engine as a prime mover, the gas turbine is now offering many attractions for investigation and research. That the success of the steam turbine is practically revolutionizing the status of the steam engine for power generation is well known, and tends to indicate the possibility of developments of even greater importance in the elimination of some of the difficulties met in gas engine practice. The steam turbine has been an important step in freeing us from many of the mechanical limitations of the reciprocating engine, but it still entails the use of that wasteful factor in the thermal-transfer process—the steam boiler. This is, of course, entirely avoided by the gas engine process, and it is with a hope of being able to combine the advantageous features of the steam turbine with the ideal thermal conditions met in the gas engine that the gas turbine has been considered. For several reasons the turbine form of engine appears particularly well adapted to the use of gas, among them the absence of exposed packing and surfaces which require lubrication.

Considerable experimental work has, we understand, been done along this line, which, although not successful, indicates the possibility of overcoming certain difficulties met in the development of a practical machine. The mode of operation

that has been worked upon as being the simplest and most natural, is that of compressing both air and gas separately and independently, and then discharging them in the proper portions for an explosive mixture into a common combustion chamber, where combustion takes place in the form of an explosive blast. The kinetic energy of the blast is utilized in driving the blades or buckets of the rotating turbine wheel in a manner similar to that in which steam is used in the steam turbine. Theoretically considered the type of turbine is unimportant, and expansion is carried on until the pressure of the atmosphere is reached. This process follows the well-known Brayton cycle, which, according to the theory of the gas engine, possesses exactly the same theoretical thermal efficiency as the Carnot cycle, provided that in the latter the final compression equals that of the pressure of combustion in the Brayton cycle. The ideal gas turbine would, therefore, give the same economy as the ideal Carnot heat engine; the only question is how would the working and cooling losses compare in practice. The work of compression for the gas and the air is the same in both types of machines, and the energy for doing this is practically the same, if it be considered that although the shaft of the turbine compressor is lighter, reduction gearing is required. The other working losses which are inherent in the piston engine would, however, prove much smaller as the friction in the nozzles, vanes and rotating wheel in the gas turbine would, at the least, be equal to that of the DeLaval steam turbine. The heat radiation could probably be made less than that of the gas engine, provided that the burning chamber could be so isolated as to dispense with water cooling. However, operation of this kind would give very high final temperatures of the expansion which would seriously impair the maintenance of the wheel vanes; other than single-tier turbines, that is, those working with nozzles, cannot be used on account of the high temperatures. If vaporized water be mixed with the gas in the combustion chamber the temperature would be lowered, but the efficiency would be reduced in proportion. The use of the exhaust heat for vaporizing the injected water would be of some assistance, but in view of all the disadvantageous conditions it has been questioned by some engineers whether a gas turbine working according to the described process, has any chance to compete successfully with the piston type gas engine.

The difficulties which are presented in operating a turbine in this manner are admittedly very serious, but is it not possible in some manner to avoid them? It would seem possible to find some method of cooling the blades if the intense heat of the blast tends to cause disintegration. The possibility suggests itself of directing steam jets for cooling upon the rotating blades at points separated from the combustion nozzles, the steam for which is generated possibly by the hot waste gases of combustion exhausting from the turbine. Other means of counteracting the destructive effects upon the turbine mechanism of the intense heat may be devised in the light of experience. The advantages offered by the gas turbine in eliminating the difficulties met in the use of the steam boiler, as well as those experienced in the piston gas engine, are by far too great to be overlooked, and it is hoped that this subject will receive careful consideration. We do not believe that the method that has been suggested of operating a gas turbine in connection with a multi-cylinder gas engine, so as to utilize the high pressures of the exhausts in driving the turbine blades is the direction in which progress is tending; if the gas turbine can be made practical in any case, it would seem to be possible to carry out the entire process of transformation of the heat to work in the combustion nozzle, and thus so greatly simplify and concentrate the entire operation. This is manifestly the direction toward which recent progress is now pointing to further and more reasonable economies in power generation.

Generators and Transmission Circuits for Single-Phase Railways

Among the many problems incidental to the adoption of single-phase railway systems is that of the generators to be used. This is one of the first questions to be settled after the decision to use single-phase alternating-current motors has been made. On what will probably be one of the first roads to put single-phase railway motors in operation, contracts had already been let for three-phase generators before the decision to adopt the single-phase motor was reached, and it is likely that many other roads partially completed, which are now considering single-phase equipment, will find themselves in a similar position. The discussion of the advantages of one, two and three-phase generators for single-phase railway work by W. A. Blanck in another column, is therefore most timely. On a road where new generating machinery is to be purchased, along with the adoption of the single-phase railway motor, the single-phase generator has claims which cannot be turned down off-hand. Where two or three-phase generators are used for single-phase work, it is somewhat at the expense of simplicity, since the road must be divided into two or three sections operating upon the different phases, and there is no opportunity to operate the whole generating capacity upon one section of the line. Of course, there are very few occasions when it would be necessary to do this, but in certain emergencies it might be very desirable. Furthermore, it might make a decided difference as to the number of generating units which must be kept ready for operation.

The proposition to ground one side of a single-phase transmission circuit, as advanced by Mr. Blanck, is not quite so radical as it might seem at first thought. As a matter of fact, it is now the common practice to ground the neutral wire of a high-tension transmission system when the transformers or generators are star-connected. It is now generally recognized, and has been demonstrated mathematically that the strains upon the insulation which actually rise in practice are less with such a grounded neutral than on a circuit which is entirely free from grounds. It is possible, therefore, that a single-phase circuit grounded on one side would not require forbiddingly elaborate insulation. The grounding of one side of the high-tension transmission line for a single-phase railway might result in considerable reduction in first cost, and this reduction of cost is one of the objects in the introduction of the single-phase railway system. It has already been proposed to work high-voltage direct-current transmission lines grounded, and some experiments have been tried to this end. A grounded single-phase system is equally capable of being so worked, but whether in practice such operation would be advisable, is another question, and one upon which at present we have no experimental light. If the new commutating alternating-current motors meet the present expectations of their advocates, there will certainly be a strong tendency in favor of single-phase rather than polyphase lines. How far the better utilization of the material in a polyphase generator will tend to offset its greater complication of circuits remains to be seen. The key to the whole situation is the extent to which single-phase motors for general purposes can be made to compete in general operative qualities with polyphase motors, and of this it is too early in the game to speak with certainty.

NOTES ON LOS ANGELES RAILWAY COMPANY'S SYSTEM

Detailed descriptions have just been published in these columns of many interesting features of the Pacific Electric Railway Company's system in and about Los Angeles. To describe the system of the Los Angeles Railway Company in all its departments would involve repetition of much that has been printed about the Pacific's electric system, since, in many features, the two companies have the same standards. The Los Angeles Railway Company is the older corporation, and while its lines and equipment have been steadily developed and brought up to a high state of efficiency, the Pacific Electric Railway Company has necessarily had a more phenomenal growth during its short existence of two years. Henry E. Huntington is president of and controls both companies, but the other stockholders and officers are not the same in both. The two systems are operated separately. The features of the similarity are the standards of track and overhead construction and the power supply. In rolling stock, car houses and methods of operating, the Los Angeles Railway Company has distinguishing features which will be the main subject of the present article, points of similarity and identity being briefly mentioned.

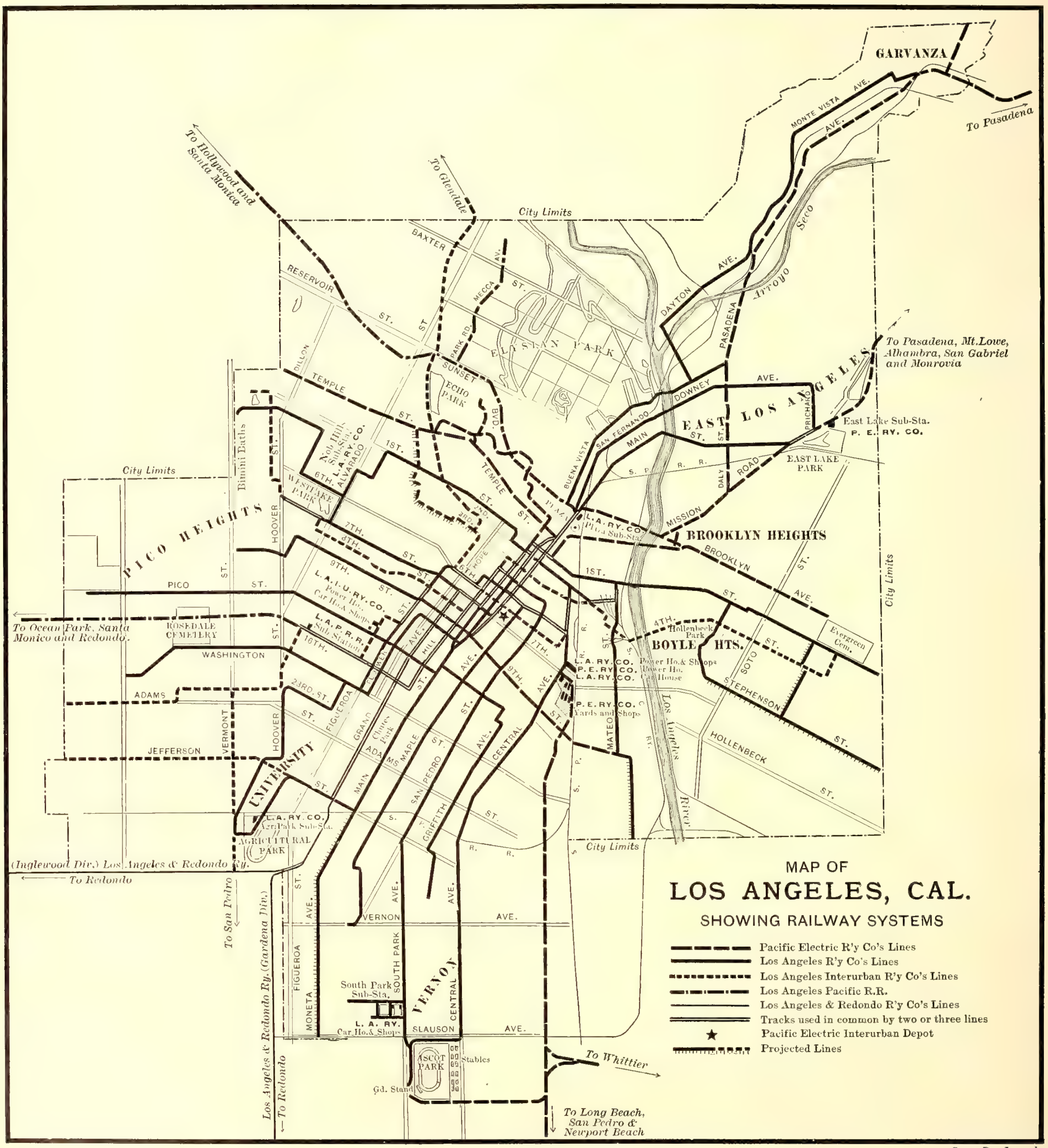


FIG. 1.—ELECTRIC RAILWAYS IN LOS ANGELES

Street Ry. Journal

The Los Angeles Railway Company was incorporated in 1895, and at that time took over the Los Angeles Consolidated Railway. A year later the Los Angeles Cable Railway Company was taken over, and soon afterward the cable system was abandoned and the lines changed for electric operation. All traces of the old cable roads have recently been removed,

both in track and rolling stock. In 1898, after being changed from animal to electric traction, the Main Street & Agricultural Park line was purchased. About the same time the Mateo Street and San Pedro Street lines were acquired.

The Los Angeles Railway Company now operates seventeen lines within the city limits, covering 127.62 miles of track, while proposed extensions will bring the trackage up to 136.6 miles. As will be noticed on the accompanying map, Fig. 1, these lines, indicated by heavy full lines, radiate from the center of the city to all parks and residence sections. The Pacific Electric Railway and the Los Angeles Interurban Railway Companies, whose lines are indicated respectively by long dash and short dash lines, operate a few city branches in connection with their interurban roads. The Los Angeles-Pacific Railway Company and the Los Angeles & Redondo Railway Company, which operate interurban lines only, have the routes of their cars in the city indicated respectively by the dash and dot and light full lines.

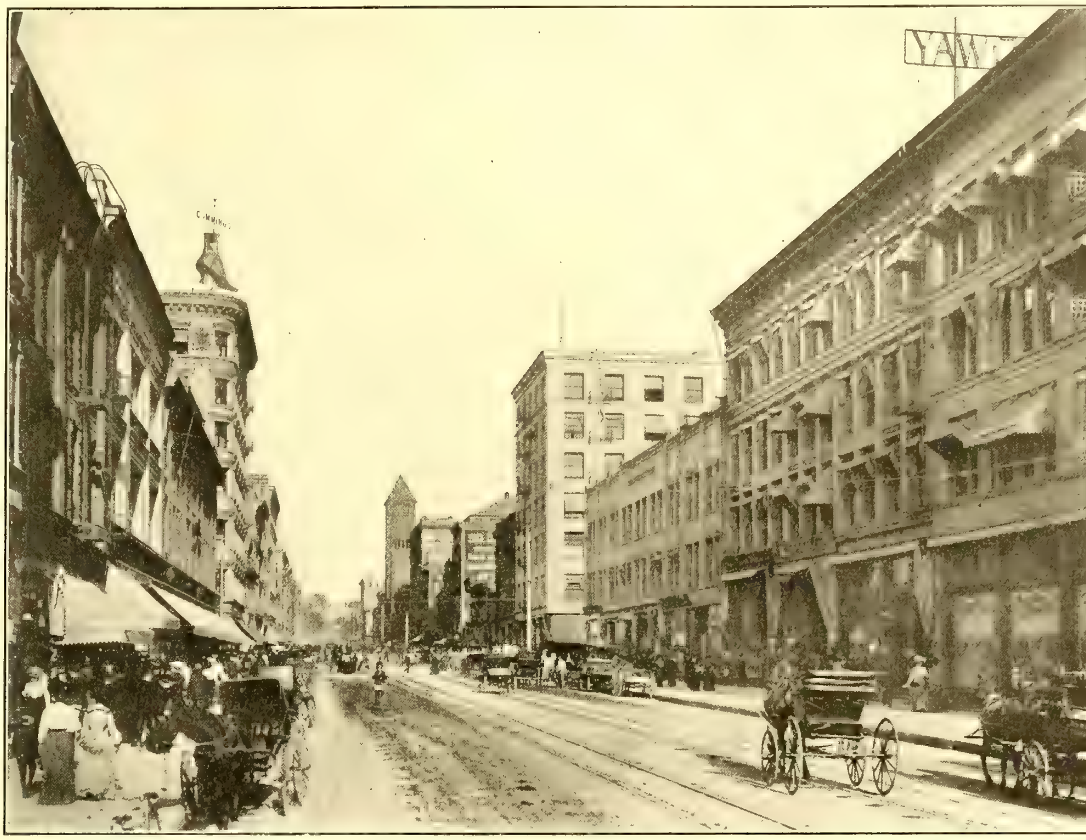


FIG. 2.—VIEW OF BROADWAY, LOS ANGELES, SHOWING STREET WITH NO TROLLEY POLES, SPAN WIRES BEING SUPPORTED FROM BUILDINGS

FIG. 3.—SWITCHING TOWER AT FIRST AND SPRING STREETS, LOS ANGELES, LOOKING UP NORTH SPRING STREET

TRACK AND OVERHEAD WORK

For paved and graveled streets the track construction is identical with that of the Pacific Electric Railway Company, described and illustrated in the STREET RAILWAY JOURNAL of Feb. 27, with the following exception: The Los Angeles Railway lines are all laid with a 3-ft. 6 in. gage. In some portions of the city, particularly in the new Garvanza extension, some unusually heavy grading was necessary for the construction of the lines. One branch running to Westlake Park on Second and First streets has a number of very heavy grades, the maximum being 11½ per cent.

In the overhead construction the Pacific Electric standards are used, all trolley wire being of No. 000 double-grooved wire. The side-pole span construction prevails on all streets, and where the company operates over a private right of way, cen-

ter-poles are employed. In the business districts on Broadway, Spring and Main Streets, and the cross streets, wherever the property owners made no objection, the side-poles have been removed and the span-wires fastened to the buildings by means of strain insulators. Fig. 2 is a view on Broadway showing the street unobstructed by poles, with the exception of two or three used for arc lights at street intersections.

OIL OPERATED SWITCHING SYSTEM

A novel feature of the Los Angeles Railway Company's system is the switching apparatus and tower, located at the intersection of First and Spring Streets. At this corner are a double-track crossing and two double-track connecting curves. The cars of eight of the fifteen lines of the Los Angeles Railway Company, of three lines of the Pacific Electric Railway Company, and all the cars of the northern division of the Los Angeles Pacific Railroad Company pass this corner, giving a regular service of 210 cars an hour, which, during rush hours, and on holidays, is increased to over 300 cars an hour..

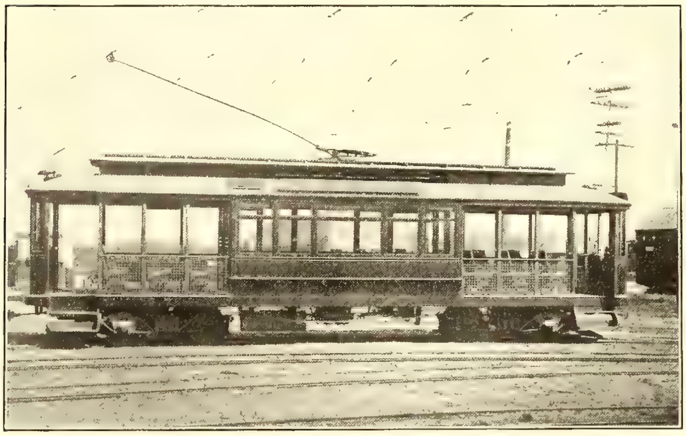


FIG. 4.—STANDARD LOS ANGELES CAR

Until recently the switching was done by hand by a switchman, whose work in operating the four switches had become quite a gymnastic feat. On Jan. 1, last, a semi-automatic switching system was installed, which is operated by a switchman located in the small tower shown at the right in Fig. 3. The system, which is the patented invention of Dr. W. J. Bell, a dentist of Los Angeles, is operated by means of liquid pressure, oil being used as the fluid. All the compressor apparatus, controlling valves, etc., are located in the tower. To each of the four switches is run a pressure pipe, ¾ in. in diameter, and the oil cylinders of the switches are connected by one common return pipe to the oil tank in the tower. The pumping apparatus occupies one side of the tower, and its inclosing case affords a seat for the switchman. There are two double-acting plunger pumps set on a malleable casting in which is placed a 10-gallon open oil tank. Each pump is driven by a ½-hp slow speed series-wound Paragon motor from the 500-volt railway current. The two pumps and motor are in duplicate, so that either one or both may be operated. At each end of the pump base is an air chamber, from which pipes are brought around to the switchboard in front of the operator. This switchboard contains four three-way valves, one connecting, by means of an individual pipe, with each switch. All the switches are held in usual position, that is, for straight track, by means of springs, and for this position the valve handles are upright, indicating no pressure on the pipe line. When the operator desires to throw a switch, he pulls down the valve handle to a horizontal position, which movement opens the three-way valve and allows oil under 60 lbs. pressure to move the switch tongue over against the force of the springs. When it is necessary to throw the switch back, the valve handle is raised, thus taking the pressure off the switch-cylinder. The oil returns through the same pipe to the open tank under the pumps from which they draw their supply. The switch-cylinder, which is located in an iron box just outside the track, is 3½ ins. in diameter, and, as it works constantly in oil, its wearing qualities are very good. It is not even necessary to use rings in the piston head. A thin paraffine oil, from which the solids and distillates have been removed, which therefore, is practically non-inflammable, is used in the system. The oil not only lubricates the valves and cylinders, but in colder climates would prevent freezing, as there are no moving parts exposed, except the projecting end of the piston between the guard rail and the tongue, the spring also being inclosed in the cylinder.

In order to signal the motorman to proceed after a switch is set, small semaphore blades are arranged, which, when thrown to a vertical position uncover electric lamps that serve as signals at night. Each semaphore is operated by an electric solenoid switch controlled by a push button located beside the valve handle. When a car approaches, unless signaled to proceed immediately, it is brought to a stop just before reaching the switch, and the motorman gives one stroke of his gong as a

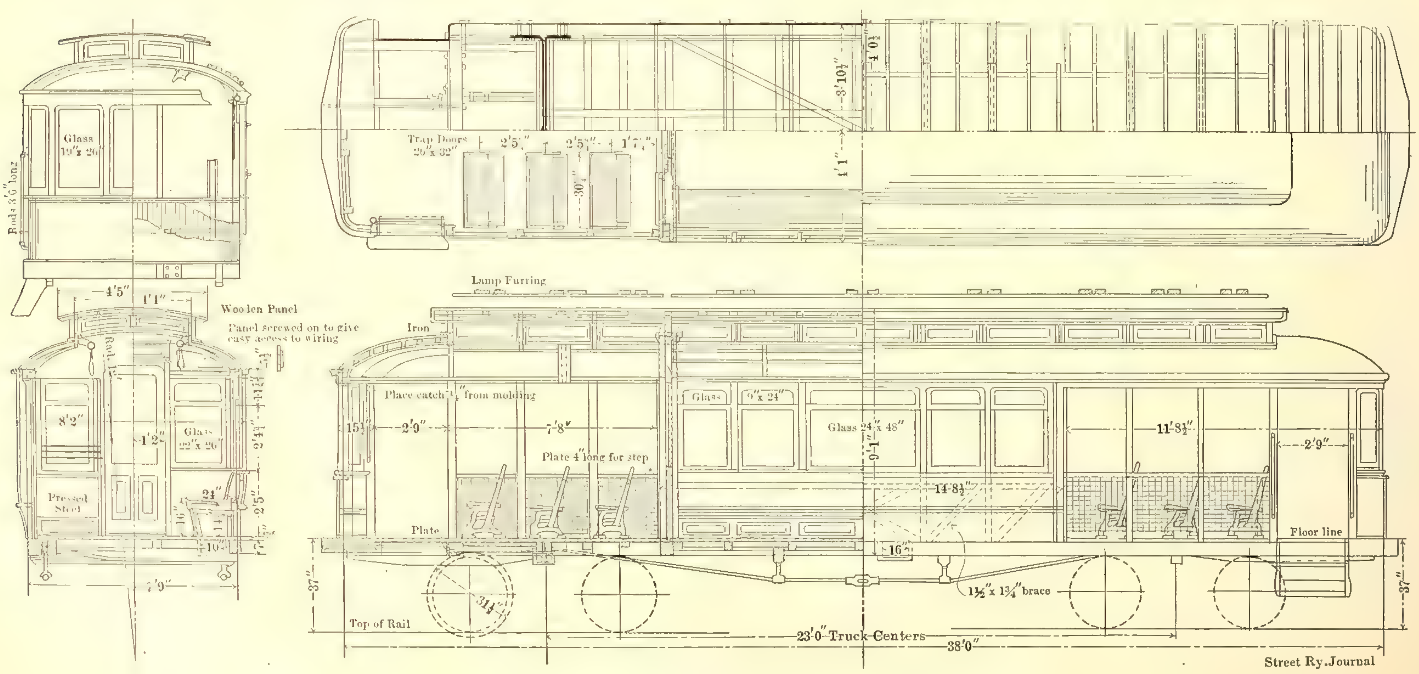


FIG. 5.—PLAN AND CROSS-SECTION OF CAR

questioning signal. The tower operator then throws the switch, and when he is ready for the car to proceed gives the clearing semaphore signal, which is answered by two gongs by the motorman.

The tower is hexagonal in shape, the operating room being 3½ ft. across and 6 ft. high. It is supported 8 ft. above the sidewalk by means of a hollow steel post, the bottom of which is stayed to an iron plate embedded in concrete. The four pressure pipes and one common return pipe are carried down through the center of the post. The tower is about 16 ft. high over all, and as it is ornamental in design, does not disfigure the street or the abutting property. It is placed at the edge of the curb, so does not take any more space than an ordinary electric light or telephone pole.

There are several features which commend the use of a system of this sort. It places the control of the cars absolutely in the hands of the switchman, who can switch the cars rapidly, and still allow only one car to be on a crossing at a time, thus conforming to the rules of the company and minimizing possible danger to pedestrians and vehicles. From his elevated position he has an unobstructed view down all four streets, and in cases of blockades or unusual disturbances on the street, can move the cars as necessity demands. He has a telephone at his hand for communication with the chief dispatcher, so that he can report unusual delays or accidents. In reality the switchman is important to the public safety. At the ringing of his large gong, all cars stop, and this, indicating something unusual, warns the pedestrians to seek safety on the sidewalk. This alarm has served its purpose excellently several times during the running away of teams on the approach of fire engines. In case of an accident or of disobedience of orders on the part of a motorman, the operator can throw, and thereby stop a car by switching the rear truck over to the other track after the front truck has passed the switch point. Of course, this prerogative is only to be exercised in extreme emergencies, but it illustrates the control which the switchman has over the cars. With the aid of a megaphone, the operator can give personal orders to a motorman or conductor on any corner. Another good feature of the oil-operated switches, is that the switch tongue moves slowly to its position, being entirely free from the quick action that characterizes the electrically-operated switches, which so often, in bad weather, slops mud and water over the cars and pedestrians.

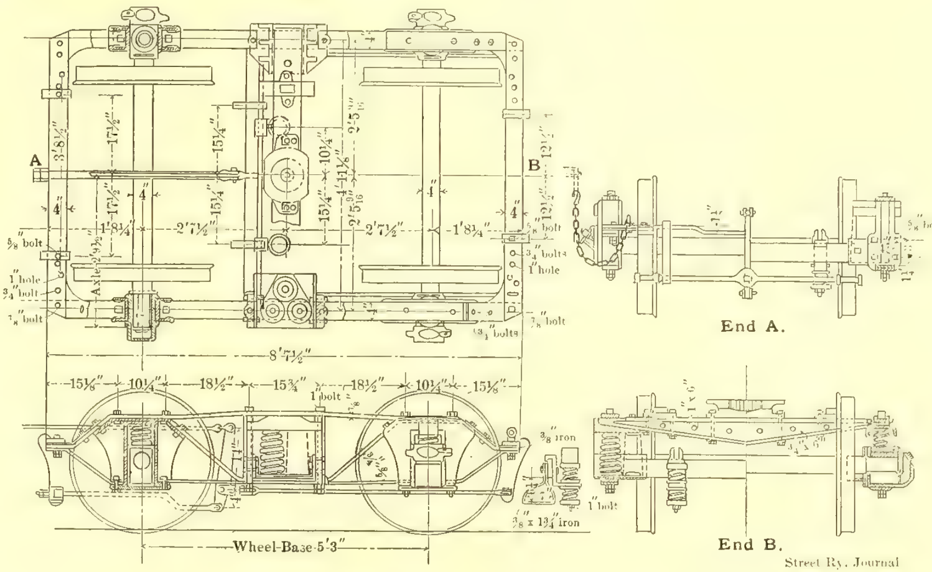


FIG. 6.—DETAILS OF STANDARD TRUCK

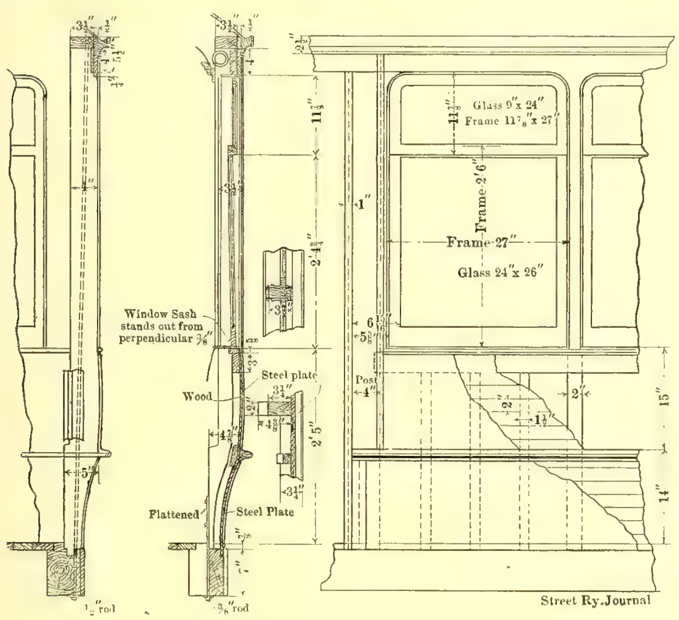


FIG. 7.—CAR WINDOW DETAILS

Plans are now being prepared for similar switching towers which will be installed at three other important intersections in the down-town district. For a single track switch Dr. Bell has devised an apparatus that can be operated by the motorman,

Form 3500-1M-4-03

LOS ANGELES RAILWAY COMPANY

DESCRIPTION OF CAR EQUIPMENT

.... 190....

Initial .... *Class* .... *Number* ....

Builder ....
Rebuilt by ....
Length: Over Dash ....; " Body ....; " Buffer ....
Width ....
Distance: Center body bolsters ....; Body bolster to dash ....
Vestibule: Standard ....; Octagon ....; Curved ....
Trucks: Kind ....; Wheel center ....
Wheels: Number ....; Size ....; Kind ....
Journals: Kind ....; Size ....
Springs: Number ....; Size ....; Kind ....
Brakes—Kind ....
Fenders—Kind ....
Steps—Kind ....
Curtains: Number ....; Kind ....

Lighting: Headlight, Kind ....; Interior, number and kind ....; Vestibule, number and kind ....; Attachment for trailers ....
Seats: Capacity of car ....; Interior, cap. and kind ....; Vestibule, cap. and kind ....
Weight: Body ....; Trucks ....; Motors ....; Complete ....
Windows: Whole number ....; Number, one side of car ....; Number, vestibule ....; Size of glass ....
Doors: Kind ....; Size of opening ....
Register, kind ....
Trolly catcher, kind ....
Trolly base, kind ....
Controllers, kind ....
Motors: Kind ....; Make ....; Equipment ....

SPECIAL APPLIANCES AND REMARKS CONCERNING REPAIRS:

FIG. 8.—FORM USED BY MASTER CAR BUILDER TO KEEP RECORD OF ALL CARS

and such a switch has been in successful operation for some time at Fifth Street and Maple Avenue. The track part of the switch is identical with that used at the First and Spring Street installation, being operated by oil. The switch is thrown by the car-controller closing a circuit through an insulated section of the trolley wire which is connected with the electrical operating device, located at the side of the street on a pole. No electrical wires or apparatus are necessary under this street, a feature which tends to insure the reliability of the switch.

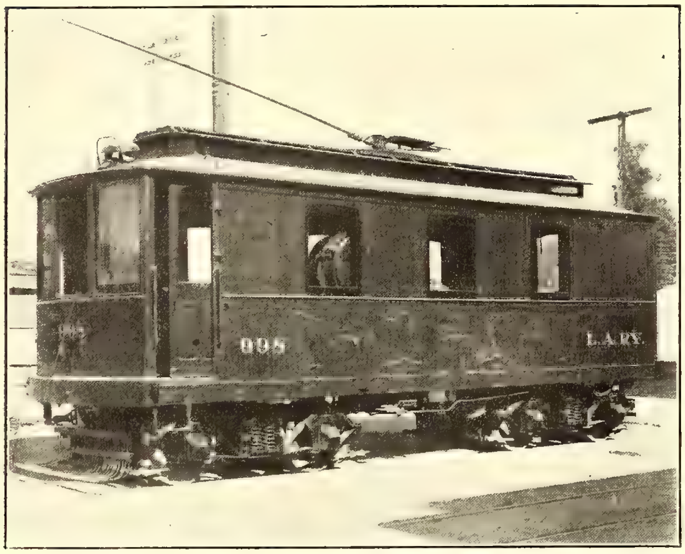


FIG. 9.—EMERGENCY CAR

ROLLING STOCK

The company has a total of 284 cars on its system, the majority of which are of the standard type illustrated in Fig. 4. Some forty odd Pullman cars that were about to be discarded, have been rebuilt to conform with the adopted standard, and the remaining cars are of the open cross-bench type, and are used only as extras. A brief description follows of the standard cars and of results accomplished in standardizing the equipment and construction of the rolling stock in general.

FIG. 10.—EMERGENCY CAR WITH COMPARTMENTS OPEN

FIG. 11.—INTERIOR OF EMERGENCY CAR

The standard car, Fig. 4, is of the combination open and closed type, which has proved so popular in California, and has come to be known as the Los Angeles type. The length over bumpers is 39 ft. 2 in., and over the dash 38 ft. The closed compartment has a length of 14 ft. 6 ins., and the car is 8 ft. 3 ins. wide. The bottom framing comprises side sills of yellow pine, plated with 7 in. x ½ in. steel and cross sills of oak. Ash is used for the posts and longitudinal rails, and the closed compartment has paneled sides of yellow poplar. The roof is of the monitor, full-ventilator pattern, covered with canvas, and is thoroughly reinforced with steel carlines over the posts. Fig. 5 shows a plan of the car and a cross section. The seats in the longitudinal part are arranged longitudinally, and in each open section are six walkover seats. The total seating capacity of the car is forty-two. Pantasote curtains are provided, and in the open section, they extend to the floor line. The steps are of the Stanwood pattern.

Anderson and Smith arc headlights are employed, but without the interior arc light. Instead of the wire resistence that is generally used with the headlight, incandescent lamps have recently been employed to serve as resistance. When the interior arc was used ten incandescents were depended upon for the rest of the illumination. C. A. Henderson, the auditor of the company, realized that there was considerable waste of current through the arc resistence, so decided it would be more economical to do away with the interior arc, substituting incandescents, which could also act as resistance. Consequently, under the direction of the chief electrician, J. L. Clarke, the following arrangement was made: Five 4-light bunches of incandescents, mounted in Benjamin wireless fixtures were placed in series, with the headlights as resistance. Three of these bunches are in the closed compartment and one in each of the open sections. In addition there are four panel lights in the inclosed portion, and a fifth on the outside over one of the doors, forming a series of five, which is connected directly to the car circuit, and is useful in lighting the car when the headlight is being changed or when it is out of order. This gives twenty-five lights in the car instead of ten incandescents and one arc, and besides saving the current of five lamps, gives a very good illumination and one that is more pleasing than that from the combination lighting. Another improvement in the electrical management of the cars has been the placing of all fuses on the compressor and light circuits under the car-sill, thus minimizing the risk from fire.

The trucks of the car are known as the Los Angeles Railway standard, and are of the design illustrated in Fig. 6, and also shown on the car in Fig. 4. Each truck is formed of 4-in. forgings, varying in thickness from ⅝ in. to 1 in. The bolster is built up of 1 in. x 6 in., and ¾ in. x 6 in. steel plates, with a solid oak center. Bracket wheels, 30 ins. in diameter are mounted on 4 in. axles, with 3½ in. x 7 in. journals. The wheel base is 5 ft. 3 ins., and the bolster centers of the two trucks of each car are 23 ft. apart. The equipment comprise two 38-B Westinghouse motors and K-11 controllers.

Christensen and Westinghouse air brakes are used, the latter being the standard. The total weight of the car is 29,000 lbs.

The Pullman cars mentioned above were originally 25-ft. cars, and have been lengthened to 33 ft. 9 ins., the closed part being 10 ft. 6. ins. The vestibules were changed to the standard, and walkover seats installed, the seating capacity being increased

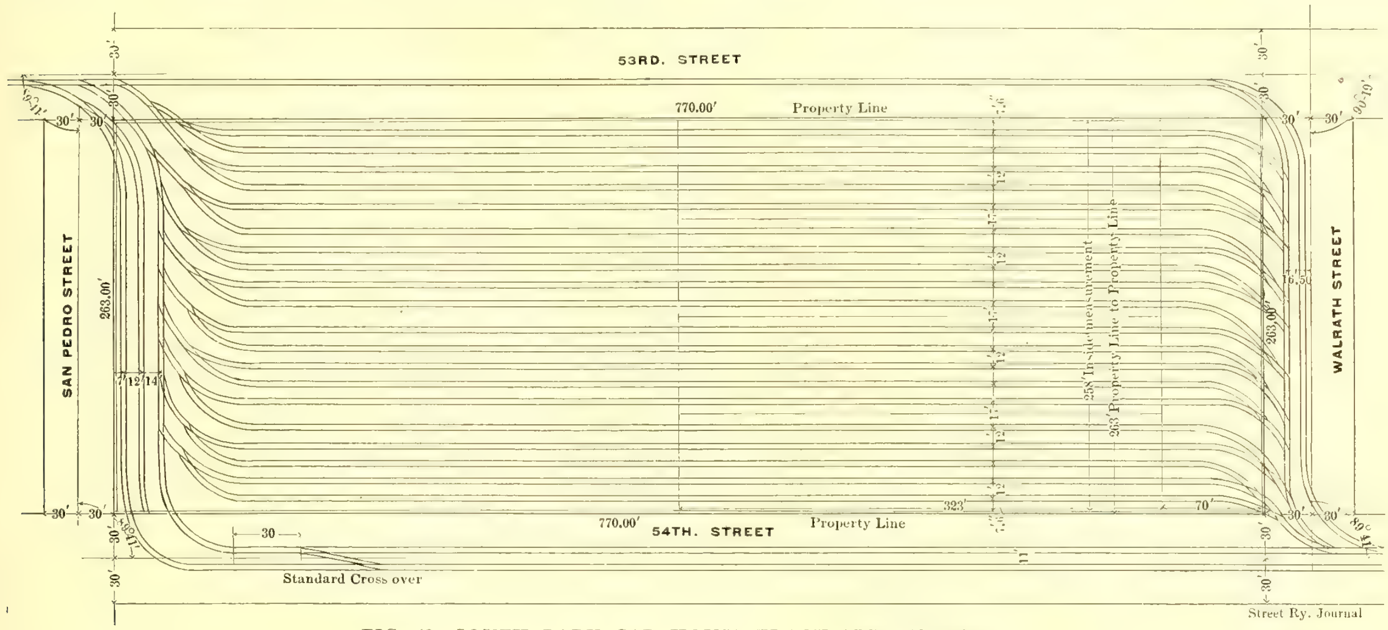


FIG. 13.—SOUTH PARK CAR HOUSE TRACK ARRANGEMENT

to thirty-eight. These cars are 8 ft. wide and weigh 25,000 lbs. They are equipped with No. 49 Westinghouse motors.

Several important improvements in the line of standardizing the rolling stock of the Los Angeles Railway Company have recently been effected under the direction of the master car builder, E. L. Stephens. One of these was the reducing of the number of car axles from nineteen varieties to two types,

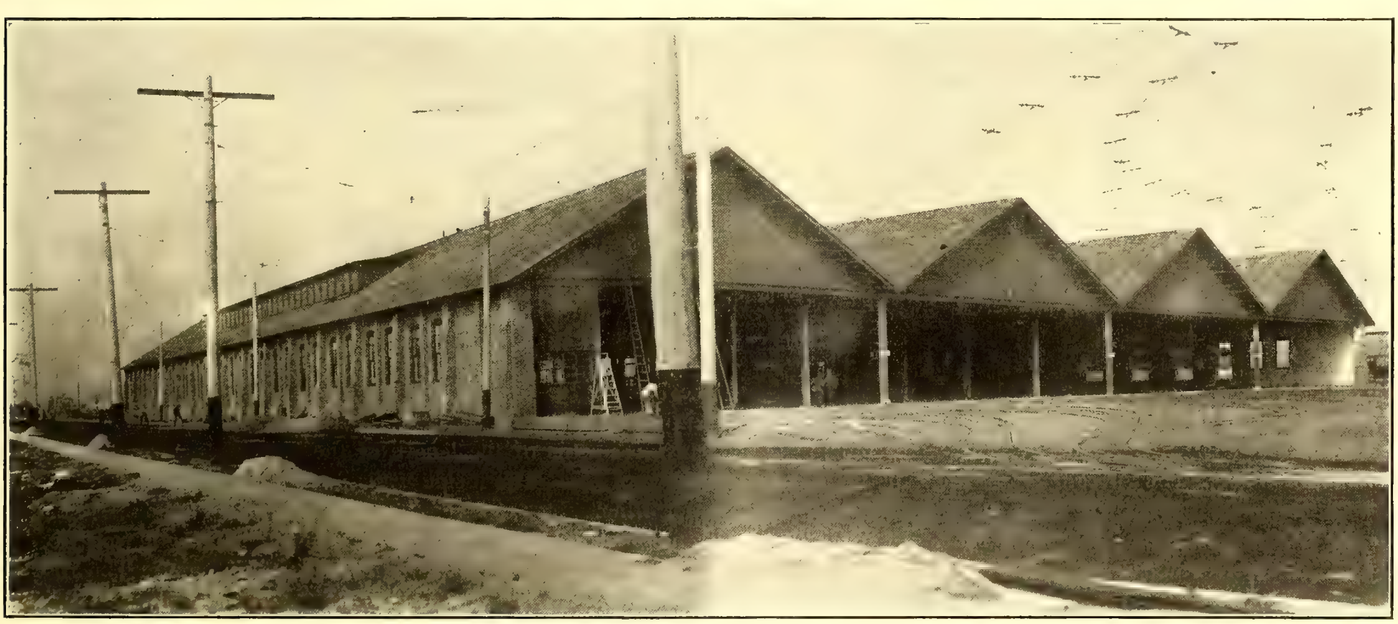


FIG. 12.—SOUTH PARK CAR HOUSE

one of these being the standard 4-in. axle, with $3\frac{1}{2}$ in. x 7 in. journals. The motor equipment has also been standardized, so that instead of six types, but four are now used, and the majority of them are of the 38-B type. All destination sash for the end transoms have been reduced to one standard size, so that the sash fit all cars on the system. Other improvements have been carried on in the way of standardizing the fixtures, windows, and in fact, every part of the car that can be reduced to a standard.

As a means of maintaining a detailed record of every car, Mr. Stephens keeps a file of descriptions of car equipment made out for each car on the blank form shown in Fig. 8. This gives a complete description of the entire equipment, and space is left at the bottom for note of special appliances and remarks concerning repairs. Every time a car goes through the shop, is repaired, or has its equipment changed, record is made on a new blank, so that the description is kept up to date.

For ready reference for the master car builder, a record of the car is kept in a wall-rack. A small card, about 1 in. x 2 ins., is made out for each car, containing its number, the class of brake equipment and the date when the car was last varnished or painted. At one side of the rack are placed the cards of the cars in the shop, and when they are placed in service new cards are made out and placed in their proper numerical position in the main portion of the rack. Similar car records made up of blue-printed designation blocks are maintained in the offices of the general manager and superintendent, these being described in the STREET RAILWAY JOURNAL of Dec. 5, 1903.

EMERGENCY CARS

The company has recently fitted up an old car for emergency

work in case of accidents. It possesses several useful features. The car, which is illustrated in Fig. 9, is 26 ft. 2 ins. long and 7 ft. wide, and is mounted on Los Angeles Railway trucks, with a quadruple equipment of 12-A motors. It is provided with an arc headlight and interior incandescents. A special feature of the car is that of the three compartments built in above the floor of the car, with door opening on the outside. These compartments are about 20 ins. high and 4 ft. long, and in them, as shown in Fig. 10, are stored all tools and appliances necessary in blocking up and taking care of a damaged car. In the compartment shown on the left are kept the heavy tools, such as saws, axes, chisels, hammers, jacks, etc. In the middle part is a dolly-truck, for use in case of racked gear, block and tackle, chains, etc. The third compartment contains timbers and blocking materials. The compartments have doors on both sides of the car, and are lighted by incandescent lamps, so that at night the materials may be quickly found. Within the car, as shown in Fig. 11, are a reel of 500 ft. of 1¼ in. hemp ropes and tackles for use in moving broken wagons off the track, etc. An oil box with zinc lining is provided for the lanterns and oil cans. Separate cases contain the tools of the day and night crews. The air compressor and tank are located on the compartment floor, there being no room for them beneath the car on account of the short body. The vestibules of the car are inclosed, so the men are protected from the weather. Doors are provided in the front and rear vestibule panels, so poles or large timbers can be loaded on to the car. This car has proved a very useful addition to the wrecking equipment of the company, the outside doors of the compartment being especially valuable, as they allow the minimum amount of handling of the heavy dolly truck and tools. The car is thoroughly gone over and cleaned every day, and is kept in constant readiness for service.

CAR HOUSES

The system of the Los Angeles Railway Company has had a good steady growth during the last few years, and for operating purposes it became necessary to make it into two divisions. The headquarters of division No. 1 is at Sixth Street and Central Avenue, where are located the power house and three car houses, the repair work also being done there at present. The offices of the superintendent and chief dispatcher are temporarily situated at this point, but will be removed to the new Pacific Electric terminal station at Sixth and Main Streets upon its completion.

For division No. 2, a large car house has just been erected on a tract of land in South Park, near the southern limits of the city. (See map, Fig. 1.) This car house, illustrated in Fig. 12, has a total width of 264 ft., and a total length of 323 ft. The inside dimensions are 257 ft. x 320 ft. The building is divided into four longitudinal bays, each having five tracks, the twenty tracks giving 6400 feet of trackage within the building. Room is thus provided for 160 40-ft. cars. The building is open at both ends, and has brick side walls with heavy pilasters every 20 ft., alternating with light pilasters, between which windows are placed. A wood and iron Fink truss roof, constructed with no purlins and no rafters, covers the building, 2-in. tongued roof-planks being spiked directly onto the trusses. Alternate louvre windows and ventilators run three-fifths of the length of the building on each side of each roof bay. The inside walls are sprayed with white magnite, which forms a hard and fire-resisting surface. The iron is painted with black asphaltum paint, and all work exposed to the weather with Princess' metallic paint. The roof is covered with P. & B. burlap roofing. A solid pit with 6-in. concrete floor, 4 ft. 6 ins. below the tracks, extends under the whole car house. The car house floor sits on posts without bracing, every post being secured to the concrete floor by an iron dowel pin. This construction allows free access to any part of the pit. All wood used in the building is of Oregon pine.

Access to the car house is had from the east end, and connection will later be made at the west end. Fig. 13 shows the arrangement of tracks in the barn and at both ends, while Fig. 14 is a detailed drawing of the switches at the west end. The company owns a block to the west of the car house, so that an extension could be made to the present building, thus

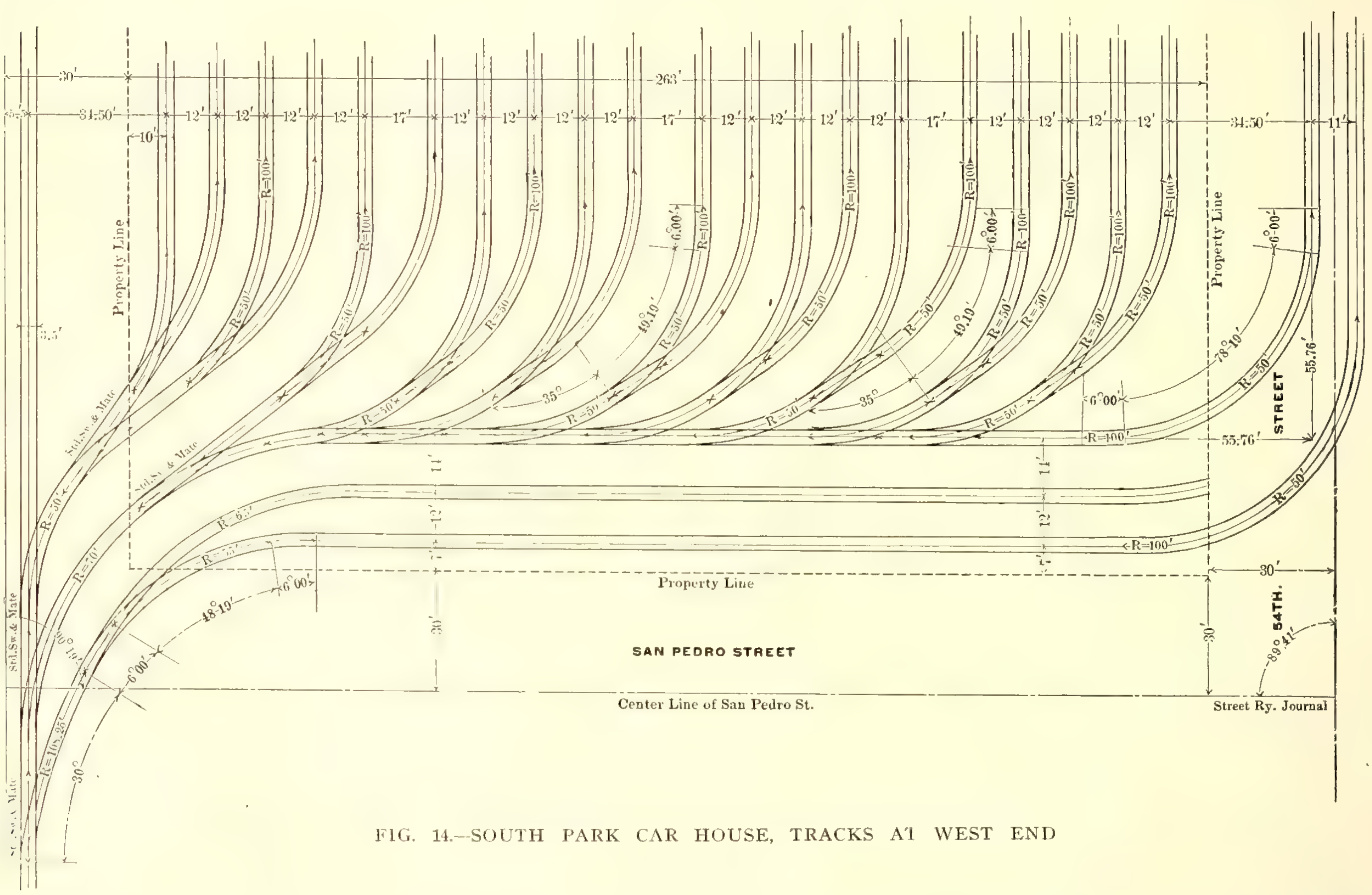


FIG. 14.—SOUTH PARK CAR HOUSE, TRACKS AT WEST END

doubling the car storage capacity. The lines that will connect with this car house are the Vernon, Griffith, Maple, San Pedro, Main, Grand and University lines.

In erecting the special overhead work at the east end of the car house, instead of the ordinary goose-neck hanger, a straight iron bar about 8 ins. long was used, the insulator being bolted to the bar. This construction is less apt to be damaged when trolley poles come off. It may be noticed in Fig. 12, and also in Fig. 16, which is a view of the special overhead and track work at the east end of the car house.

NEW SHOPS

The company has been hampered for some time for lack of proper shop facilities. After the large Pacific Electric shops described in the Street Railway Journal of March 19, 1904, were completed, practically all of the repair work was done there. Lately, however, those shops have been crowded, and such work as painting, armature repairs and the lighter machine work has been done in the old shops of the Los Angeles Railway Company, at Sixth Street and Central Avenue. Now it has become necessary to have better shop facilities, and plans have been drawn by the engineer of buildings for a group of three shop buildings, which will be nearly as large as those of the Pacific Electric Railway Company. They will be located on the block east of the car house just described. One building, 300 ft. long, 88 ft. wide and 22 ft. high in the clear, will be used as a car repair shop, with an armature-winding room 70 ft. wide, partitioned off one end. Parallel with the shop and 75 ft. from it will be a building 366 ft. long and 88 ft. wide, in which will be located the offices of division No. 2 and of the shops, a storeroom and paint shop. Beyond these two buildings will be the third, built in the shape of a block letter C, 263 ft. across, and containing the carpenter, blacksmith and machine shops. In the 75-ft space between the two long buildings and between the wings of the end building will operate a 50-ft transfer table. The group of shops will have a total length of 587 ft.

Contracts have already been let for the erection of the first building, and this will be used for general repair work until such time as it seems necessary to complete the others.

FIG. 16.—EAST END OF CAR HOUSE, SHOWING SPECIAL TRACK AND OVERHEAD WORK

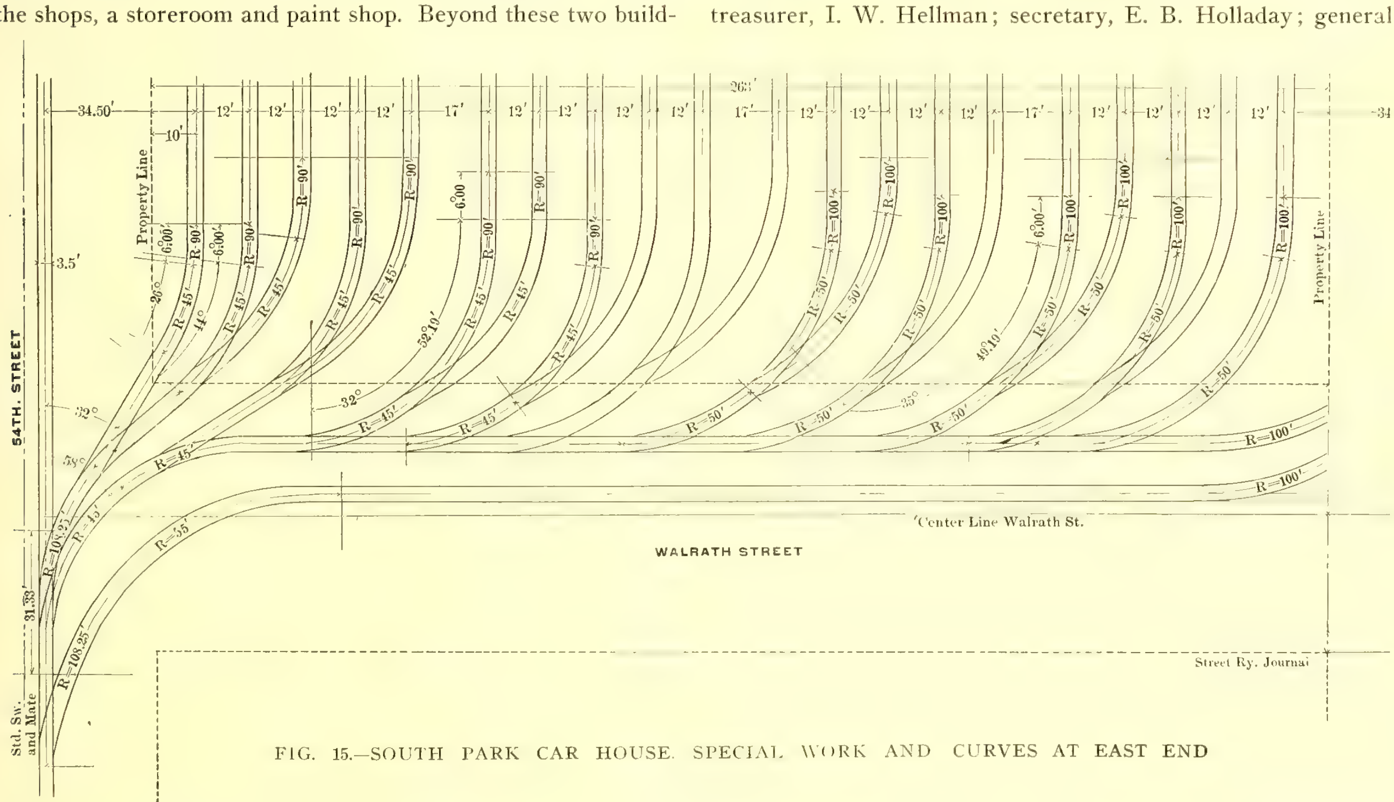


FIG. 15.—SOUTH PARK CAR HOUSE. SPECIAL WORK AND CURVES AT EAST END

ORGANIZATION

The organization of the Los Angeles Railway Company is somewhat different from other companies of its size, so a study of the accompanying organization tree, Fig. 17, will be of interest. The officers of the company are as follows: President, Henry E. Huntington; vice-president, Ch. de Guigne; treasurer, I. W. Hellman; secretary, E. B. Holladay; general manager, Howard E. Huntington; auditor, C. A. Henderson; superintendent, John J. Atkin; chief engineer, G. J. Kuhrts; chief electrician, J. L. Clarke; master car builder, E. L. Stephens; consulting electrical engineer, R. S. Masson; superintendent of line construction, C. O. Anderson; engineer of buildings, E. S. Cobb.

In a subsequent issue an account will be given of the different features entering into the operation of the Los Angeles Railway Company's system. This will include a statement of the methods employed and reproductions of the forms used in engaging motormen and conductors, tests by the company's surgeon for physical fitness, manner of securing employees'

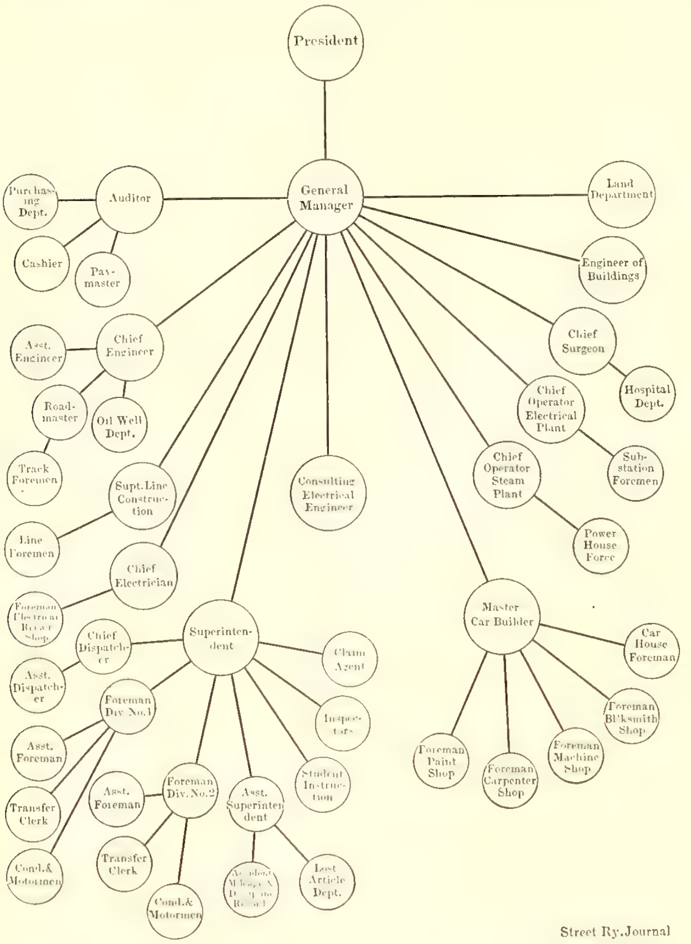


FIG. 17.—ORGANIZATION CHART OF LOS ANGELES RAILWAY COMPANY

references and bonding, details of the practical instruction in car operation given to both motormen and conductors, permanent rules and regulations governing the duties of motormen and conductors and temporary rules regarding such subjects as transfers and rights of way, merit system, wage rates, monthly hospital fees, accident insurance, dispatching methods, mileage reports, claim department methods, and other important details.

CORRESPONDENCE

A SINGLE-PHASE RAILWAY MOTOR

Boston, Mass., March 31, 1904.

EDITORS STREET RAILWAY JOURNAL:

I have read with much interest the additional information given in your last issue concerning the Westinghouse alternating railway motor. I have already gone upon record as a believer in the future of the alternating motor for railway purposes, and I am gratified to learn of the practical steps which are being taken in its development. I am sorry to learn, however, that the present crop of apparatus is being planned for so low a trolley voltage as 1000 volts. It is, of course, true that such a step simplifies the overhead work, but on the other hand, it is not providing high enough voltage of distribution to bring out fully the characteristic advantages of the alternating system. Even as warm a friend of alternating motor systems as I must admit, to be candid, that they have some disadvantages. On the plans of action now under way the value of the rail return is seriously impaired by the use of alternating current even of the low frequency proposed, and the power factor of the system being only moderately good, there is an abnormal demand for current in proportion to the energy delivered and a certainty of exaggerated drop in the working conductors unless the voltage is pushed up. Between added drop in the overhead wires and the corresponding increase in track resistance, the alternating system must show a good margin of gain in the change for higher voltage on the working conductors in order to make a good economic showing. Undoubtedly the gain in raising the trolley wire pressure from 600 volts to 1000 volts is more than enough to square the game, but whether it is enough to render the game thoroughly attractive is quite another matter.

In the interurban work, where alternating motors are most acutely needed, the working voltage might just as well be pushed up to a point where it would count for more, and the manufacturers are sure to encounter prompt demand for higher voltage which they will be obliged to meet. It might as well be faced first as last.

In the matter of power factor, I regret to see any attempt to raise a cloud of dust in the manner tried by your correspondent. It is decidedly infra dig. on the part of an engineer who evidently understands the real facts, and, moreover, it does no good. A low power factor is per se a bad thing, which may be more or less mitigated by other conditions, but should be taken for what it is—a not unreasonable price for certain very considerable advantages. I am well aware that an increase in power factor may result from increased energy losses, and, in fact, I have an interesting remembrance of a pair of 1-hp induction motors which I once designed and which may serve to illustrate the point. One of them got, quite by accident, some abnormally bad iron, and showed a power factor of .94, if I remember correctly, but a real efficiency of about .72. Its mate had an efficiency of .79, and a power factor of about .80. But it does not follow that a motor of low power factor will be highly efficient. In the case of alternating railway motors, as in other motors, the power factor may be bad for a variety of causes, and the motor of bad power factor may or may not have compensating good qualities. But nothing is gained by attempting to dodge the real issue and by descanting on the possible or hypothetical virtues of motors of low power factor. The fact is that sensible people must realize that by working with alternating motors there are certain important gains to be made, and that the loss of a few per cent in real or apparent efficiency of the motor is a small price to pay for these gains. The day has gone by in which it is necessary to apologize for the especial characteristics of the alternating system. The alternating-current railroad system will stand or fall, not by a change of a few per cent in the apparent energy demanded, but by the qualities of the motor as motors, and by the operative results of the system as a whole.

LOUIS BELL.

VERTICAL MOTOR-GENERATOR SETS AT THE LEND-GASTEIN ALUMINUM WORKS

Oerlikon, Bei Zurich, March 16, 1904.

EDITORS STREET RAILWAY JOURNAL:

Dear Sir—In your issue of March 5,, you are so kind as to publish an article descriptive of the vertical motor-generator sets as installed by our firm at Lend-Gastein. Unfortunately an erroneous statement was made in the article on page 377, where you say, "The motors are of the synchronous type." As a matter of fact, they are non-synchronous. Will you kindly correct this in one of your numbers? The motors have their rotor windings short-circuited upon themselves. The starting of the motor is performed by starting the generators, which are, of course, separately excited.

E. HUBER.

THE EVANSVILLE & PRINCETON TRACTION SYSTEM

The Evansville & Princeton Traction Company is one of the latest interurban lines in Indiana, and the first in the southwestern section of the State. It is 28.25 miles in length, and outside of the terminal cities and towns through which it passes is located upon a private right of way, averaging 60 ft. in width.

The population, according to the last census in the towns and townships directly on the route, was 77,141, and in townships tributary, but not directly on the route, 9540, equivalent to about, directly on the route, 1500, making a total population of 78,641.

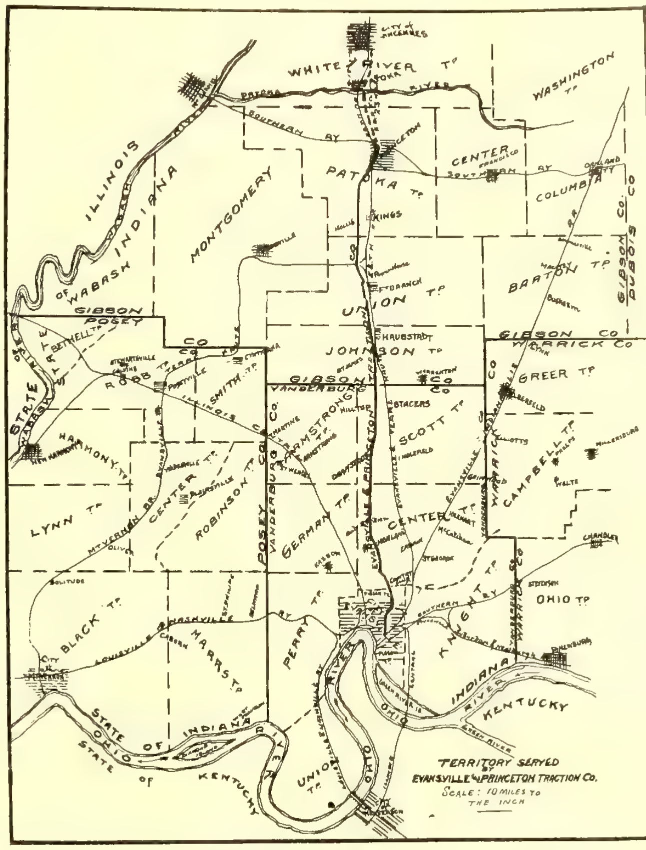
Evansville and Princeton are both growing rapidly, so that 85,000 people would probably be a fair estimate of the tributary population.

ROADBED AND TRACK

The roadbed upon the private right of way is 12 ft. to 16 ft. wide, with slopes on fills of 1½ to 1, and in cuts of 1 to 1. It is wider in the cuts in order to allow for ditching. It is thoroughly drained with open side ditches and cross drains of extra heavy sewer pipe culverts, having concrete bulkheads, large ditches and cattle runs being crossed by timber bridges resting on pile bents. In addition large streams are crossed by either girder or through truss bridges upon concrete abutments. The largest of these is that over Pigeon Creek, shown in one of the illustrations.

The track consists of 70-lb. T-rails, 30-ft. lengths, with 22-in. Weber joints, the joints being staggered. The ties are 6 ins. x 8 ins. x 8 ft., mainly hewn white oak. In Evansville a 7-in. Shanghai rail is used through the paved streets. The car house special work is constructed of 56-ft. T-rails. All spikes are 5½ ins. x 9-16 in. Country sidings have spring frogs and spring switches with long leads. The road crosses the Evansville belt line in Evansville, and a branch of the Evansville & Terre Haute Railroad north of Fort Branch, and the main line at Princeton, the crossings being of the two-rail type.

The road is at present dirt ballasted, but the company has closed a contract for stone ballast with a concern having a quarry on the line of the road, and in consequence of this contract has installed a thoroughly modern stone crushing plant. All the cross-roads and farm crossings are of plank, placed according to steam railway practice.



MAP SHOWING TERRITORY SERVED BY THE EVANSVILLE & PRINCETON TRACTION COMPANY

4-MILE STRETCH OF STRAIGHT TRACK

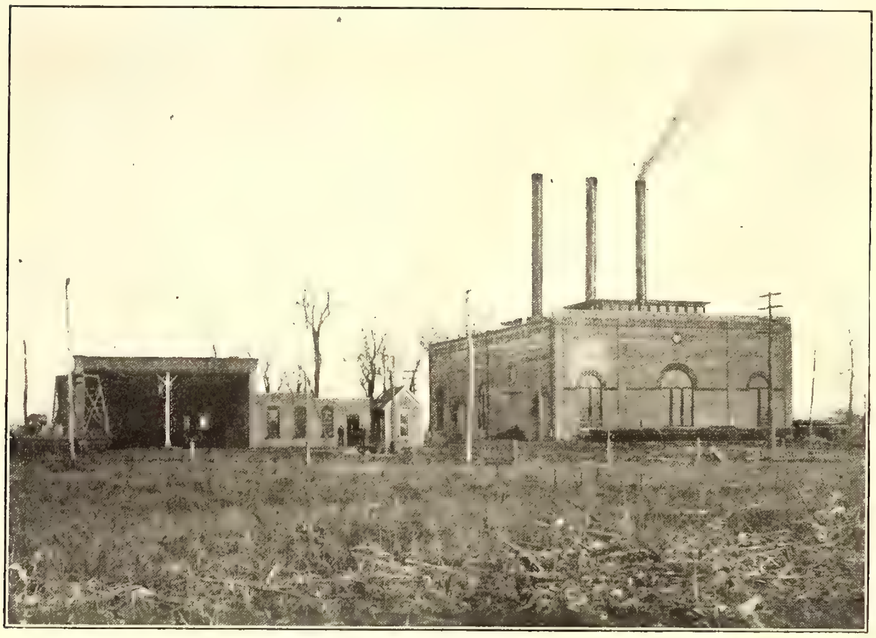
VIEW ON THE EVANSVILLE & PRINCETON ELECTRIC RAILWAY

The track is bonded under the joints with No. 000 concealed copper bonds, furnished by the Ohio Brass Company.

LINE CONSTRUCTION

Bracket construction is used in the country, span wire construction in the cities and towns. The trolley wire consists of one No. 00 round wire and feeder of No. 0000 W. P. insulated copper, and the high tension of No. 2 copper. The telephone

line is strung upon the same cross-arm as the feeder wire, except along the high-tension line, where it is placed upon oak brackets. Stromberg-Carlson telephones are placed at various points along the line. All overhead material was furnished by the Ohio Brass Company.



GENERAL VIEW OF POWER STATION

POWER HOUSE

The power house, a brick structure, 75 ft. x 104 ft., is located at Fort Branch, adjacent to a creek, where an artificial lake was built for condensing water.

The main units consist of two 400-kw, 360-volt, three-phase alternating current revolving field-type Westinghouse generators, direct connected to two 18-in. x 36-in. x 42-in. Lane & Bodley cross-compound condensing Corliss engines, running at 100 r. p. m. The condensers consist of two 12-in. and 15-in. x 10-in. Worthington jet condensers. The exciting units, which also light the buildings, consist of two 30-kw, 125-volt, 350 r. p. m. Westinghouse exciters, direct connected to two 7¾ in. x 12-in. Buckeye engines.

In the boiler room there are three 300-hp Stirling boilers, with 48-in. x 80-ft. independent stacks. The pop valves are set for 150-lbs. pressure. In the boiler room there are also two 9-in. x 5¼-in. x 10-in. Laidlaw-Dunn-Gordon piston-type feed pumps, and two Wainwright closed feed-water heaters. The exhaust from the condensers and the feed pumps is arranged to pass through the heaters, the exhaust piping and the feed-water piping being by-passed, so that either or both heaters can be used or both can be cut out. All high-pressure piping is extra heavy, long sweep bends being used to allow for expansion. The steam pipe is covered by Johns-Manville asbestos covering.

In the engine room is one 300-kw Westinghouse rotary converter, also three 125-kw, 400-11,000-volt static transformers, with Westinghouse low-equivalent type of lightning arresters and fuse circuit breakers. The switchboard consists of blue Vermont marble panels with the latest type of Westinghouse switches, circuit breakers, ammeters and voltmeters. Synchronizing lamps are used for throwing in the machines. All high-voltage wire is bare copper, mounted on high-tension line insulators. All wire from the generators, exciters and transformers to the switchboard is lead covered.

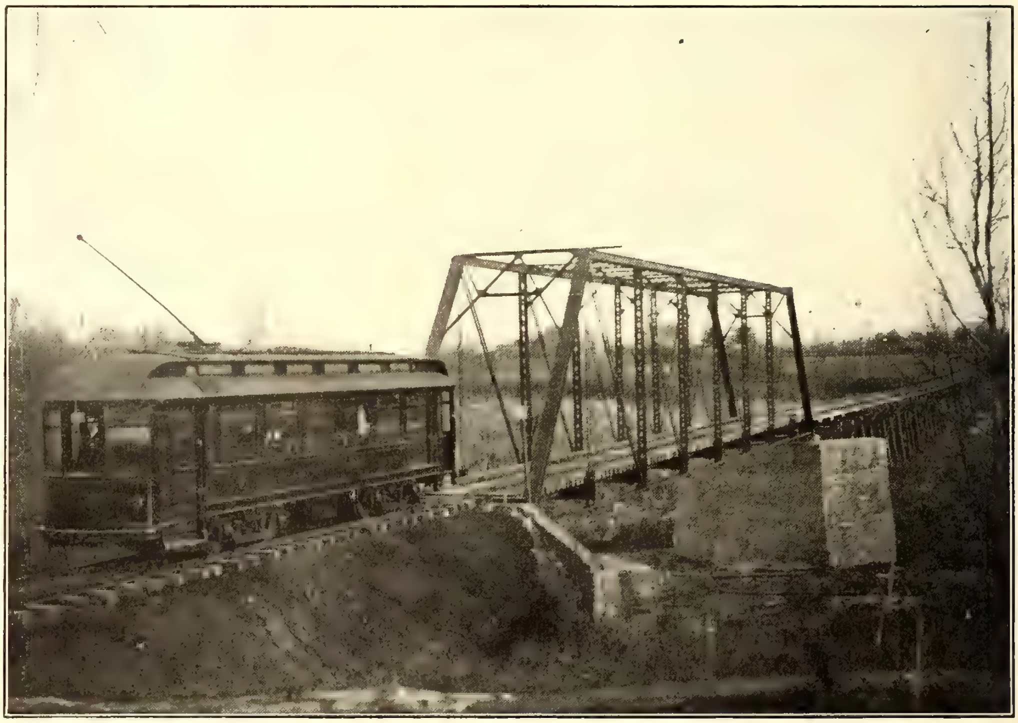
The sub-station and waiting room near Evansville is a brick structure, with tar and gravel floor and concrete floor. The apparatus here is the same in make, size, etc., as that in the power house sub-station.

The car house, 47 ft. x 110 ft., and repair shop, 20 ft. x 50 ft., is also located at Fort Branch, adjacent to the power house and park. It is of brick, with tar and gravel roof, and is to be equipped with 7½-hp motor, emery wheel, shaper, medium sized lathe, drill press, wheel press, grindstone, forge and necessary small tools for a modern repair shop.

There is a small office building for the superintendent adjacent to the car house.

ROLLING STOCK

The rolling stock consists of five interurban passenger cars, one double-truck work car and six single-truck flat cars. One double-truck freight and express car has been ordered. The passenger cars are single end, semi-convertible, combination baggage and passenger, with vestibule. They are 42 ft. 3 ins. over all, and were built by the St. Louis Car Company. The side and end sills are constructed of two 8-in. channels, arranged to allow the window sash to drop between same.



TRESTLE AND BRIDGE ON EVANSVILLE & PRINCETON TRACTION LINE

The cars are mounted on the St. Louis Car Company's M. C. B. type of trucks, and are each equipped with four Westinghouse No. 56 motors, and Westinghouse independent air brakes. They are heated by Peter Smith hot-water heaters, the stove being placed in the motorman's vestibule, and have Ohmer registers, Knutson retrievers and arc headlights. The seats are of the St. Louis "Walkover" type. The cars have a saloon just back

of the baggage partition, with dry hopper and water cooler. The interior finish is mahogany. A view of this car was published in the Street Railway Journal for Dec. 5, 1903.

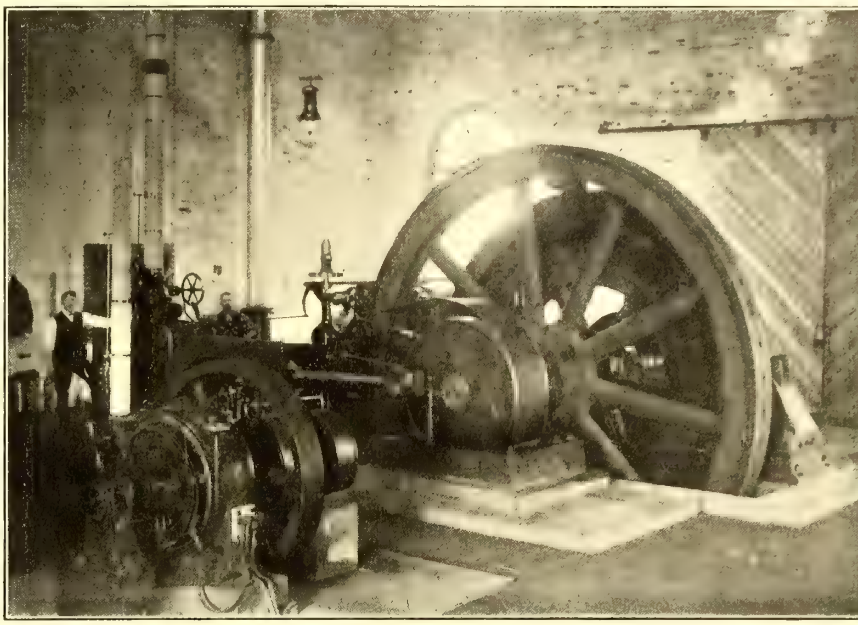
The work car also has a quadruple No. 56 motor equipment. In addition to the above the company also has two hand cars and one velocipede for track and overhead repairs.

CAPITALIZATION, EARNINGS, ETC.

The company has a capital stock (all common) of $600,000, and a bonded indebtedness of $400,000, or $14,000 per mile.

The line was put in operation in the middle of December, was financed by Denison, Prior & Company, of Cleveland, Ohio, 1903, and during the month of January, 1903, the average daily receipts were about $200.

The rate of fare depends upon the distance traveled. The line is divided into 5-cent zones, and the through fare is 45 cents. The company also sells 500-mile and 1000-mile mileage books at the rate of 1¼ cents per mile, school tickets and party tickets, making special party rates. The express and parcel freight business has not yet been fully developed, as the company has not received its express car. This business, however, even under the present conditions, has increased to such an extent as to make it difficult with the combination passenger cars to maintain the schedule The cars run under an hourly schedule. The officers of the company are: Joseph E. Heston, Princeton, president; Samuel T. Heston, treasurer; E. J. Baldwin, Princeton, secretary; W. L. Sonntag, Evansville, general manager; H. E. Burchfield, general superintendent; H. G. Walker, chief engineer. The consulting engineers of the line were E. P. Roberts & Company, of Cleveland.



INTERIOR OF POWER STATION

It is to be feared that too little attention is being paid by managers generally to the standard rules for electric railway operation adopted by the American Street Railway Association. It is hardly necessary to say that it is useless to get together and formulate such rules if the various companies do not adopt them. While, of course, technically, there is no obligation on the part of the various members of the American Street Railway Association to adopt standard rules recommended by that body, every company owes to itself, and to the electric railway business in general, to come as near the uniform standard as possible. That the matter has not received more attention since the last convention, we believe to be due mainly to the fact that it is one of those matters that can be put off until a more convenient time, and so gets delayed from month to month, with no action taken. It is, of course, a serious matter to revise all the rules of a road to conform to the rules recommended, but if it is to be done at all the sooner it is done the better.

PLATE GIRDER BRIDGE

WORK AND EMERGENCY CAR ON ON THE BOSTON ELEVATED

The Boston Elevated Railway Company has for construction and emergency service on its elevated division a car which is probably the most complete in the country. It is about 40 ft. over all, and is of the gondola type, with a closed compartment at one end. The flat end is for carrying special work, timber, etc., and is provided with a pneumatic jib crane for lifting heavy apparatus to and from the platform. On the open end of the car is a large number of pieces of timber of all sizes.

The inside of the closed end of the work car is divided into three or four compartments. The following are a few of the construction and emergency apparatus carried: Chains of all sizes, each one distinctly marked with its size and length, such as ½ in.—15 ft. long; ¾ in.—12 ft. long; troughs for laying over the third rail in the subway or on the elevated structure, so that workmen will not come into accidental contact with it; lumber of various sizes; ropes and tackle of various sizes; all kinds of bars and lanterns; a complete assortment of jacks, including two 30-ton lifting car jacks, six 15-ton Norton jacks, two 10-ton journal jacks, two 8-ton journal jacks, five bridge jacks, two Pearson pulling jacks and two Pearson derailing jacks; a number of portable work boxes filled with tools ready to be taken by the workmen on to the structure or along the subway; two Bell re-railing frogs, and quite a complete assortment of medical supplies, including arnica, medicated cotton and linen for bandages, applications for burns, etc. The work car has also a trail car, which can be used if required, and which is equipped with a 15-ton crane 15 ft. long.

THE ORGANIZATION OF THE OHIO INTERURBAN RAILWAY ASSOCIATION

On Thursday, March 31, a number of interurban electric railway managers met at the Algonquin Hotel, in Dayton, according to a plan which has already been outlined in this paper, to organize the Ohio Interurban Railway Association, a body which promises to occupy an important position in the future development of electric railways of Ohio. The remarkable progress made by electric railway builders in Ohio during the past few years is too well known to require description. Suffice it to say that the development has been carried on with such feverish energy that each promotor has practically ignored his neighbor, and has given no attention to the possibilities of co-operation. Lately, however, there has come a period where operation rather than construction has become the keynote for many of the prime movers in this development, and the desirability of an exchange of opinions and ideas has become apparent.

As outlined several weeks ago in these columns, the initial movement was made at Dayton several weeks ago, although at that time the chief object in view was an agreement for interchangeable mileage for all the interurban lines radiating from Dayton. Several of the bright minds in the movement pointed out the desirability of extending the scheme to all the roads of Ohio and Eastern Indiana, and of the formation of a new State association, which would be to Ohio what the New York and Pennsylvania State associations are to their respective States. An organization was accordingly effected, and the first meeting was called for the time and place mentioned.

While the Dayton meeting was devoted primarily to the discussion of the interchangeable transportation plan, the extent of the attendence and the interest manifest in the above and other topics touched on, indicates that a strong and efficient organization will result. Over sixty railway men, representing about thirty companies, were present at the session and joined the organization.

It was decided to profit by the experience of other associations of this character, and to make the business features predominate, rather than the social features. For the time being, at least, meetings will be held once a month, alternating at the various centers of the State, in order that interest may be awakened throughout the district, and it was decided that only one subject shall be presented and discussed at a time. Each session will occupy a portion of one day, and the subject at hand will be thoroughly thrashed out, and, if possible, some action will be taken at the time. As far as possible, it will be the aim to systematize and standardize methods of construction, maintenance and operation. It was pointed out that the possibilities for co-operation for mutual benefit were almost unlimited. The opportunities for connecting up lines and operating through fast cars from center to center, the desirability of uniformity in freight and express rates and classifications and the interchange of business, the desirability of standard operating rules, and the chances for co-operation in legislation, were among the topics suggested for future discussion and adoption, and these and similar subjects will be taken up at meetings in the future.

The Dayton meeting resulted in the adoption by the majority of the companies represented, of an interchangeable ticket book which will be accepted for transportation over all the roads in the agreement, and if the new Ohio Interurban Railway Association never effects another tangible agreement, there is little doubt that it will have accomplished something that will tend to stimulate and increase the business of all concerned. The subject was thoroughly discussed in all its phases, and the form of coupon book which was finally adopted, was the result of the combined experiences of interurban managers from all over the district. The best evidence of this was the fact that while the original committee, composed largely of men from the immediate vicinity of Dayton, presented a sample form of coupon book, which they believed was thoroughly acceptable, the discussions in the open meeting resulted in the adoption of a book which differed in nearly every clause from the original book, and that too without a dissenting vote in any case.

It was the concensus of opinion that the interchangeable book would result in the securing of business from a class that has heretofore largely patronized the steam roads on short hauls as well as long—the commercial traveler. Most traveling men buy the steam road interchangeable mileage, and by reason of having this mileage they take the steam train rather than pay cash to electric roads, despite the fact that the latter give more frequent service and lower rates than the steam roads. With an interchangeable book, good on all the roads in the district, and selling at a reasonable price, it is figured that much of this class of business can be secured by the electrics. The new book will be particularly advantageous for representatives of jobbing houses that cover all the small towns within a limited radius of such centers as Cleveland, Toledo, Cincinnati, Dayton and Columbus. Heretofore it has been impractical for such houses to take advantage of the reduced rates on electric roads because they could not afford to buy mileage books on all the roads in their district, but with an interchangeable book the advantages will be obvious. It is not the intention to have the interchangeable book supplant the various forms of commuters' books sold by the various lines, and these will be sold as heretofore to the regular patrons whose requirements they have answered.

The meeting was called to order at 2:25 p. m., by President Harry P. Clegg, who delivered the following address of welcome:

Gentlemen: It gives me great pleasure to greet you here to-day on the occasion of the launching of the Ohio Interurban Railway Association. That this craft is assured a long, successful and useful career upon the seas of utility is of a certainty forecast by the many favorable auguries attendant upon this ceremony. The excuse for our existence, the reasons for our being, are best answered by calling to your attention the spontaneity with which we sprang into existence.

Upon the first occasion of the gathering together at Dayton of any considerable number of men engaged in interurban work, and with the idea of arriving at uniformity in the minor matter of an interchangeable mileage book, the many other subjects that would facilitate operation, and that could be advantageously handled and agreed upon, became so apparent to the representatives of the various properties gathered here that it needed only the suggestion of Mr. E. C. Spring to crystalize this organization then and there into existence. We simply came into being by reason of the necessity existing for such an organization, and we lay no claim to originality, either in the inception of the idea or to our plans for carrying out the same.

Our ground work may have its faults, but we have endeavored to steer clear of them by providing that our deliberations should be as untrammeled by red tape as it was possible to have them, and at the same time provide sufficient regulation to be business-like.

Our constitution recites that the objects of this association shall be to promote knowledge upon all matters relative to the construction, operation and management of interurban railways and their equipment, to promote the interchange of traffic, and to encourage social relations amongst its members. It is intended to embrace all matters that it would be of interest and advantage to us to consider, and provision has been made for amplifying the purposes of this organization if it is deemed advisable.

We are inviting you here to-day to join us in sharing its advantages, in increasing its influence and in broadening its scope.

How many times have we all heard from our patrons these suggestions, with variations: "You traction men ought to get together and arrange this and determine that or standardize the other." We all knew that it would be greatly to our benefit to do these things, but the majority of us have been so engrossed with details pertaining to construction, our properties being

very largely of recent development, or we have been so occupied with other and more pressing matters that, although we recognized the need of this organization, we permitted the formation of it to be deferred.

Let us, however, endeavor to counterbalance the tardiness with which this step has been taken with such prompt, active and effective work that the fruits of our efforts will make us wonder how we managed to accomplish anything in the past without the assistance and advantages of this organization.

We are here to-day for the purpose of furthering our mutual interests and safeguarding the traveling public's interest by getting together and acting together in all matters which it will be of mutual interest for us to consider; and that this will of necessity tax us for the exercise of our broadest and most indulgent views upon the matters presented is an all apparent fact.

I wish, therefore, that this indulgence first be exercised in considering the Ohio Interurban Railway Association, its officers, its aims and its ideals.

It must not be regarded as the exponent of any single interest, or any set of interests, but ever be the champion of and reflect the express wishes and desires of the whole body; that its deliberations should be conducted with the utmost fairness is, therefore, essential. We gladly extend to the supply men the full privileges and opportunities of our organization, knowing well that there will be no unseemly advantage taken by reason of it.

The dignity and lofty purposes that should be the attributes of that business, which, as was said at the last convention of the American Street Railway Association, has more to do with and more intimately concerns the private life, the private necessities and the private conveniences of the citizens than any other business, should prevail.

Let us not lose sight of that fact, and let it be the anchor that will prevent our drifting into frivolity, for a wasting of time that will lead to vain regrets.

President Clegg stated that he had the resignation of Mr. Boyer, one of the members of the executive committee, and that there would, therefore, be a vacancy to fill. Mr. Spring moved that the secretary be instructed to cast the ballot for F. J. J. Sloat, of the Cincinnati, Dayton & Toledo Traction Company, to fill the vacancy. This motion was seconded, put to vote and carried.

The president then called upon Mr. Merrill, chairman of the committee on Interchangeable Mileage, for his report.

Mr. Merrill read the report of the committee, and reported that up to date twelve companies had signified their willingness to become parties to the agreement. It was decided to consider the agreement clause by clause. Mr. Merrill stated that the book cover was to read as follows:

Form No....... Book No.......

Interchangeable Coupon Ticket.

Sold by..........................Railway.

Good between all stations on the interurban electric lines mentioned below.

Good only for the individual use of persons whose signature appears on contract and when officially stamped by selling agent and subject to all the conditions named in contract. Signature to contract must be made in ink.

Care should be taken to keep the coupon strips in their original folds within the cover for the convenience of the conductor in tearing coupons. Read all conditions and notices hereon.

Days of the month, name of the month and year to be printed on margin providing for two-year limit.

Mr. Adams, of the Toledo, Fostoria & Findlay Railway Company, suggested the addition to the words "good between all stations" on the interurban lines mentioned on the face of the cover of the words "or hereafter added."

Mr. Merrill stated that this clause appeared in another place in the book, but thought the suggestion a good one to have on the face of the cover "or which may hereafter be bulletined."

Mr. Adams then asked whether the book could be used by more than one person. In the discussion on this point Mr. Fravel, of the Dayton & Western Traction Company, said that the companies could readily add to the number of persons who may use a book, but to start out he thought they should feel their way cautiously.

Mr. Spring, of the Dayton, Covington & Piqua Traction Company, said that one member of the committee had reported to him that on several roads out of Dayton the abuse of mileage good for more than the individual has been very extensive. For instance, one man going over the road met a half-dozen drummers and took them along on his mileage book, the road getting only the reduced rate, whereas it would otherwise have reaped the benefit of the individual rate of fare. This is but one objection to the unlimited number entitled to the use of mileage books.

Mr. DeWeese, of the Dayton & Northern Traction Company, Mr. Lang, of the Dayton & Western Traction Company, Mr. Sloat, of the Cincinnati, Dayton & Toledo Traction Company, and others, also expressed their opinion that the interchangeable book should be made good for one person only.

Mr. Stebbins, of the Appleyard system, said of the references to the book being a mileage book were erroneous. The book contains five-cent coupons instead of mileage coupons, and Mr. Stebbins said this was a great advantage, as in this way each road can charge its own mileage rate, one road charging one rate, another another rate. He also discussed the question of the number of coupons to be contained in the book, and the discount to be allowed by its purchase over the local fare.

After considerable discussion it was voted that the book should be good for one individual only.

Mr. Merrill stated that the next provision on cover of book provided for a two-year limit. After some discussion on this point, Mr. Anderson, of the Dayton & Xenia Transit Company moved that the limit of the book be one year. The motion was seconded, put to vote and carried. It was then decided to incorporate in the book $12.00 worth of coupons and sell it for $10.00.

Mr. Merrill then read the wording of the agent's stub as follows:

AGENT'S STUB

To be filled out and detached by selling agent and forwarded to the auditor's office with his daily report.

Interchangeable Coupon Ticket.

$12.00 for $10.00.

Good only for use of

....

Sold at .... Station.

.... 190...

This book expires........................, 190...

There was a discussion on the elimination of the word "daily" from the words "with his daily report." It was argued in favor of doing so that on some roads the agent makes returns monthly, and this plan would permit each road to continue its present practice. It was decided to omit the word "daily."

Mr. Merrill then read the audit check, which was adopted as read.

Mr. Merrill then read Clause 1 of the contract, as follows: "This cover, when accompanied with coupon strip, all of which must be attached to cover in consecutive order, entitles the purchaser whose name appears as signature to this contract, to transportation over any of the electric railways herein mentioned and will be hereafter bulletined, providing the signature on back of coupon, made in the presence of the conductor, agrees with signature affixed to contract."

Mr. Lang called attention to the importance of providing that the coupon strip should also bear the same serial number as the cover, so that a passenger could not substitute some other strip in his cover.

Mr. Gunn, of the Appleyard system, stated that the interchangeable Central Traffic Association book contains this contract: "The cover of this mileage is of no value except as part of the strip bearing the same serial number."

Mr. Anderson, of the Dayton & Xenia Transit Company,

moved that the wording be changed to read: "This cover, when accompanied with coupon strip, which must bear the same serial number as the cover to which this strip must be attached in consecutive order, entitles the purchaser, etc." This wording was adopted.

Mr. Merrill then read Clause 2 of the contract, which was adopted as read.

Mr. Merrill then read Clause 3, as follows: "Mutually agreed that if this reduced rate ticket is presented by any other than the original purchaser, or if the conductor demands the surrender of the ticket and payment of full fare, said ticket to be surrendered and application for rebate made on company from whom the original purchase was made. No attempt to be made with the object in view of adjusting differences with the conductor."

There was some discussion as to whether these clauses might not provoke lawsuits in case the signature given to the conductor was not identical with that on the book.

Mr. Lang moved that the wording be changed to read as follows: "It is mutually agreed that if this reduced rate ticket is presented by any other than the original purchaser, or if for any reason the conductor demands the surrender of the ticket and payment of full fare, then said ticket shall be surrender to the conductor, who shall issue his receipt therefor, and application for rebate shall be made to company from which the original purchase was made, but no attempt to adjust differences with the conductor shall be made."

The motion was seconded, put to vote and carried.

Mr. Merrill read Clause 4 of the contract, which was adopted as read.

Mr. Merrill then read Clause 5, as follows: "Conductor will detach sufficient number of coupons to cover local fare on his train.

Mr. Lang moved that the language of Clause 5 be altered to read: "Conductor will detach a sufficient number of coupons at their face value to cover the local cash fare on his train."

The motion was seconded, put to vote and carried.

Mr. Merrill then read Clause 6, as follows: "This ticket admits of checking baggage only in accordance with the rules of the road over which it is being used."

This clause was adopted as originally read.

Mr. Coen, of Lake Shore Electric Railway Company, said that they had recently discussed with their attorneys the subject of damage on account of lost baggage, and the latter had said that posting bulletins in waiting rooms specifying a maximum damage for which the company will be responsible is not sufficient, but that every ticket on which baggage can be checked, must contain a contract, giving the specification. He therefore recommended the addition to Clause 6 of the words "Provided that in case of loss or damage to any baggage checked under the terms of this clause, the liability of the company responsible therefor is hereby agreed to be not in excess of $50."

This motion was seconded, put to vote and carried.

Mr. Merrill then read Clause 7 of the contract.

Mr. Lang moved that the opening of this clause be changed to read: "This ticket is good, etc."

This motion was seconded, put to vote and carried, and the clause as thus amended was adopted.

Mr. Merrill then read Clause 8 of the contract, which was adopted as read.

Mr. Merrill then read Clause 9, which was changed to Clause 10, and, on motion of Mr. Fravel, the following words were added thereto: "I have read all the conditions of the above contract and hereby accept the same. (Contract must be signed in ink.)"

Mr. Lang then moved the adoption of the following as Clause 9: "In selling this interchangeable coupon book over the lines of any company, the selling company acts as agent only, and assumes no responsibility beyond its own line."

The motion was seconded, put to vote and carried.

Mr. Clegg suggested that in view of the other matters before the association, the matter of the notification to conductors, and the arrangement between the various roads as to how the coupons should be handled, be referred to the Transportation Committee to be appointed by the chair, with authority to act.

The motion was seconded, put to vote and carried.

As amended, the book will read as follows:

BOOK COVER

Form No. .... Book No. ....

Interchangeable Coupon Ticket.

Sold by............................ Railway.

Good between all stations on the Interurban Electric Lines mentioned below and hereafter bulletined.

Good only for the individual use of person whose signature appears on contract and when officially stamped by selling agent and subject to all conditions named in contract. Signature to contract must be made in ink.

Care should be taken to keep the coupon strips in their original fold within the cover for the convenience of the conductor in tearing coupons. Read all conditions and notices hereon.

Day of the month, name of the month, and year to be printed on the margin providing for one year limit.

....

AGENT'S STUB

To be filled out and detached by selling agent and forwarded to the Auditor's office with his report.

INTERCHANGEABLE COUPON TICKET

$12.00 for $10.00

Book No. ....

Good only for individual use of

....

Sold at..............................Station.

...................................., 190..

This book expires.................................... 190..

AUDIT CHECK.

Interchangeable Coupon Ticket.

Book No. ....

....

This to be used for signature of purchaser.

Sold at............................Station.

...................................., 190..

Expiration date punched in margin of cover, ...

The conductor will take up this audit check upon first presentation of ticket, and return same to audit office with his other collections.

CONTRACT NO. ....

1. This cover when accompanied with coupon strip which must bear the same serial number as the cover to which this strip must be attached in consecutive order entitles the purchaser whose name appears as signature to this contract to transportation over any of the electric railways herein mentioned, and will be hereafter bulletined, providing signature on back of coupon made in the presence of the conductor agrees with signature affixed to contract.

2. Failure on part of conductor to note discrepancy in signature on coupon does not forfeit selling company's privilege to demand surrender of ticket at its option.

3. It is mutually agreed that if the reduced rate ticket is presented by any other than the original purchaser, or if for any reason the conductor demands the surrender of the ticket and payment of full fare, then said ticket shall be surrendered to the conductor, who shall issue his receipt therefor, and application for rebate shall be made to company from which the original purchase was made, but no attempt to adjust differences with the conductor shall be made.

4. All coupons will be null and void unless attached to cover in same consecutive order as originally purchased and good only when torn by conductor in the presence of the passenger.

5. Conductor will detach a sufficient number of coupons at their face value to cover the local cash fare on his train.

6. This ticket admits of checking baggage only in accordance with the rules of the road over which it is being used, provided that in case of loss or damage to any baggage checked under the terms of this clause the liability of the company responsible therefor is hereby agreed to be not in excess of $50.00.

7. This ticket is good over lines heretofore mentioned for one year from date of purchase. No rebate will be allowed for unused portion of ticket at expiration of time limit as punched on margin.

8. Minimum fare to be collected limited to ten cents.

9. In selling this interchangeable coupon book over the lines of any other company the selling company acts as agent only and assumes no responsibility beyond its own line.

10. I have read all the conditions of the above contract and hereby accept the same. ....

(Contract must be signed in ink.)

The meeting was then opened for general discussions, and several gentlemen were called upon by the chair for suggestions of topics for future consideration.

F. W. Coen, treasurer of the Lake Shore Electric Railway, described the progress his company has made through the recent introduction of limited through cars from Cleveland to Toledo, and dwelt at some length upon the possibilities of such service between other centers. Referring to the article on this subject recently published in the Street Railway Journal, he pointed out the remarkable increase of earnings per car mile shown by the limited cars. He predicted that the expansion of the limited through service idea in connection with the interchangeable coupon books adopted by the association would have the effect of securing for the electric roads much of the business of commercial travelers.

Mr. Wilcoxon, superintendent of the Western Ohio Railway, stated that his company had just perfected an agreement with the Dayton & Troy Electric Railway for the operation of through limited cars between Lima and Dayton. Mention of this arrangement is made in another column of this issue.

Edward C. Spring, superintendent of the Dayton, Covington & Piqua Railway Company, was called upon as the practical founder of the new association to give his ideas as to the best methods of carrying out the aims of the organization. Mr. Spring reviewed briefly the constitution of the association, and advocated frequent meetings to keep up the interest and effect tangible results. He suggested that for the time being, meetings be held every month, to alternate in various centers of the State, and that but one subject be discussed at a time. He stated that the executive committee had decided on this course. He urged that all present make personal appeals to their own companies and to neighboring roads to secure a large membership for the association. He advocated that each road make an effort to have at least one representative present at each meeting, and he stated that the executive committee had decided to select topics for discussion which would be timely and of great interest and value to every operating company in the State.

Theodore Stebbins, director of the Appleyard system, pointed out the good results obtained by the New York and Pennsylvania State associations and the New England Street Railway Club. He advocated that the Ohio organization profit by the experience of others and confine its sessions strictly to business, rather than having extended programs given up in a large measure to frivolities.

EDW. C. SPRING

J. M. Morgan, president of the Cincinnati, Toledo & Detroit Short Line, a proposed road, advocated that one of the first essentials of the association be a committee on legislation, and the united effort of all members to correct some of the obnoxious measures that now hamper the development of interurban properties. He pointed particularly to the action of steam roads in refusing to exchange freight business with electric roads, and cited the case of the Toledo & Western Railway, which is handling standard freight cars by electric locomotive, but whose business, he stated, is being hampered by the inability to interchange cars with the connecting steam roads.

George S. Davis, of the Street Railway Journal, was asked to give some figures relative to the growth and extent of the interurban business in Ohio. His remarks were in brief an outline of the article on Ohio Electric Railways published in the March 12 issue of this paper. Replying to Mr. Morgan's statement that the freight business on interurban roads was being handicapped by the inability to interchange with steam roads, Mr. Davis ventured the opinion that as soon as the electric roads commenced to originate any substantial amount of car load business, there would be no difficulty in inducing the steam roads to interchange. As a matter of fact, while the steam roads claim to have no intercourse with the Toledo & Western, Mr. Davis stated that foreign steam road cars are handled almost every day on this road, and Toledo & Western cars have been sent to all parts of the country. Recently 125 car-loads of a certain article were shipped from a point on the Toledo & Western to an eastern city without change of cars. The electric road has no direct dealings with the steam roads because the cars are handled through Toledo by the Toledo Terminal & Belt Railway, a steam belt line, and then delivered to the steam roads, and in this way every steam line running out of Toledo is defeating its own alleged boycott against the electric road. The Cincinnati, Georgetown & Portsmouth Railway, of Cincinnati, which to all intents and purposes is an electric line, interchanges car-load freight business with steam roads and its freight and express cars are hauled into the center of the city by the Pennsylvania Railroad locomotives. As instances of the exchange of passenger business between steam and electric roads, Mr. Davis stated that during the summer months the Wheeling & Lake Erie (steam) sells thousands of tickets from points along its line to Lakeside, a resort reached by the Lake Shore Electric Railway. At Springfield, the Erie Railway (steam) has an arrangement whereby all passengers for Springfield are transferred to the city over the Dayton, Springfield & Urbana Railway.

PRESIDENT CLEGG

SECRETARY MERRILL

CONVENTION NOTES

The next meeting of the Ohio Interurban Railway Association will probably be held in Cleveland about the first of May. This point is deemed suitable because it is desirable to secure a larger membership from northern and eastern Ohio.

Walter H. Abbott, consulting engineer for the Pomeroy-Mandelbaum properties, was scheduled for a paper on "Steam Turbines," but at the last moment he was unable to attend. Mr. Abbott's work in this line has been fully described in recent issues of the Street Railway Journal. The paper will be presented at an early meeting.

Thursday noon the supply men headed by H. B. Gay, of the Electric Storage Battery Company, and Harry N. Ransom, of the National Electric Company, entertained the street railway men at an elaborate luncheon in the banquet hall of the Algonquin Hotel.

Thursday evening, through the courtesy of E. B. Gunn, of the Appleyard system, the delegates enjoyed a trip in a special car to the main power station of that system, located at Medway, 20 miles from Dayton. The power station, which

is one of the largest and most modern interurban stations in Ohio, was fully described in the STREET RAILWAY JOURNAL of May 23, 1903. The delegates were much interested in the trip of inspection.

Friday morning a number of the railway men accepted an invitation from the National Cash Register Company to inspect its famous manufacturing plant, an establishment which has the reputation of being one of the finest in the country.

The Dayton interurban lines issued orders to accept the badges of the Association as transportation to all points, and quite a number of the delegates took advantage of the opportunity to inspect the lines of the magnificent system centering at the Gem City.

President Harrie P. Clegg, Vice-President Edward C. Spring and Secretary-Treasurer J. H. Merrill worked like Trojans to make the first meeting a success, and no one was more agreeably surprised than themselves at the splendid attendance and the interest evidenced.

The following is a list of the charter members of the Ohio Interurban Railway Association:

ELECTRIC RAILWAY MEN

S. F. George, president Cincinnati, Dayton & Fort Wayne Traction Company, Dayton.

F. A. Ferneding, superintendent Dayton & Xenia Traction Company, Dayton.

C. N. Wilcoxon, superintendent Western Ohio Railway Company, Lima.

C. F. Smith, general manager Toledo, Bowling Green & Southern Traction Company, Findlay.

Richard Emory, general manager Appleyard properties, Columbus.

C. A. Black, president Detroit, Monroe & Toledo Short Line, Toledo.

Howard B. Arnold, auditor Dayton & Northern Traction Company, Dayton.

F. J. J. Sloat, general manager Cincinnati, Dayton & Toledo Traction Company, Cincinnati.

C. E. Hooven, general manager Cincinnati, Lawrenceburg & Aurora Railway, Cincinnati.

J. M. Morgan, president Cincinnati, Toledo & Detroit Short Line, Toledo.

T. E. Howell, superintendent City Railway Company, Dayton.

F. D. Carpenter, general manager Western Ohio Railway Company, Lima.

A. W. Anderson, superintendent Dayton & Xenia Traction Company, Dayton.

F. W. Adams, general manager Toledo, Fostoria & Findlay Railway, Fostoria.

J. R. Harrigan, general manager Columbus, Newark & Zanesville Traction Company, Newark.

E. J. Rauch, superintendent Canton-Akron Railway Company, Canton.

F. J. Green, president Springfield & Xenia Traction Company, Springfield.

George W. Rounds, general manager Canton-Akron Railway Company, Canton.

John L. Bushnell, president Springfield, Troy & Piqua Traction Company, Springfield.

H. C. Dimond, secretary Springfield, Troy & Piqua Traction Company, Springfield.

William Glaney, assistant superintendent Dayton & Northern Traction Company, Brookville.

R. W. Deaver, auditor Dayton & Western Traction Company, West Alexandria.

Howard Fravel, superintendent Dayton & Western Traction Company, West Alexandria.

J. M. Parker, general superintendent, Springfield & Xenia Traction Company, Springfield.

H. C. Lang, secretary, Western Ohio Railway Company, Cleveland.

Theodore Stebbins, director Appleyard system, Columbus.

Albert Emanuel, attorney Dayton, Covington & Piqua Traction Company, Dayton.

O. F. Ehring, chief clerk to general manager Appleyard system, Columbus.

W. J. Canada, electrical engineer Appleyard system, Columbus.

Dennis Dwyer, president Dayton, Covington & Piqua Traction Company, Dayton.

W. E. Ralston, superintendent Dayton & Troy Railway Company, Tippecanoe City.

R. A. Crume, assistant superintendent Dayton & Troy Railway Company, Tippecanoe City.

O. H. Murlin, auditor ticket receipts Dayton & Troy Railway Company, Tippecanoe City.

Frank M. Nusbaum, chief engineer Dayton & Northern Traction Company, Brookfield.

J. Yorty, chief engineer Dayton & Xenia Traction Company, Dayton.

J. R. W. Gregg, chief electrician Dayton & Xenia Traction Company, Dayton.

W. A. Grim, chief engineer Urbana, Mechanicsburg & Columbus, Columbus.

R. E. DeWeese, superintendent Dayton & Northern Traction Company, Dayton.

C. Kline, assistant superintendent Dayton, Covington & Piqua Traction Company, West Milton.

E. B. Gunn, general superintendent Dayton, Springfield & Urbana Railway Company, Springfield.

B. M. Brown, superintendent Columbus, London & Springfield Railway Company, Columbus.

R. M. Graham, chief engineer Dayton, Covington & Piqua Traction Company, West Milton.

J. S. Harshman, president Appleyard system, Springfield.

W. S. Lasure, road master Appleyard system, Fairfield.

J. R. Randall, general manager Southern Ohio Express Company, Dayton.

R. D. Colburn, superintendent motive power Dayton, Covington & Piqua Traction Company, Dayton.

J. O. Arnold, president Dayton & Germantown Traction Company, Dayton.

Adam Anweiler, superintendent Piqua City Line, Piqua.

R. H. Carpenter, general passenger agent Western Ohio Railway, Lima.

F. B. Mason, chief engineer Western Ohio Railway, St. Marys.

J. H. Merrill, purchasing agent Western Ohio Railway, Lima.

Harrie P. Clegg, president Dayton & Troy Railway Company, Dayton.

Fred W. Coen, treasurer Lake Shore Electric Railway, Cleveland.

Edward C. Spring, general superintendent Dayton, Covington & Piqua Traction Company, West Milton.

W. A. Black, treasurer Columbus, Delaware & Marion Railway, Columbus.

SUPPLY MEN

A. L. Wilkinson, general sales agent Ohio Brass Company, Mansfield.

C. F. Wickwire, special representative Ohio Brass Company, Mansfield.

John F. Ohmer, vice-president and general manager Ohmer Fare Register Company, Dayton.

E. B. Grimes, assistant vice-president and general manager Ohmer Fare Register Company, Dayton.

W. E. Hinmon, special representative Ohmer Fare Register Company, Dayton.

W. D. Riddell, consulting engineer, Riddell & Son, Xenia.

George K. Cretone, special representative Newcastle Bridge Company, Dayton.

George F. Lewis, special representative Viscosity Oil Company, 134 West Ninth Avenue, Columbus.

William L. Bloomer, manager Bloomer Bureau Publishing Company, Columbus.

George E. Fischer, president and treasurer Fidelity Construction Company, Atlas Hotel, Dayton.

Eugene H. Farr, manager Farr & Boylus Company, Chicago.

C. W. Chamberlain, Dayton, president Board of Trade.

E. C. Welfeck, Jr., Salesman Keasby & Matison Company, Cincinnati.

H. B. Gay, manager Cleveland office Electric Storage Battery Company, Cleveland.

B. C. Butler, agent American Brake-Shoe Company, Columbus.

E. L. Van Winkle, Salesman for Post-Glover Electric Company, Cincinnati.

Judson Pratt, local manager Valveline Oil Company, Cincinnati.

Edward B. Wright, general manager Sheridan Coal Company, Dayton.

Henry N. Ransom, National Electric Company, Cleveland.

E. C. Spencer, Dayton Manufacturing Company, Dayton.

Clem V. Jacobs, Street Railway News, Cleveland.

Will I. Ohmer, Recording & Computing Register Company, Dayton.

J. E. Gimperling, Jr., William B. Scaife & Sons Company, Dayton.
F. C. Peck, salesman, Standard Brake-Shoe Company, Chicago.
F. M. Randle, representative American Stoker Company, Erie, Pa.
George S. Davis, Street Railway Journal, New York, Cleveland.

SINGLE VERSUS MULTIPHASE GENERATORS IN ALTERNATING CURRENT RAILWAY WORK

BY W. A. BLANCK

The present great interest in the development of alternating-current railways makes most timely some considerations as to the selection of the generators delivering the energy to the system, particularly the choice between single and multiphase machines.

If the road to be equipped with the alternating-current system takes its current from a power house in which polyphase apparatus is already installed, it would be natural to supply the various sections of the line from the different phases of the generators. However, in case of an entirely new installation, the use of single-phase generators may be more advantageous, notwithstanding the greater cost of the single-phase as compared to the multiphase generator of equal capacity. Some of the relative merits of the two systems will now be considered.

For the purpose of discussion, three typical cases have been chosen, shown by Figs. 1, 3 and 5, using one, two and three-phase generators. In each case, 20,000-volt generators are assumed to feed directly into the high-tension bus-bars, thus simplifying the diagrams by the omission of the step-up transformers. High-tension switches connect the bus-bars to the transmission lines leading to the stated sub-stations. In the sub-stations are installed the step-down transformers, with primaries connected to the transmission line by high-tension switches. Single-pole switches are inserted between one side of the 3000-volt secondaries and the trolley wire, while the other side and the transformer case are tied to the rail. The power house is located at the center of the line, which is divided into sections, as the case may determine. These sections are separated by suitable insulators, and arrangements are provided for readily connecting them by jumpers in case of emergency. A simplification of these cases is also shown in corresponding figures designated 2, 4 and 6, where the rail is used as a common return for both primary and secondary circuits. It will be noted that in case this is done with the three-phase generators, Fig. 6, 34,000 volts must be delivered to the bus-bars in order to maintain 20,000 volts between the transmission line and the grounded neutral.

In Fig. 1, using a single-phase system, it is necessary to install double-pole switches on the transmission line both in the power house and sub-station. Normally the static strain between the transmission line and ground will be half of the impressed voltage.

In Fig. 2, with a single transmission line, it is only necessary to use single-pole switches in all primary circuits, thus affecting a very material saving in the expense of high-tension switches as well as a saving of 50 per cent in transmission line copper and insulators. It will be noted, however, that this arrangement subjects the transmission system and transformers to the full static strain of the impressed voltage. This will call for somewhat greater care in insulation of the transformers, and will continuously subject the insulators of the transmission line to a higher strain. The decreased number of insulators, with the corresponding decrease in points at which failure can occur, however, tends to counterbalance the somewhat more rigorous requirements.

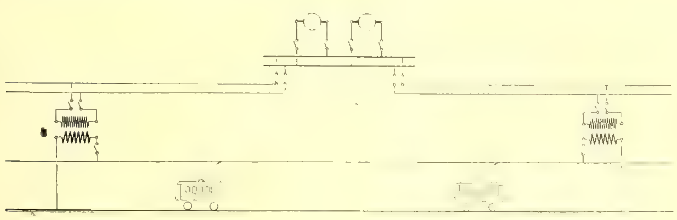


FIG. 1

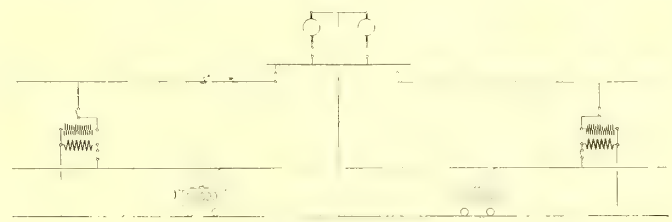


FIG. 2

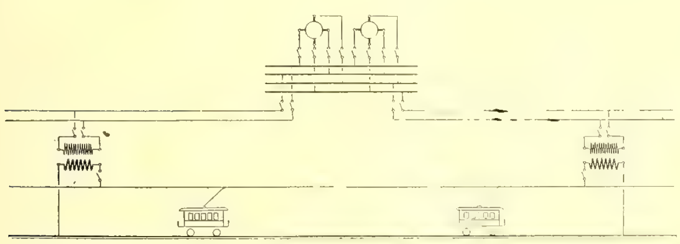


FIG. 3

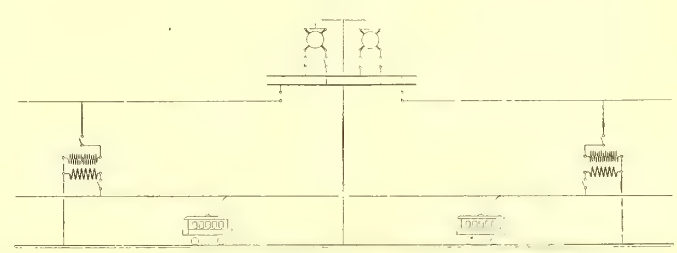


FIG. 4

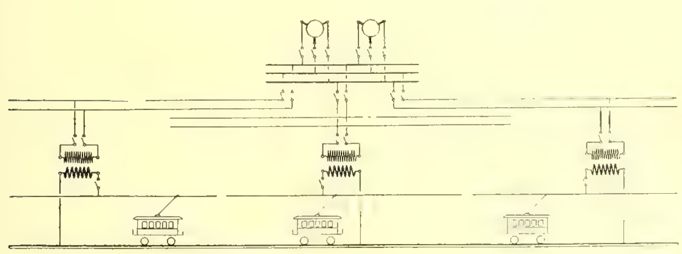


FIG. 5

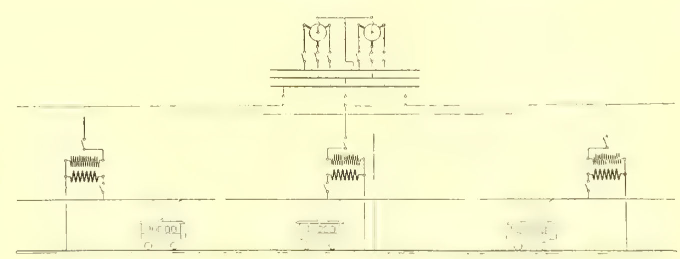


FIG. 6

Should it transpire that one line is grounded in Fig. 1, the system can still be operated until such time as repairs can be made, while in Fig. 2 such a failure would necessitate the shutting down of that particular transmission line. This condition, however, is exactly analogous to that of a star-connected three-phase system now so generally operated with a grounded neutral.

When the system depicted in Fig. 1 is in normal operation, the adjacent sections are at the same potential, and the section

insulators are subjected to no strain whatsoever, while if one section is shut down the insulator will have to withstand the full trolley potential of 3000 volts.

Should any one section of the transmission line, or any one sub-station be put out of commission, it is possible by use of the jumpers mentioned above, to feed the disabled trolley section from each of the adjacent sections, thus maintaining service without excessive drop.

A very important feature in the operation of this system is the fact that the full generator capacity is available at any point on the system, thus making it possible to take care of any lack of balance in the distribution of the load, due to the congestion of traffic at any point of the system.

In Fig. 3 the use of two-phase generators is considered. This will be most advantageous when applied to a system consisting of a single line with the power house located at the center. Current will be supplied to one end of the system from one phase of the generators, while the second phase feeds the other end.

In comparing the Figs. 3 and 4, the conditions are exactly similar to 1 and 2, so far as the saving in switches, copper and insulators and the static strains are concerned. However, a noticeable difference exists so far as operation is concerned. Since the adjacent sections are fed by different phases, the section-insulator must stand 4200 volts when in normal operation. In case one section of the transmitting system is disabled, current can be supplied by means of jumpers only from the adjacent sections supplied by the same phase, which will result in double the drop due to similar occurrence in case 1. Since the section of the system fed by the different phases must be entirely separated, this arrangement does not provide for an unbalance in load so well as in Fig. 1. In fact, only 50 per cent of the generator capacity is available on either section, a point of considerable importance in practical operation.

In Fig. 5 the application of three-phase generators to the single-phase system is considered. This arrangement is best adapted to a railroad system consisting of main line and branch, with the power house located at the junction, since it will then be possible to feed the sections without necessary overlapping of the transmission lines. Again, similar relations hold between Figs. 5 and 6 as between Figs. 1 and 2, so far as the saving in switches, copper and insulators and the static strains are concerned. The insulators separating sections fed by different phases have to withstand 5200 volts, as compared with the 4200 volts in Fig. 3. The same limitation in feeding any section of the trolley from its adjacent section in case of a disabled transmission line hold as in Fig. 3. So far as available generator capacity for any section is concerned, the two cases are materially different. In Fig. 5, due to the delta connection, it is possible to utilize 66 per cent of the generator capacity on any section, whereas, in Fig. 6, with the star-connection, only 33 per cent of the generator capacity is available on any one section.

It is evident that, on account of the high potentials, section insulators must be of considerably greater length than those now used on the low-voltage trolleys; making them approximately from 4 ft to 6 ft. in length. This will have a very appreciable effect on the lights when the car passes the section insulator, as well as presenting the difficulty in starting which would arise should the car come to rest under the insulator. Moreover, the arcing due to the interruption of the current with the high voltage trolley is apt to prove serious.

All these difficulties can be overcome in Fig. 1 by the use of two trolley bows, one mounted over each truck of the car. Since these will more than span the insulator, the current will not be interrupted, thus materially improving the operation of the system.

This arrangement with the two bows can only be applied in Fig. 1, as in Figs. 3 and 5 it would not be permissible to short-circuit two sections fed by different phases.

A metallic telephone circuit system installed on the same poles as the grounded high-tension line will be subjected to higher static strain and greater inductive action than in the case of the ordinary transmission line. The effect of induction can be overcome by frequent transposition of the telephone wires. To guard against shocks due to static strains, care must be taken to provide perfect insulation for the telephone instruments, as well as for the person using the 'phone.

From the foregoing discussion, it appears that it will be entirely possible to use two and three-phase generators now installed to furnish power for single-phase systems, but that the difference in potential between sections and the small generator capacity available on any section are serious obstacles to the satisfactory operation with this arrangement.

Where entirely new apparatus is to be installed, it is undoubtedly better to use single-phase generators. Their first cost is somewhat greater, but the system is far more flexible in its stability to handle unbalanced load conditions, and with the double bow trolley, gives perfect continuous service over section insulators.

While the suggestion to use rail as common return for both high-tension and trolley circuits is a radical departure from current practice, it does not involve greater risks for personal injury or the continuity of the service than in the ordinary three-phase system with grounded neutral. The immense advantages of simplification and decrease in the expense of the transmission system, most imperatively bespeak for this feature most careful consideration.

The Cleveland & Southwestern Traction Company has adopted the method of operating cars in use on steam roads. Cars run on schedule, and calls for orders are made only when a car is five minutes late. All telephone booths and stations have been equipped with Egry automatic registers, which record all orders received by the crews. The company considers this plan of great advantage, as it fixes the responsibility in case of mistakes or accidents.

State Statistician Johnson, of Indiana, says that the dearth of farm hands in that State is due to the rapid development of the interurban electric railway. The uncertain hours of farm work, it seems, cause men holding permanent places to give up their jobs in order to assist in building an electric railway, and then permanently to abandon their former line of work if a position as motorman or conductor is available, or they can secure any other berth.

Under a lease which expires 1096 years hence, the Chicago & Milwaukee Electric Railroad Company has secured from John Alexander Dowie the right to extend a line through Zion City. According to the terms "said lease is to expire 3000, A. D." The reason given for granting a lease instead of a purchase is that it is forbidden "to sell the property of God."

John D. Rockefeller has made a contract with the Cleveland & Southwestern Traction Company for delivering to his summer home at Forest Hill, near Cleveland, a large amount of fine washed gravel for making roadways and walks in his private park. Rockefeller purchased a gravel bank at Wellington, 45 miles from Cleveland, and the material will be screened and washed and delivered to Forest Hill in bags. It will be handled at night, as it will be necessary to traverse Euclid Avenue, Cleveland, for a distance of 7 miles over the tracks of the Cleveland Electric Railway.

ST. LOUIS THE CONVENTION CITY

As stated in the editorial columns of this issue, a decision to hold the 1904 convention of the American Street Railway Association at St. Louis, was reached at the meeting of the executive committee of the association held at that city on March 26. The selection of a place for holding the convention was very thoroughly considered at the meeting of the executive committee in New York on Feb. 29. There were arguments in favor of St. Louis, but it was determined to make no ultimate decision until after a personal inspection by the members of the committee of the hotel, convention hall and other facilities afforded in St. Louis.

At the meeting in that city it was found that the World's Fair management would designate October 12 as "American Street Railway Association Day," thus making it one of the formal days of the Exposition. They also promised the Association their cordial co-operation in making the meeting a success in every respect, and also placed at the disposal of the association for its meetings "Recitation Hall," which is in the great building known as "Festival Hall," and is located in the central part of the grounds. For the meetings of the subsidiary associations they offered smaller halls in the same building. As October is a very attractive month in St. Louis, it was decided to accept these offers and designate Oct. 12 and 13 as the days of the convention. It was also proposed to make the entire week commencing with Monday, Oct. 10, one which would offer special attractions to street railway men, and to this end it has been suggested that the American Railway, Mechanical and Electrical Association should hold its convention on Monday and Tuesday, Oct. 10 and 11, and that the Street Railway Accountants' Association should hold its meetings on Friday and Saturday, Oct. 14 and 15. The annual banquet will be held on Thursday evening, Oct. 13. The place of holding this banquet has not yet been selected,

The Southern Hotel has been designated as the headquarters of the association. There are a large number of other hotels, however, many of which were personally inspected by the executive committee. Among them was "The Inside Inn," which is the large building erected within the Exposition Grounds for the accommodation of visitors, and which will undoubtedly be patronized by a great many people. The secretary of the association is now preparing a circular which will give such information as will enable any person by the exercise of a little care, to be well located during "Convention Week" at the Fair. The association will also send to all members before the meeting, a book giving the names of every hotel and lodging house in St. Louis, their location and the rates per day and week, and will exercise every endeavor to have all attendants at the convention well cared for. Assurances were also secured from leading hotels in regard to rates, and were regarded as very satisfactory.

The program for the meetings of the American Street Railway Association has not yet been fully decided upon, but Prof. W. E. Goldsborough, chief of the Department of Electricity, has consented to address the association on its first meeting upon the Exposition and those exhibits which will be of particular interest to the delegates.

The meeting of the executive committee at St. Louis was attended by two representatives of the Supply Men's Committee and by a representative of the Street Railway Accountants' Association.

As a result of its trip to St. Louis, the executive committee is very enthusiastic as to the accommodations at St. Louis for the convention and the prospects for a successful meeting, and in this opinion they will undoubtedly have the hearty assent of the great majority of the members of the association.

INTERURBAN CAR FOR THE PENSACOLA ELECTRIC TERMINAL RAILWAY

The Pensacola Electric Terminal Company, of Pensacola, Fla., has lately received from the J. G. Brill Company the car shown in the accompanying illustration. The large windows, which are opened at the rear, and the low window sills show that it is of the builder's well-known semi-convertible type. The car, which is mounted on No. 27-E-1 trucks with four 25-hp motors, will be run on a fast schedule between Pensacola and Palmetto Beach, a popular and fashionable wintering resort. Pensacola has a large transient population, and is well known as one of the largest lumber markets in the country, and has also a considerable export trade in fish and fruit. Its fine harbor is shared by a United States Navy Yard, and the shipping is extensive.

The car seats forty-eight passengers, the seats being 35 ins. long, leaving the aisles 28 ins. wide. Cherry in natural color and birch ceilings comprise the interior finish. The corner posts are 3¾ ins. thick, and the side posts 3¼ ins. The arms are of special design, and are arranged so as not to block the window lifts. Removable net window guards extend from corner post to corner post and give ample protection to passengers. The car body measures 33 ft. 4 ins. over the panels, and 42 ft. 9 ins. over the vestibules; from panels over vestibules, 4 ft. 8½ ins.; width over sills, 8 ft. 2½ ins., and over posts at belt, 8 ft. 6 ins. The platform timbers are reinforced with angle-irons and angle-iron center-knees extend to crossings inside the body bolsters. The side sills are 4 ins. x 7¾ ins., with 12 ins. x ⅜ in. steel plates on the inside, to which the bases of the posts are secured. The needle beams are double-trussed, and substantial under trusses are anchored at the body bolsters. The end sills are 5¼ ins. x 6⅞ins. Brill sand-boxes, angle-iron bumpers, "Dedenda" gongs, conductors' gongs, ratchet brake handles and channel-iron radial draw-bars are included in the equipment. The wheel base of the trucks is 6 ft. 6 ins., and the diameter of the wheels, 30 ins. The trucks have solid forged side-frames, to which the transoms are secured with double and single corner brackets forged from single billets.

INTERURBAN CAR FOR PENSACOLA ELECTRIC TERMINAL RAILWAY COMPANY

The fiftieth anniversary of the advent of the first street railway in Philadelphia was celebrated on April 4. It was on that day, in 1854, that the Philadelphia & Delaware River Railroad was chartered. The road built by this company was equipped with ten dummy engines and a few horses and mules. About 3 miles of track were operated, and less than 150 men were employed.

The Indiana Railway Company, which has lines connecting South Bend, Mishawaka, Elkhart, Goshen and Niles, Mich., has announced a raise in rates amounting to 15 to 20 per cent, between all points except South Bend and Mishawaka.

ALL STEEL RAILWAY SUBSTRUCTURE

A section of track 135 ft. in length, in which the rails are laid on a curved steel channel or stringer, has been laid on Forbes Street, in Pittsburg, and views of it are shown in the accompanying engravings. The construction is the invention of Samuel E. Duff, superintendent of the Riter-Conley Manufacturing Company of Pittsburg, and is termed by him "Railway Substructure."

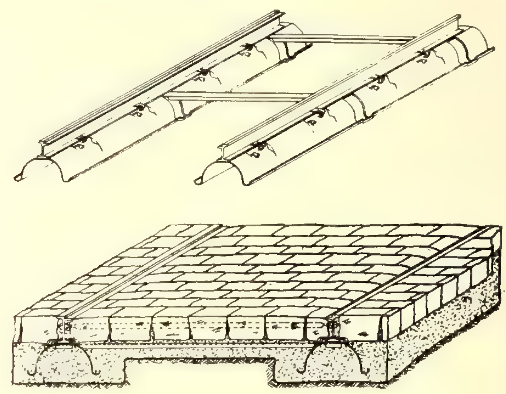
ALL STEEL STRUCTURE ON EXPOSED TRACK

The system consists of three parts, girders, tie-plates and clips, the latter for holding the rail to the girders. The girders are 7 ft. 6 ins. long, or one-quarter of the ordinary length, and rest on a broken-stone or gravel ballast, which is prepared as in wooden cross-tie construction, although it is not necessary to excavate to the full depth for the entire width of the roadway.

The ends of each succeeding pairs of girders are lapped over the ends of the immediately preceding pair by means of a slip joint. The broken-stone ballast, which is used under the rail, is then thrown into the girders from the ends and packed into place and the tie-pieces are inserted and act as spaces to maintain the required gage.

When enough girders and tie-pieces have been laid, the rails are placed on them, care being taken to have the rail joint about the center of the girder on which it occurs. The rail clips are then inserted. These clips are all alike except those used at the rail joints, where they have to be slightly altered on account of the interference with the angle-bar rail splice.

The ballast is then completed by tamping under the sides of the girders whatever is required to give them firm and even bearing. While the tamping is being done the track can be brought to the required alignment and elevation. The ballast is then placed between the girders and outside of them, and the paving can be laid. The weight of the substructure for steam railroad work per linear foot of track, that is for two rails, of the girders with tie-pieces and clips, is 110 lbs. per ft., while the weight of the street railway design is 80 lbs. per foot complete. It is thought, however, that these weights can be decreased, as the tests show that the structure possesses unnecessary strength.

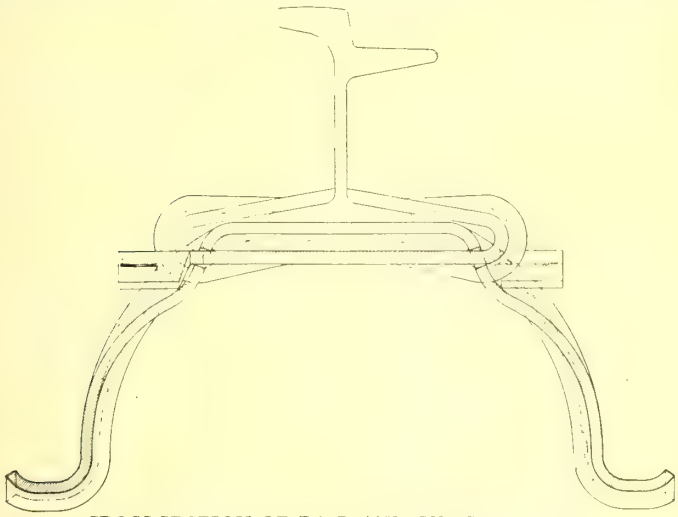


SECTIONS OF STEEL RAILWAY STRUCTURE

VIEWS OF FORBES STREET, PITTSBURG, SHOWING METHOD OF LAYING STEEL TRACK STRUCTURE IN PAVED STREET

If a concrete foundation is desired, it can be employed, as the form of the girders is such that the shocks of the passing traffic are taken up by the top of the steel girders and are not transmitted directly to the concrete. It is thought that there will be less trouble in breaking of concrete than when the rails are laid directly on the concrete. It has also been

found that it is not necessary with either concrete or broken-stone ballast to fill the inside of the girder completely in order to obtain sufficient bearing power. With concrete the inventor recommends that a space of about 2 ins. should be left unfilled under the top flange of the girder, thus allowing a uniform deflection to take place as the moving loads pass over the rails



CROSS-SECTION OF RAIL AND SUB-STRUCTURE

and avoiding any interference with the clips that hold the rails in place.

As the clips are not held fast in the ballast or concrete, they can be removed at any time by simply straightening out the ends and driving them back through the slots in the girders. As they are annealed, this can be done a number of times without breaking them. As soon as the clips are removed, the rails can be lifted off of the girders and new ones laid. And as the clips rest against the webs and not the outside of the bottom flange, a new section of rail could be used without great difficulty.

In curves having a radius of over 500 ft. the ordinary straight girders can be used. For curves having a lesser radius special curved girders are employed.

Although the initial cost of the structure would probably be more than that with wooden ties, the manufacturers claim that the system is much more durable, and that the tendency to break down at the joints is eliminated. The expense of laying is comparatively small, as no delicate tools are required, and there is less tamping than with wooden tie construction.

AMUSEMENT APPARATUS FOR RAILWAY PARKS

Coincident with the development of suburban and interurban electric railways there has been a large increase in the number of picnic parks owned and controlled by traction companies. Since, in many cases, this feature is a very important factor in the financial success of a company, it is one that deserves careful consideration whenever the question arises of securing suitable attractions.

Among concerns prominently identified in the manufacture of apparatus for recreation grounds is the Herschell-Spillman Company, of North Tonawanda, N. Y. While this company builds an extensive line, it has devoted particular attention to the development of riding galleries. Its latest models embody many expensive improvements, and are used extensively throughout the country.

The improved gallery has an outside diameter of 40 ft., and is made to revolve by a Norway iron cable passing about the cable rim situated under the platform, and is so placed that the cable acts as a band to bind the gallery together more firmly. The inner ends of the arms or sweeps are attached to a set of machine-finished hub castings which are fastened to the center pole.

The gallery consists of sixteen strong, accurately finished wheels, running upon a heavy steel track 7 ins. wide; upon these the superstructure is built, consisting of sweeps, horses, chariots, platforms, steps, picture center, image, etc. This gallery is supplied with steel and malleable castings in very many places where cast-iron has always been used, thus reducing the weight and adding materially to the strength and fine appearance of the gallery.

Every part is so designed, constructed and numbered, that in a few hours the entire machine can be taken apart and packed ready for transportation. The gallery can be put together quickly and accurately, requiring only the services of three men.

There are twenty-four horses, four chariots and sixteen chairs with each machine. The building, carving and painting of the horses is done by expert mechanics, who have had long experience in this line of work, thus enabling them to give a very life-like appearance to the horses. Each horse has an easy galloping motion, and there are no iron rods to annoy the rider. The four chariots are of fine design, and will each seat easily four to six people. The chairs are also finely decorated. The entire gallery will seat comfortably fifty-six adults.

Over the gallery is a 50-ft. 8-oz. army duck tent, with substantial side walls. The tent is supported by proper poles, ropes and tackle. Every gallery is also furnished with military band organ fitted with two barrels, each barrel containing eight up-to-date popular selections of music. The organ has a rich, powerful tone, and is supplied with trumpets, piccolos and flageolets.

This gallery is also furnished with a negro or Chinese image, neatly clothed, represented as turning the organ. The construction is such that it automatically, but very naturally, turns its head and bows to the audience whenever the gallery is in motion. The gallery is equipped with a special stud-wheel,

ELECTRICALLY OPERATED RIDING GALLERY

which prevents accidents and saves labor in operating the machine.

The picture center supplied is one piece of canvas, showing a fine continuous oil painting, which is much more convenient to take down and pack for transportation than the old style

center. It is also very much more durable and adds materially to the beauty and finish of the gallery.

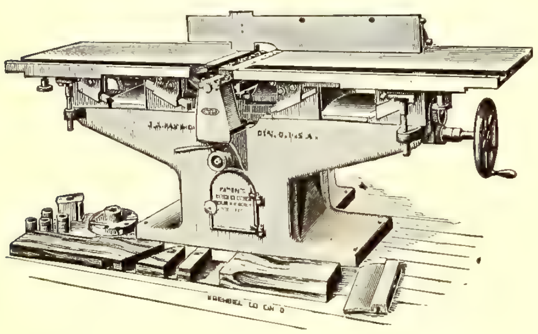
A special engine and boiler are usually furnished with this riding gallery, but if desired, the latter can be arranged for electric drive or any other form of motive power.

The accompanying cut refers to a machine recently installed in a very popular park. This machine differs from the regular riding gallery furnished by this company merely in the matter of a carved picture center on the machine, instead of the oil-painted canvas center. This carved picture center is of the same general design as the front of the organ used on this machine, and there are small mirrors in every other panel. This simply shows one of the many variations that this company makes in its product in the way of beautifying the machine and giving it a far more elaborate appearance.

It will be noticed from the illustration that this machine has a pavilion over it instead of the canvas tent. It is driven by electricity from a street railway circuit, and is handled by one man. The controller box is placed on the machine, and it is, therefore, unnecessary for the operator to leave the machine at any time. This makes a very neat arrangement, and one that is very much appreciated by park managers.

UNIVERSAL WOOD-WORKER

The wood-working machine shown in the accompanying cut has been designed by the J. A. Fay & Egan Company, of Cincinnati, Ohio, to meet successfully the most particular requirements. It will do a variety of work and saves the use of several separate machines, as it does each kind of work to advantage. It is adapted for heavy work, and is especially recommended for street car shops and where large timbers are worked.



UNIVERSAL WOOD WORKER

It is made to plane 16 ins. wide, and will plane to advantage out of wind, surface straight or tapering, rabbet and face inside blinds, rabbet door frames, bevel, joint, chamfer, bore, grain, bead, rip, cross-cut, tenon, rout, groove, work circular moldings, and other like work.

Vibration and wear on all parts are lessened by new and ingenious devices, while the different adjustments, change of knives, etc., can be made easily, quickly and accurately.

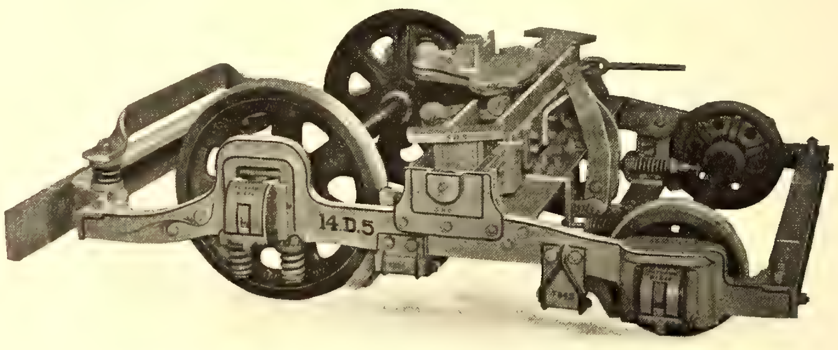
An attachment for boring is mounted at the back of column, having a table and necessary stops to regulate the cuts. A fence is also provided for angle boring, and a table placed on top of the boring table for rotary mortising.

The tables are each 6 ft. long and are planed true. Each has independent vertical and horizontal adjustments, and is easily raised and lowered. The adjustable fence and bevel-rest requires no separate adjusting, as it raises and lowers with the tables.

IMPROVED MAXIMUM TRACTION TRUCK

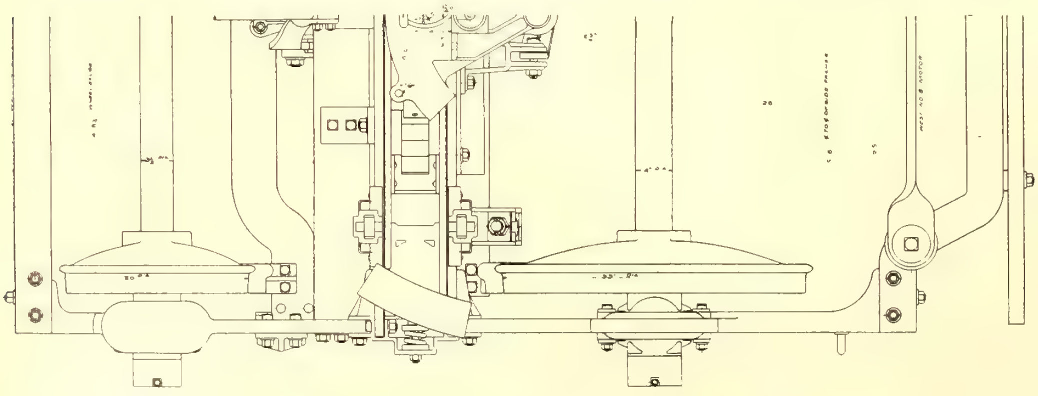
The Brooklyn Rapid Transit Company has recently ordered 400 No. 14-D-5 maximum traction trucks from the Peckham Manufacturing Company. This type, which is shown in the accompanying illustrations, embodies numerous improvements resulting from extended investigations made by the Peckham Company of the behavior of maximum traction trucks under different operating conditions.

Instead of having the truck frame surrounded only on three sides of the truck, the No. 14-D-5 truck is surrounded on all sides by extra strong, low carbon steel side frames, which are so braced at the ends and center as to keep the truck frame square. The side-frames are provided with flexible spring supports on the journal boxes to prevent crystallization and relieve the truck and car from shocks and concussions when crossing rails and switches.

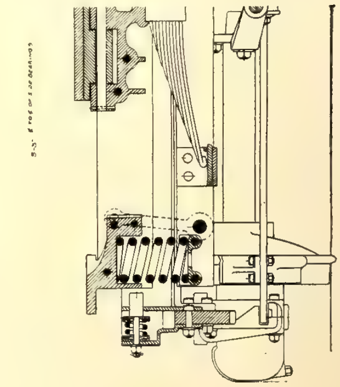


IMPROVED MAXIMUM TRACTION TRUCK FOR HEAVY SERVICE

An important feature of this truck is the center-bearing swing-bolster, which supports the car body and allows it to swing easily when turning curves. This ease in turning relieves the wheel flanges (especially those of the small wheels) from side strains, thereby preventing derailments and excessive flange wear. This bolster is located so near the center of the truck that the weight of the car body upon the small wheels is sufficient, without the aid of special spring devices, to pre-



SECTIONAL VIEW OF TOP FRAME



ALL DIMENSIONS GIVEN FOR LIGHT TRUCK WITHOUT CARBODY

CROSS-SECTION THROUGH CENTER OF BOLSTER

vent the small wheels from jumping the track. As the motors are supported outside of the driving axle, the traction is increased and the motors made accessible more easily.

This truck is well suited for short radius curves, owing to the use of a segmental self-oiling swivel plate with a king pin over or near the axle, which permits the truck to swivel on curves with as short a radius as 20 ft.

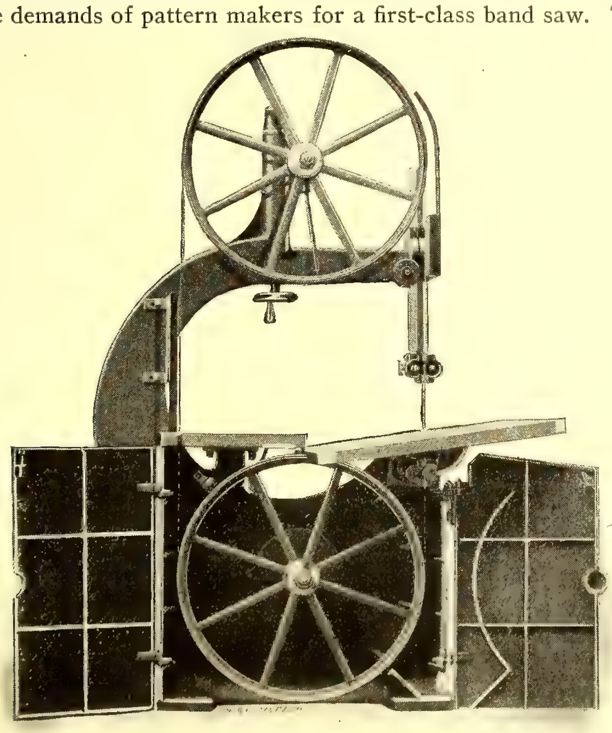
The low end extensions of the side frames prevent coming in contact with open car steps. The flange-shaped end extensions of the side frames, which are machine fitted to correspond to angle-bar cross-sections, prevent the truck from getting out of square. The angle-bar end sections are accurately machine-fitted to end extensions and secured by machined bolts driven into reamed holes. The journal boxes are packed with wool waste and oil.

The brake mechanism is designed to give the proper amount of brake pressure to both the large and the small wheels without the use of adjusting springs. The wear of the brake-shoes can be adjusted simultaneously upon all four wheels simply by turning one bolt. Brake-shoe chattering is prevented by the use of the Taylor non-chattering brake hanger.

The principal dimensions of this truck are: wheel base, 4 ft. 6 ins.; diameter of driving wheels, 30 ins. or 33 ins., and of pilot wheels, 17 ins. to 22 ins.; diameter of driving axles, 3¾ ins. or 4 ins., and of pilot axles, 3¼ ins. or 3½ ins. The weight of the truck without motors is 5200 lbs. The carrying capacity is 25,000 lbs. per truck, and 50,000 lbs per car.

A UNIQUE BAND SAW

The machine shown in the accompanying illustration has been designed and built by the American Machinery Company, of Grand Rapids, Mich., and Manchester, England, to meet the demands of pattern makers for a first-class band saw. The



A UNIQUE BAND SAW

company builds several sizes of band saws, but the one illustrated, which is called the type "B," is stated to be its best.

The band-wheels of this machine are cast-iron 38 ins. in diameter, carefully turned outside and in, besides having the web between the spokes milled concentric with the rims. Rubber bands or tires of the best quality are vulcanized to the wheels. These light wheels will prevent the breaking of light blades which otherwise break when a machine with heavy wheels is started suddenly. They are very sensitive and so adjusted in connection with the steel spring cushion that sudden strains and expansion of blades are instantly taken care of.

The work table is 40 ins. long, 36 in. wide, 40 ins. from the floor. It is very generously ribbed and strong, having the necessary throat and slot to disengage the saw. The bracket, which is 11 ins. wide, 8⅜ ins. long, is bolted to the under side of the table, giving ample bearing and width to carry the table true with the working of the machine. This table can be tilted by a screw and hand-wheel from a straight plane to 45 degs. one way, and 5 degs. the other.

On the left, between the column and the work-table is an auxiliary table which is bolted to the frame. This table is 21 ins. wide and 22 ins. long. It increases the surface of the work-table almost by one-half.

The driving band wheel is entirely enclosed with a casing having two doors. These doors open in the center and swing each way, allowing the operator to put on or remove the saw at his pleasure. This casing is provided with a device whereby the dust is collected and thrown to the front of the machine by the action of the air which the wheel creates, doing away with all the annoyances of piping and encasing.

The bearings upon which the shaft of the driving band wheel is carried through the main frame, have long boxes which reach the entire length, and are designed with an oil-well underneath the entire length of the main bearing. The upper band wheel, or driven band wheel, is carried upon a shaft which is 1½ ins. in diameter and 20 ins. long. The box which carries this shaft is 12¼ ins. in length, babbitted with genuine babbitt and split on the side with two screws to compress the box and take up the wear, the end thrust being taken up by a collar upon the end. This shaft is also prepared as the lower shaft for the carrying of the wheel.

The greatest height of cut of this machine is 18 ins. It will carry saws from 3-16 in. to 2 ins. in width. The tension on the saw is taken up by a telescope spring placed on the top of the adjusting screw with one spring of the required weight and elasticity to carry 3-16 in. to ½ in. saws, and a double spring taking the rest of the range of saws from ½ in. to 2 ins. The blades are 20 ft. long; any length between this and 18 ft. may be used. The weight of the complete machine is 2600 lbs.

AMERICAN JACKS FOR SIBERIAN RAILWAY

A contract for a car-load of track jacks has been received from the Russian Government by the Duff Manufacturing Company of Pittsburg, Pa., for use on the Siberian Railway. This railway, and in fact nearly all the Russian railways, have been using the company's Barrett jacks for several years, but this contract is unusually large, as the Siberian Railway is such an important factor in the Russo-Japanese war. The placing of the order with an American firm is especially interesting, as it greatly minimizes the somewhat prevailing belief that Russia did not intend to purchase any American manufactures, but would look to European markets for its requirements. On the same day that the Duff Manufacturing Company received the Russian contract it received an inquiry for a rush order of Barrett jacks for the Japanese railways. It is a peculiar coincidence that the two warring nations should have sent specifications for the same article to the same firm on the same day.

The Boston & Worcester Street Railway has adopted a new schedule of fares between Boston and Worcester, making a single fare either way 45 cents. Return trip tickets may be bought at the rate of 40 cents each way. Of this fare 5 cents is collected by the Boston Elevated Railway, which operates the cars in Boston and Brookline, and 5 cents by the Worcester Consolidated Street Railway, which operates the cars in Worcester.

FINANCIAL INTELLIGENCE

WALL STREET, April 6, 1904.

The Money Market

Such changes as have occurred in the money situation during the last two weeks bear rather on the outlook than on immediate conditions. Rates for money remain the same as they were, call funds being abundantly supplied at 1½ to 1¾ per cent, and loans on time easily obtainable at 2½ per cent for sixty days, 3½ for four months, and 3¾ to 4 per cent for five and six months. These very low rates reflect the unusually strong position of local bank reserves, the present surplus standing at $24,000,000, as against $2,000,000 a year ago. Loans have now been expanded to the unprecedented total of $1,022,000,000, but the recent increase in the account has been more than offset by the unparalleled figure attained by cash holdings. Several causes have combined to permit the great augmentation of specie and legal tender reserves. Of these the two most important are the Panama Canal operation, which has drawn large amounts of currency from the interior for deposit in New York, and the second the quieting down of interior trade which has enabled the out-of-town banks to keep an exceptionally large balance in this city. The recent loan expansion is explainable partly on the ground of increased activity on the Stock Exchange and partly as the result of the $50,000,000 Pennsylvania loan, payments on which began last Friday. The one point of doubt regarding the future is the effect of the canal settlements under which this country is obligated to pay some $40,000,000 to France. Sterling exchange has risen sufficiently to allow a small profit in gold exports, and a preliminary engagement of $600,000 for Paris was announced on Monday. This, it was generally agreed, is the beginning of a movement which is likely to reach good-sized proportions in the course of the next two months. As to the amount of gold which our bankers will ship, there is wide difference of opinion. Some authorities look for a very heavy drain, placing their estimates as high as $30,000,000 to $40,000,000. Other authorities make much more moderate calculations, and contend furthermore that the gold taken for export will be largely offset by the release of Treasury funds contemplated in the Panama financial plan. The situation may be summed up in the conclusion that no immediate rise in money rates is probable, and that whatever advance may occur later on will be slight, owing to the extremely large surplus held by the New York institutions. A feature, however, whose significance cannot be ignored, is the inability of corporations desiring to borrow large sums over long periods to obtain accommodation at anything like the prevailing market quotations. This means that while lenders are perfectly willing and even anxious to put out their funds on approved and readily marketable collateral they are averse to getting any more tied up with loans which cannot easily be converted into cash.

The Stock Market

Interest in the stock market for the last two weeks has converged entirely upon the question of the dissolution of the Northern Securities Company and the consequences it may have for other roads, particularly the Union Pacific. Northern Securities stock has sold on the curb at 100, an advance of 15 points from where it sold when the court decision was handed down a month ago. In the curb dealings also there has been some urgent bidding for Northern Pacific and Great Northern shares "when released." The incident, however, of overshadowing concern has been the enormous purchases of Union Pacific stock on the Stock Exchange, leading to an advance of nearly 20 points from the lowest it sold the day before the Northern Securities opinion was delivered. All manner of conjecture has accompanied this astonishing movement, but at this writing no trustworthy explanation has appeared. The old idea that control of the property is being sought, has been strengthened by the announcement that the Harriman interest has brought suit in the Circuit Court at St. Paul to overthrow the plan for dissolving the merger proposed by the Hill-Morgan faction and to secure a declaration that the Union Pacific is entitled to receive for its Northern Securities holdings the $72,000,000 of Northern Pacific stock which it first put into the combination. If the Harriman party were to carry its point, the Union Pacific would virtually control the Northern Pacific Company, the Hill-Morgan people would be placed in the position of a minority in Western railroad affairs, and, in short, the whole situation which precipitated the disaster of May, 1901, would arise again. All this, of course, suggests an obvious motive for a contest for control of the Union Pacific, or at least for the acquisition of a sufficient interest in Union Pacific securities to give rival capitalists a voice in the management of the company. The whole episode, it is quite needless to say, has paralyzed investment activity in the general share list, it has checked whatever disposition there might have been for the outside public to come back into Wall Street, and it has put a restraint upon the general advance in prices.

The traction group, in view of the supreme importance of the railway share dealings, has been forced to take a back seat in the recent market. Some satisfaction was expressed at the lowering of franchise valuations in the estimates for the new year given out ten days ago. But the market for the various stocks scarcely gave much heed to the matter. There has lately been some rather good buying of Metropolitan, on the idea that the stock is selling too low on its merits, and that the short interest created on the recent decline has by no means been fully covered. The inside speculative party in Brooklyn Rapid Transit has made no further effort to advance the price. Left to itself the stock has acted well, and it is in a position to become a trading favorite should the speculation take a shift into a new quarter of the market. Dealings in Manhattan Elevated have been small, and its fluctuations unimportant.

Philadelphia

Dealings in the traction shares in Philadelphia have scarcely made much response to the activity in the general market. The only stock to make any noteworthy gain during the last two weeks is Union Traction, which rose from 48¾ to 50, the highest price of the season. Philadelphia Company common has been comparatively active, but shows no net advance for the period. It declined from 40½ to 39⅜, and then recovered to 40½, subsequently selling at 39, "ex" the dividend. The preferred changed hands at 44½ and 44¼. Philadelphia Electric was heavy, rising at one time to 6, but later falling back to 5 13-16. Consolidated Traction of New Jersey sold as low as 62⅞, and as high as 64. Philadelphia Traction declined from 95½ to 95, and rallied to 95¼. A few scattering lots of American Railways were taken at 43¾. Small transactions occurred in Fairmount Park Transportation at 24, and Pittsburg preferred at 48¾. One hundred and fifty shares of Reading Traction were dealt in at 29¾, down one-quarter per cent from the last previous sale.

Chicago

The receiver of the Union Traction Company has made a proposition to the city for the settlement of the traction muddle on the north and west side lines. He offers that the company, in return for renewal of the franchises, will agree to give the city municipal ownership on six months' notice, pave and light the streets on which the lines run, lower the tunnels, and maintain the best possible street car service, provided the city will pay the tangible value of the property and whatever the court may determine the companies' ninety-nine-year rights are worth in case the city decides to take over the roads. Those who are best informed on Union Traction affairs, say that dividends on the leased lines will, in all likelihood, be passed again. Loss of traffic during the severe winter, together with the loss of cars by fire and heavily increased operating expenses generally are the reasons assigned for the inability to pay the guaranteed rentals. Dealings in the Union Traction group of securities have been light. Three hundred Union Traction common sold at 5½ and ten shares of North Chicago at 71. City Railway advanced sharply from 161¾ to 166½ on sales of about 400 shares, the price later receding to 165. Lake Street Elevated receipts dropped from 1⅞ to 1⅝, but later recovered to 1⅞. Metropolitan Elevated common sold at 17. The preferred declined from 49¾ to 48½, then rallied to 50, fifty shares selling at the higher figure. Fifty shares of Northwestern Elevated common changed hands at 17½, and an odd lot of the preferred at 45. Three hundred Union Elevated sold at 2⅛.

Other Traction Securities

In the Boston Traction group Massachusetts Electric preferred has been the most active. It rose on fairly large transactions from 72¾ to 74, reacting later to 73½. Massachusetts Electric common has been curiously dull around 19. Boston Elevated sold as high as 139½, dropped to 138, then recovered to 139¼. West End common was dealt in between 91¾ and 92, and the preferred between

110 and 111. Realizing sales in some volume have been reflected in the United Railway issues on the Baltimore Exchange. The income bonds declined from 54 to 52⅝, the general mortgage 4s from 91 to 90, and the stock from 8 to 7½. Charleston Consolidated Street Railway 5s advanced a point from 84 to 85. Atlanta Street Railway 5s was strong at 105⅞ and 106. City and Surburban, of Baltimore, 5s were in good demand at 113⅛, up to 113½. Other sales comprised Columbus Consolidated Street Railway 5s at 104¾, Lexington Street Railway 5s at 96, and Baltimore Traction convertible 5s at 102½.

Speculation in Miami & Erie Canal Transportation stock was the feature of the trading in Cincinnati last week. The failure to get through the Legislature the bill changing the electric canal-boat towing project to a steam road, resulted in a tremendous slump in this security. Speculators who believed that some plan might still be worked out to make the property valuable, bought freely in the stock, and over 2500 shares changed hands with a range of from 1½ to 3¾, the latter the closing price for the week; one lot of 1000 shares sold at 2, the middle of the week. The demand for Cincinnati, Newport & Covington common and preferred continued strong. About 400 shares of the common sold at between 30¼ and 30¾, and over 500 shares of the preferred sold at 85½ to 86½. Detroit United sold at 64½ to 65, Cincinnati, Dayton & Toledo at 21, Cincinnati Street Railway at 138, and Toledo Railways & Light at 20½, all small lots.

The only noteworthy feature in the local curb dealings has been the advance in Interborough Rapid Transit on large transactions. A week ago the stock rose from 107⅞ to 108⅝ on sales of 1400 shares. During the last week it went to 110½, reacting later to 110, with sales of 2300 shares. Two hundred New Orleans Street Railway common sold at 9½, and 100 more at 9. Fifty New Orleans preferred went yesterday at 30. The only other dealings were the sale of 1500 Washington Traction preferred from 45 to 44¾, 100 United Railways of St. Louis preferred at 55, and one lot of Syracuse Rapid Transit bonds at 100¼.

Tractions were apathetic at Cleveland last week. Cincinnati, Dayton & Toledo sold at 21, a shade in advance of previous sales. Three small lots of Northern Texas Traction sold at 32¾, also a slight advance over previous sales. A small lot of Northern Ohio Traction & Light sold at 15¼, a fractional decline. Clevelan Electric advanced to 75 on a small sale.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with two weeks ago:

	Closing Bid March 22	Closing Bid April 5
American Railways	43	43
Aurora, Elgin & Chicago (preferred)	—	—
Boston Elevated	138½	139
Brooklyn Rapid Transit	43	44¼
Chicago City	*158	—
Chicago Union Traction (common)	6	5
Chicago Union Traction (preferred)	30½	30
Cleveland Electric	73½	72½
Consolidated Traction of New Jersey	63	62
Consolidated Traction of New Jersey 5s	105½	105
Detroit United	64	64
Interborough Rapid Transit	108¼	109
Lake Shore Electric (preferred)	—	—
Lake Street Elevated	1¾	1½
Manhattan Railway	143¼	142
Massachusetts Electric Cos. (common)	19	19
Massachusetts Electric Cos. (preferred)	72	74
Metropolitan Elevated, Chicago (common)	16½	a17
Metropolitan Elevated, Chicago (preferred)	a48½	48
Metropolitan Street	112⅛	113¼
Metropolitan Securities	77	80
New Orleans Railways (common)	9	8½
New Orleans Railways (preferred)	29	29
New Orleans Railways 4½s	79	a78
North American	85¼	84½
Northern Ohio Traction & Light	14½	14½
Philadelphia Company (common)	40	*38⅞
Philadelphia Rapid Transit	14	13¾
Philadelphia Traction	95½	95¼
St. Louis Transit (common)	12	11
South Side Elevated (Chicago)	90½	90
Third Avenue	120½	120
Twin City, Minneapolis (common)	92	91
Union Traction (Philadelphia)	48½	49½
United Railways, St. Louis (preferred)	54½	52
West End (common)	90	92½
West End (preferred)	109½	110¾

a Asked. * Ex-dividend.

Iron and Steel

The quarterly statement issued yesterday by the Steel Corporation, while showing a very heavy shrinkage in earnings from a year ago, is nevertheless encouraging proof that the corner has been turned in the steel industry. Net receipts turn out to have been over twice as large in March as they were in January. The directors of the company, moreover, have seen fit to continue a full 7 per cent dividend on the preferred shares. The conclusion to be drawn from the report can hardly be otherwise than hopeful as far as the future is concerned. Return to the great prosperity of eighteen months ago is not, of course, to be expected but the worst has evidently been seen of the recent depression, and a fairly prosperous condition is to be looked for during the rest of the season. In the lower branches of the iron industry demand is reported as increasing. Southern makers are well filled with orders for two months ahead, and are taking a moderate amount of additional tonnage. With the Northern makers business is even more active. In the higher branches of the trade the situation is fairly satisfactory, the n ain blot on the outlook being the hostile attitude of labor in New York City. Quotations are as follows: Bessemer pig iron $13.85 Bessmer steel $23, and steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 13½ cents, tin 28 cents, lead 4 7-16 cents, and spelter 5⅛ cents.

MEXICO CITY TRACTION MERGER

The Compania de Ferrocarriles del Distrito Federal de Mexico, S. A. (the Federal District Railway Company of Mexico), which operates an extensive system of electric traction in Mexico City and suburbs, has purchased the Compania Mexicana de Traccion which concern was recently granted concessions for the construction of upwards of 100 miles of track in and around the capital of the southern republic.

The first named enterprise is owned by a British capitalized concern—the Mexico Electric Tramways, Limited, in which the London financial house of Wernher, Beit & Company is the dominant factor. The Wernher-Beit people also control electric traction systems in South Africa, Chili and Portugal. About 120 miles of road are in operation, while concessions have been secured which permit of the building of fully 50 miles more track. According to the last financial statement, the capital of the Mexico Electric Tramways is £1,900,000. Last year some 35,000,000 passengers were carried over the system. The receipts amounted to nearly $3,000,000 (Mexican). Practically all the material, equipment, etc., is of United States manufacture.

The Compania Mexicana de Traccion is controlled by Americans. The capital of the company is $500,000, subscribed by Pittsburgers. The president of the company, who is now in Mexico City, is M. R. McAdoo, formerly general manager of the Pittsburg, McKeesport & Connellsville Railroad Company. The American board of directors, styled an advisory board, is composed of James B. Oliver, president; Julius Bieler, treasurer; James H. Park, Reuben Miller and Frank B. Smith. These gentlemen, with the exception of Mr. Oliver, are prominently interested in the Crucible Steel Company. The company acquired what are known as the Moylan, Garcia & Reguima concessions, permitting of the building and operating of about 100 miles of line, 50 miles in Mexico City proper, and the balance in the suburbs. These franchises were for the construction of several miles of track running parallel to the Wernher-Beit lines. The company also obtained a concession for the building of about 10 miles of line in Mexico City down past the Chapultepec fortress to one of the most flourishing suburbs. One of the most important features of this franchise is that it gave the company a valuable entrance into the city. The necessary permits have also been secured for lines to traverse the Colonia del Paseo and the Colonia Nueva del Paseo also over the streets of the American colony. The Empreso del Circuito de Banos, a 2-mile horse road, which operates in the heart of the Mexican capital, was also taken over by the American company.

W. W. Wheatley, who recently resigned from the general management of the railway department of the Public Service Corporation of New Jersey, has been appointed general manager, vice Charles Clegg, at the special meeting of the board of directors of the Federal Company, which met in Mexico City last week, when the purchase of the Mexican Traction Company was finally consummated. No official particulars are yet available as to the purchase price. Mr. Wheatley resigned from the Public Service Corporation on Feb. 1, and left for Mexico City about two weeks later. He entered on his new duties April 1.

THE EARNINGS OF THE CLEVELAND ELECTRIC RAILWAY

President Horace E. Andrews, of the Cleveland Electric Railway Company, has inaugurated a campaign of publicity regarding the business of the company, and has made public the statement of earnings of the company for last year, showing the decrease in earnings caused, the company says, by the decrease in fares and the alleged abuse of transfers.

The statement, as given out, shows only the gross earnings of the company by months. The months during which the company failed to show an increase in earnings were November, December, January and February. Abnormal conditions prevailed, however, during January and February. If the company had been operating on its present ticket rate schedule, it would have scarcely held its own in earnings, not including the extra day of Feb. 29. The growth of the use of transfers after universal transfers with transfer to and from Willson Avenue were adopted was very great.

The table of earnings made public by Mr. Andrews has earnings of both the Cleveland City and the Cleveland Electric Railway Companies compared for the year 1902, and that portion of 1903 prior to consolidations. It is as follows:

	1903	Increase or Dec.	Per cent Increase or Dec.
January	$360,937.17	$39,529.90	12.29
February	328,088.92	37,614.92	12.95
March	373,214.21	35,276.87	10.44
April	380,172.91	47,739.25	14.36
May	415,746.05	43,566.14	11.71
June	403,854.20	39,279.60	10.77
July	405,408.48	14,559.87	3.63
August	404,062.29	10,421.43	2.65
September	385,758.73	10,875.38	2.90
October	385,022.55	2,666.48	.70
November	355,822.26	*13,490.56	*3.65
December	362,023.38	*14,419.22	*3.83
First quarter	$1,062,240.30	$112,421.69	11.84
Second quarter	1,199,773.16	130,584.99	12.21
Third quarter	1,195,229.50	35,856.00	3.09
Fourth quarter	1,102,868.19	*25,243.30	*2.24
First half	$2,262,013.46	$243,006.68	12.04
Second half	2,298,007.69	10,613.38	.46
Total	$4,560,111.15	$253,620.06	5.89

	1904	Decrease	Per cent Decrease
January	$332,090.90	*$28,537.80	*7.99
February	317,399.37	*10,689.55	*3.25

*Indicates decrease.

The table showing the growth of transfers by months shows the percentage of traction patrons who rode on transfers:

	Per cent
	1903
January	10.36
February	11.90
March	10.15
April	14.53
May	11.74
June	47.19
July	76.11
August	76.30
September	84.16
October	70.35
November	50.54
December	52.92
	1904
January	45.99
February	49.70
	1903
First quarter	10.75
Second quarter	24.94
Third quarter	78.63
Fourth quarter	60.16

BROOKLYN COMPANY TO INSTALL 5500 KW TURBINE.

The Westinghouse Machine Company has received an order from the Brooklyn Rapid Transit Company for one 750-r. p. m., 5500-kw turbine connected to a 25-cycle three-phase Westinghouse alternator, wound to give either 6600 volts or 11,000 volts The Transit Company expects to install this set in the proposed extension to its Kent Avenue power station.

PARIS LETTER.

(From Our Regular Correspondent.)

Interest in traction affairs in Paris continues to center round the Metropolitan Railway concessions. The company reports that it has carried out, as far as is practicable, the recommedations of the Prefect of Police regarding the improvement in its stations. These recommendations have been embodied in a report made by the Commission appointed after the lamentable accident of August last, which report has not yet been made public. Certain details of the report are evident from the action taken by the Metropolitan Railway. The backs of all seats in the stations have been removed, and the lighting circuit is connected to feeders independent of the circuit supplying current to the tunnels for lighting purposes. This avoids all chances of the station being thrown into sudden darkness by reason of failure of the lighting circuit in the tunnel. In addition large electric signs have been placed showing the outlets from the stations, and oil lamps have been furnished for all stations. Duplicate exits are also to be provided at all important new stations.

The most important station as yet constructed on this system, and also that involving the greatest amount of constructional work, is that at the Opera, and is fast approaching completion. The station consists of three levels, for three different lines, Nos. 3, 7 and 8, respectively. These stations are superposed at depths of 6, 12 and 18 meters from the surface. Although the two lower portions of the station are not far advanced, arrangements have been made that their completion will not interfere with the traffic on the upper story of the station, which is destined for the No. 3 line, called Courcelles-Opera-Place Gambetta.

This line is approaching completion and will shortly be put in service. The equipments have been ordered and are due about the end of June next. This means that public service will be in all probability started towards the end of the summer. The equipments will be of the usual train control system, similar to the Sprague-General Electric system, known in America. Ninety equipments will be furnished by the French Thomson-Houston Company, arranged for two motors of 175-hp each. A novel feature will be the use of double-truck cars of a length of 15 meters. All controlling mechanism is to be mounted in special cabs at the head of the motor cars, which cab will be armored and insulated from the rest of the car. The trains will consist of five cars, the three alternate ones being motor cars, and the second and fourth cars trailers. Special insulated cables will in all probability be used, and the cars will be undoubtedly built of fireproofed wood.

The new Opera station is laid out on very simple lines, the main staircase will have a breadth of 9 m, and the ticket office a superficial area of 324 sq. m. The length of platforms is 75 m and their width 4 m. The station will probably be furnished with elevators between the three levels, this being the first Metropolitan station to be so equipped. The line itself runs under the busiest thoroughfares of the city, the inner boulevards, and is expected to give great relief to the center of the city.

1903 appears to have been a fairly prosperous year for most of the French tramway companies. Their annual meetings will soon be held, and meanwhile several of them publish the following results of traffic receipts and increases over 1902:

	Receipts, 1903 Francs	Increase Over 1902, Francs
Cie Generale Parisienne de Tramways	8,193,433	577,059
Cie Francaise de Tramways de Bordeaux	4,384,068	314,265
Cie de Chemins de Fer Nogentais	2,412,766	247,167
Cie des Tramways de Nice	2,016,627	206,866
Cie des Tramways de Rouen	1,989,925	8,833
Société des Tramways d'Amiens	611,753	21,159
Société des Tramways Algeriens	790,349	54,791

The Nice Tramway Company, the largest, perhaps, outside of the metropolis, is a model of progress. It is stated that the company will build a new double line between Villefrance and Beaulieu, a very hilly district, and to equip the line with twenty cars with multiple-unit or train control system. This will be the first use of the train control system on French tramways, and will undoubtedly be followed by other applications. The cars will be equipped with two 50-hp motors each.

The existing omnibus and cab companies are keenly feeling the competition of the Metropolitan system, and the Prefect of the Seine has just approved of a new tariff for cabs, varying from 75 centimes for first kilometer, and 25 centimes for following for two-place vehicles to 1.25 per first kilometer and 40 centimes for following kilometers for six-place cabs and carriages. About 1000 vehicles are to be licensed on this basis and each will be furnished with a new "taxameter." The formation of a company, with a capital of $80,000, is announced to work this patent meter.

The strike on the Est Parisien tramways lately come to an end, has been followed by one on the Paris-Arpajon light railway line. About 200 men are out, and demand various concessions of which

all do not relate to wages. For instance, overtime is not paid extra, and only one day a month is given as rest. Pay is made monthly. The men demand a fixed day of rest per month, or two days not fixed. Pay is to be made fortnightly, with extra pay for overtime. These are their principal requests, and neither side appears to be able to give way on any detail. The steam trains are kept running, as required by the company's charter, but the electric service has been stopped.

The Est Parisien lines, which are operated largely by the surface contact system, are in a very bad way, and the company's shares appear to indicate that a crisis is approaching in the company's affairs. As is well known, Paris has had enough of the surface contact system, and it is very doubtful whether any more franchises will be given for this system of traction.

The Curtis steam turbine is about to make its appearance in France. The Thomson-Houston Company has obtained the sole right to make and sell in French territory, and announces that it has just received an order for two 800-kw machines for installation in the station of the Nice Gas & Electricity Co. The turbines will be delivered this year and ready for service.

A scheme is on foot to provide a complete light railway system for the Department of Haute Vienne. The total length will be 325 km, and the estimated cost over $5,000,000. The project will be presented, when complete, to the general council of the Department.

Another project is to provide a feeder to the existing line passinging through Mt. Blanc and uniting the French and Italian side of the Alps. Chamomix will be the French terminus, where a junction will be made with the narrow-gage electric line connecting with the network of the P.-L.-M. Railway. The French and Italian governments will shortly be approached in the matter.

The Oporto Tramway Company has asked estimates for the transformation of its line into single-phase, 25 cycles in place of the present 500-volt d. c. This step has been taken as the result of the successful applications of single-phase motors in the States, the Lamme motor especially having made a good impression. The installation is of some importance, requiring the use of four 500-kw steam turbine groups. It is proposed to use a voltage of 1000 volts outside city limits and 400 volts within. This would occasion the use of transformers on the cars to step-down the voltage to 400.

Resulting from the Berlin-Zossen high-speed experiments, it is announced that the German government has decided to put into service a "lightning train" of the same description as used at Zossen, between Berlin and Hamburg. A special track will be reserved for this train, and the speed will be 200 km per hour. German engineers expect this line to be in service before the end of the present year. This would reduce the time of transit between Berlin and Hamburg to two hours.

CONDITIONS IN BLOOMINGTON AND NORMAL

Bloomington and Normal, Ill., are now in every way the quiet, peaceable cities they were before Jan. 1, when the conductors and motormen of the Bloomington & Normal Railway went on strike. Cars are run on regular schedule, the volume of traffic is even greater than ever before and the present employees are more efficient than the old men. On the Union Depot and Front Street lines the traffic has actually increased to such an extent that the company has found it necessary to place larger cars in service.

The strike was caused by the refusal of the company to comply with a demand of the union for an increase in wages. As a result about fifty-seven men went out, including three regular and two extra line men and shop men from the car house. All the power station employees, who are non-union, remained at their posts. The strike soon digressed into a series of riotous demonstrations increasing in boldness until a protective league of citizens was formed to guard the public interests and police the streets. One of the worst demonstrations against the company was made on Jan. 3 at the Court House Square, where a car was almost totally wrecked. Fortunately no one was injured. Of the several attempts at dynamiting cars, the most dastardly was made at 8 p. m. Jan. 30 on a Front Street car, at the corner of Front Street and Robinson Avenue. Charles F. Evers, whose home is in St. Louis, and who formerly worked for the St. Louis Transit Company, was the motorman of this car, and the conductor was a man who had deserted the strikers. A young woman passenger was severely injured in this attack.

More than half of the men who went on strike have applied to the company for reinstatement, but so far only five have been taken back and they are now working as extras. The men work eleven and twelve hours a day and average $65 a month.

The company has recently established a school for motormen, in charge of C. Robinson as instructor. The results are very satisfactory.

A NEW COMPANY TO COMPLETE LINE BETWEEN NEW YORK AND PHILADELPHIA

A charter has been granted in New Jersey for the New Jersey Short Line Railroad, which is to be an extension of the Trenton & New Brunswick Railroad from Milltown to Elizabeth. The company is incorporated for $300,000. The incorporators of the company are: Richard D. Ashbridge, of East Downingtown, Pa.; Thomas P. Phillips, Abraham A. Moyer and Thomas R. Heller, of Philadelphia; Thomas P. Curley, George H. B. Martin and John H. Sintzeo, of Camden. The road will extend from Milltown Junction, where the Trenton & New Brunswick Railroad connects with the Middlesex & Somerset, for New Brunswick, across the Raritan River, and thence direct to the Kill von Kull, at Elizabeth. It is presumed that passengers will be carried by steamer or ferry from this point to New York City. The road will be constructed under a steam railroad charter, and both passengers and freight can be carried. It will be entirely upo. private right of way. The Trenton & New Brunswick Company has been working upon the plan for nearly two years. While this line is being built a through service will be run from Trenton to Jersey City, via New Brunswick, Bound Brook, Plainfield and Elizabeth. This will be begun May 10, and the fare will be 80 cents single or $1.50 excursion. The distance from Jersey City to Trenton, via Bound Brook, is about 72 miles. Owing to the difference in gages it will be necessary to transfer passengers at Trenton, on the trip from Jersey City to Camden. The lines north of Trenton are all standard gage, while the Camden & Trenton line is 5 ft., and the Philadelphia, Bristol & Trenton (Pennsylvania line) is 5 ft. 2½ in.

THE FLOODS IN INDIANA AND OHIO

The floods this spring in Indiana have been unusually severe, and in Indianapolis are said to have been the worst in the history of the city. White River, Fall Creek and Pogue's Run have verified the warnings given some time ago of what they could do under proper conditions. Fortunately, there has been little loss of life, but there has been great damage to property and serious personal inconvenience to thousands. In the face of the serious damage the public service companies, one and all, have done very well. This is particularly true of the electric railway companies, many of which had tracks under water and their power plants and car houses partly submerged for days.

The waters began to recede on Sunday, March 27, and on Monday, March 28, with the apparent passing of the danger point, the interurban lines running into Indianapolis, all began active preparations to resume operations on regular schedule. The Northwestern Company's plant at Lebanon escaped serious damage, but it was impossible to run cars beyond Carter's Hill, just outside the Indianapolis city limits. The Shelbyville line of the Indianapolis & Cincinnati Traction Company experienced much damage in the neighborhood of Super Creek, just east of Brookfield. Passenger traffic had to be suspended. Sixty feet of the approach to the bridge at Sugar Creek were washed away, and the power house at Shelbyville was flooded. The Indianapolis & Martinsville line had a great deal of trouble near Martinsville, but there were no serious delays. The Indianapolis & Franklin line was damaged by Sugar Creek and Blue River. The bridge over the smaller stream was washed away, and one of the 150-ton bridges was torn from its fastenings and thrown up on the bank at one side. The Indianapolis & Plainfield line was forced to suspend operations because of the flooding of the West Washington Street power plant in Indianapolis, from which its lines are operated. The Kokomo and Broad Ripple lines of the Indiana Union Traction Company suffered severely, and for several days cars were not run through from Kokomo to Indianapolis.

Several Ohio Interurban roads are again affected by floods, the condition being especially serious in Western Ohio, owing to the overflow of the canal feeder system. The Celina division of the Western Ohio Railway bordering Grand Reservoir was washed out and the city of Celina was in danger of being submerged. The Western Ohio power station at St. Marys was partially submerged, but did not close down. At Findlay the Toledo, Bowling Green & Southern Traction Company's line was again washed out, and at Troy and Piqua the lines of the Dayton & Troy Electric Railway and the Springfield, Troy & Piqua Traction Company were covered by water. Some of the city lines at Zanesville were tied up and the new power station was in danger for several days. At Fremont the Lake Shore Electric Railway was flooded for the fourth time this winter, and the company was obliged to transfer passengers through the main street of the city.

MUNICIPAL OWNERSHIP VOTE IN CHICAGO

On Tuesday, April 5, at the municipal election in Chicago, a ballot was taken on three propositions bearing on the street railway situation.

The first of these was as to whether the "Mueller law" should be adopted and put in force in the city. This law was passed by the last Legislature, and authorized cities in Illinois to construct, own, operate and lease street railways, and to provide the means therefor.

The second proposition asked for an opinion as to whether, if the Mueller law be adopted, the City Council should proceed without delay to acquire ownership of the street railways.

The third proposition asked for an opinion as to whether the City Council should, instead of granting any franchises, proceed at once under the city's police powers and other existing laws to license the street railway companies, until municipal ownership could be secured.

The last two, manifestly alternative propositions, were placed upon the ballot merely for the purpose of securing the opinion of the voters, the result of the vote having no legal bearing on the situation.

The chief interest in the election centred in the vote on the "Mueller law." This vote stood 152,433 for and 30,104 against the proposition. On the proposition that the city should at once take over the street railways into its control the vote stood 120,744 for and 50,893 against. For the temporary licensing of street railways until such time as the city is prepared to take them over, the vote was 120,181 for and 48,056 against.

ANOTHER STEAM LINE TO BE ELECTRIFIED

It is said that the plan for electrifying the Keeseville, Ausable Chasm & Lake Champlain Railroad, to which reference was first made in the STREET RAILWAY JOURNAL months ago, has been worked out and that the work is to begin at once. The third-rail system is to be adopted. The road extends from Port Kent, Essex County, N. Y., to Keesville, Clinton County, and was built thirteen years ago, mainly to supply freight facilities for the pulp, paper and horseshoe nail mills along the Ausable River, which the road traverses for more than a mile. It connects with the Delaware & Hudson Railroad, and the Lake Champlain steamers. Traffic is heavy on the line in the summer, as an excellent view of Ausable Chasm can be obtained, and it is thought that the electric service will be more satisfactory than steam. The railroad crosses Ausable Chasm by means of a cantilever bridge, with trestle work at each end. In order to avoid future expense of repairing or replacing these trestles, it has been decided to fill in the ravines. One of these trestles is 160 ft. long. Thirty-eight feet is the greatest depth. The other trestle is 258 ft. long, and about the same depth. It will take about 29,000 cubic yards for the fill. The contact rail is to be placed 2 feet from the track rail, and protected by white pine plank. Power will be obtained from a dam across the Ausable River, constructed ten years ago. A new turbine wheel will be installed and 1200 hp will be developed.

MUNICIPAL "L" FOR NEW YORK

Senator McCarren has introduced in the Legislature a bill to provide for the construction and operation of a municipal elevated railway on Willoughby Street, Fulton Street, Brooklyn, the New York & Brooklyn Bridge and its terminals, Centre Street, Delancey Street, New York, the Williamsburg Bridge, South Fifth Street, Union Avenue, Throop Avenue, Willoughby Avenue, and under Fort Greene Park, Brooklyn, and to provide for the appointment of a commission to construct it. The bill authorizes the Mayor to appoint a commission to be known as "the Municipal Railway Commission of the City of New York," to consist of three members, who are to hold office until the railroad shall have been completed and turned over to the City of New York. The commission is authorized to use such portions of bridges across the East River as may be necessary. The Board of Estimate is, by the bill, directed to authorize the Comptroller to issue corporate stock or bonds of the City of New York to the amount of $15,000,000, at interest not exceeding 4 per cent, to be redeemed in fifty years to defray expenses. It is not to be lawful to charge any person more than 3 cents for one continuous ride from any station in Manhattan to any station in the Borough of Brooklyn or vice versa. Any net surplus is to be used to retire the stock and bonds, and whenever the increase of the receipts shall justify such action, the commission is to recommend a reduction of the fare charged to passengers.

BIG STEEL COMPANY IN CALIFORNIA

Street railway builders in Southern California are deeply interested in a mammoth steel company that has just been organized in San Diego. It is the Pacific Steel Company, which incorporated on March 19 with a capital stock of $100,000,000. The new company proposes to work ore deposits in Lower California and the Southwest. It is understood that coal is to be brought from Oregon. At the first meeting of the directorate on March 22 Gen. Harrison Gray Otis, of Los Angeles, was elected president. C. W. French, of Cleveland, Ohio, who originated the movement for incorporation, is chairman of the board of directors. Other officers of the corporation are: A. A. Purman, of Cleveland, Ohio, vice-president; Victor A. Dehnel, of Cleveland, Ohio, secretary; George W. Fishburn, of San Diego, treasurer; Victor E. Shaw, of San Diego, general counsel; Willard Fuller, of Cleveland, Ohio, general superintendent. The offices of auditor, general manager and chief engineer are left vacant for the present. The Union Trust Company, of Pittsburg, Pa., has been chosen fiscal agent for the Eastern States.

LAKE STREET ELEVATED CHANGES ITS NAME

At a meeting of the stockholders of the Lake Street Elevated Railroad Company, of Chicago, March 31, the name of the company was changed to the Chicago & Oak Park Elevated Railroad Company. The meeting was then adjourned until April 20. This is one of the moves that has been made as a preliminary to the reorganization of the company in the near future. The suggestion has been made that perhaps by this change of name the property will escape some of the odium that is attached to the old name which in the financial world is associated with twelve years of financial vicissitudes.

STRIKE ON CLEVELAND & SOUTHWESTERN

Motormen and conductors to the number of about 150, employed by the Cleveland & Southwestern Traction Company, went on a strike March 31. The demand of the men was for the discharge of H. A. Nicholl, general manager of the company, and the withdrawal of a number of rules he has instituted.

The trouble had been brewing ever since Mr. Nicholl took charge of the property, Nov. 1 last. Previous to that time the system had been operated on a rather loose basis, with no general manager in active charge. As a result, the men had grown careless and the number of accidents was abnormally large. Mr. Nicholl was engaged with the understanding that stringent reforms were to be instituted, and these he set out to accomplish with great earnestness. The dispatching system was thoroughly revised and the men were made directly responsible for carelessness in operation and accidents. A system of watch inspection was instituted which required that watches be examined every two weeks. Signal lamps and flags were placed on cars, and the running rules were made more stringent. Conductors were required to clean their cars at the end of each run and motormen were required to attend to the oiling of cars at the end of a run. Several other reforms were instituted.

The climax came when the manager instructed Superintendent E. W. Coe to suspend certain men for minor offenses. The order was not complied with and Mr. Coe was asked for hi resignation. Then the men met and formed a union and voted to strike. The question of wages did not enter into the controversy.

Monday night, April 4, officials of the company held practically an all-night session with the men, but no agreement was reached. On Tuesday noon, however, the strike was settled. The company signed an agreement with the employees and promised to change several rules that had been obnoxious to them. The men will not be required to sweep out or oil their cars, but it is probable that the layovers at the terminals will be done away with. The agreement provides for the employment of either union or non-union men. All old men are to be retained, however. The question of the resignation of Manager Nicholl was waived by the men, and he will continue. No attempt was made to operate cars while the men are out, but service was promptly resumed on Tuesday afternoon.

The New Hampshire Traction Company has issued an attractive folder, containing a map of its lines and connections, covering the territory between Lowell, Mass., and Rochester. It also has the time-tables of the several roads which connect Lowell, Lawrence, Nashua, Haverhill, Exeter, Portsmouth, Dover, Somersworth, Rochester and intermediate towns and beaches. The folders have been placed in all cars of the company's lines for free distribution to patrons.

REPORT OF THE ADOPTION OF THIRD RAIL ON DELAWARE & HUDSON

Again it is reported in Scranton that the Delaware & Hudson Company has decided to equip its line between Carbondale and Wilkesbarre, a distance of 34 miles, with the third-rail system. Some time ago the Delaware & Hudson reduced the fare between Scranton and Wilkesbarre to 20 cents, and since then its passenger traffic has been so congested that it has seriously interfered with the moving of coal trains. It is the company's intention, so it is said, to add two new tracks to the road, making four in all, and equip the new ones with an electric system for passenger trains exclusively. Competition between the Lackawanna & Wyoming Valley Railroad and the Delaware & Hudson is responsible for the latter company's reduction in passenger rates.

The Lackawanna & Wyoming Valley, which is the new third-rail road recently bought by the Westinghouse people, made a round-trip rate of 50 cents between Scranton and Wilkesbarre. The Delaware & Hudson, which had previously charged 85 cents, met the rival company's reduction by announcing a flat rate of 20 cents each way. At the same time several new trains were put on, in all aggregating thirty-three a day. It was then found that the present double track could not handle the business.

PENSION PLAN FOR "L" EMPLOYEES IN NEW YORK

The Interborough Rapid Transit Company, of New York, controlling the present elevated railway system, and the underground lines now building, is planning to submit to its employees for their approval a general pension scheme. The plan, as generally outlined, provides for a sick and death benefit and a pension to be paid after the retirement of an employee who has been on any one of the elevated road lines for a certain number of years. The sum to be paid in sick or death benefits, and in pensions after retirement is to depend on the amount paid in by the member who is to benefit by the pension. Unofficially it is said it is proposed to divide the pension fund into five grades—one to pay 50 cents a month, a second to pay $1, a third to pay $1.50, a fourth to pay $2 and a fifth to pay $2.50. Those who pay $2.50 a month are to receive $1 a day as a benefit for fifty-two days in case of sickness or an accident which prevents them from working. In case of death, their heirs will receive $1,000. Those who pay $2 a month are to receive a sick or accident benefit of $5 a week and a death benefit of $800. Those who pay $1.50 a month are to receive a sick or accident benefit of $4 a week, and a death benefit of $500. Those who pay $1 a month will receive no sick or accident benefit, but a death benefit of $200. Those who pay 50 cents a month will receive a death benefit of $100.

DISSOLUTION OF SOUTHERN COMBINE

The Norfolk, Portsmouth & Newport News Company, in which has been merged the Norfolk Railway & Light Company, the Berkley Street Railway Company, the National Gas Company, of Berkley; the Old Dominion Railway Company, of Portsmouth, and the Norfolk County Ferry Company, will be dissolved in a few days. This action was decided upon at a lengthy meeting held last week. Pending the final arrangements, no official statement has been issued.

It is stated that the Norfolk Railway & Light Company, the Old Dominion Railway and the ferries have always been independent concerns, and when the merger took place these companies simply pooled their securities, the recent meeting being to decide a basis for returning the securities which were pooled. It is said that the dissolution is due to the fact that, after a trial, the combined railways did not find the arrangement profitable, and all concerned felt that by the individual operation of the roads larger dividends could be paid the stockholders.

The ferries have been leased by the Norfolk, Portsmouth & Newport News Company, and it is understood that this concern will continue their operation. The Berkley road and National Gas Company will, it is stated, go back into the hands of the Railway & Light Company of America. It is yet to be determined how the Norfolk, Portsmouth & Newport News Company will be operated. It is said that the Norfolk Railway & Light Company and the Old Dominion Company have never lost their identity, even though these roads were in the merger. Some time back the Terminal Line withdrew from the Norfolk, Portsmouth & Newport News Company, and has since been operated separately.

CINCINNATI TRACTION RELIEF ASSOCIATION

The Mutual Aid Association, composed of employees of the Cincinnati Traction Company, met Tuesday, March 22, to elect officers and arrange to change its constitution. At present the members contribute as dues 25 cents a month each, and the Traction Company puts in $600 a month. With its 1800 members there is contributed $450 per month. In January and February $3,700 was paid out in sick benefits, and in nineteen days of March $1,300 more was drawn to pay benefits. Death benefits are $800, and if this amount is in the treasury at the time of a death no assessment is made. If not, the men are assessed $1 each. It is proposed to change the constitution so as to pay a sick benefit only when a member is sick two weeks or more. Last year's assessment on the men amounted to $5 for the twelve months, while in less than three months this year they have been requested to pay $4 in assessments.

PRESIDENT MELLEN OF THE N. Y., N. H. & H. ON ELECTRICITY

In a long interview which he gave a few days ago at New Haven, President Mellen, of the New York, New Haven & Hartford Railroad expressed the following view regarding the general substitution of electricity for steam as motive power on railroads:

"I believe we are rapidly approaching the time when steam will give way to electricity as motive power, and the steam engine or locomotive be consigned to the scrap heap. The great obstacles to-day to the substitution of electricity for steam as a motive power upon railroads are the character of the construction of the roads themselves, the frequency of crossings and the danger attending the conducting of the power by third rail.

"These will be greatly overcome, and in the near future; and looking ahead a very few years on such portions of systems as have eliminated these dangerous crossings, as, for instance, our line between New York and New Haven, I confidently expect to see the steam locomotive become in the nature of a curiosity."

Closely following this came the announcement that the New York, New Haven & Hartford Railroad will soon establish through electric service over the Fair Haven & Westville and other lines between New Haven and Waterbury and that negotiations are in progress to open a new line between Mt. Carmel and Cheshire. Electric railway connections will also be made with Meriden and Middletown.

ANOTHER FRANCHISE PLAN IN CHICAGO

John C. Fetzer, the new receiver of the Chicago Union Traction Company, has advanced a plan whereby the franchise question between the city of Chicago and the Chicago Union Traction Company might be settled at once. This plan is to grant the receivers of the Chicago Union Traction Company a franchise under which the city could at any time purchase the company's property at its physical value plus whatever value the franchises of the company may have as decided by the courts. This would, of course, provide for a settlement whichever way the court decides in the ninety-nine year act case. Under such an ordinance the company could probably secure money to make improvements at once, as whatever money was put into improvements would have to be paid by the city in case it took over the lines. Among the most needed improvements mentioned by Mr. Fetzer are 200 new cars and the erection of $1,500,000 power house.

CLEVELAND COMPANY ASKS FOR FRANCHISE EXTENSION

On Monday, April 4, the Cleveland Electric Railway Company presented to the City Council of Cleveland a formal proposition for a twenty-five-year franchise extension. The company offered to return to the old six-ticket-for-a-quarter plan and to issue one transfer for each fare. A report adverse to its acceptance was made by the Council committee, and the proposition was rejected. Last week the Council requested the company to make some proposition, and offered to relieve the company of all special taxations, such as paving, bridge maintenance, and grade-crossing expense. President Andrews of the company submitted figures to show that while the company would lose $200,000 in receipts as demonstrated by the previous experience with the six-tickets-for-a-quarter plan, it would be relieved of payment of between $70,000 and $100,000 under the special tax provision. Councilman Hitchens, leader of the Republican faction in the Council, has announced that he will endeavor to pass an ordinance extending the franchise of the company for twenty years, on a basis of seven tickets for 25 cents, and one transfer. His ordinance will be introduced next week.

LIMITED SERVICE ON OHIO ROADS

The Western Ohio Railway, of Lima and the Dayton & Troy Electric Railway, of Dayton, have effected a traffic arrangement for the operation of through limited cars between Lima and Dayton, Ohio, a distance of 83 miles. Each road will furnish one car, which will be especially equipped for the service, and each car will make two round trips, giving two limited cars each way per day. The 83 miles will be made in two and one-half hours, and the fare will be $1.45. The parallel steam road makes the run in two and one-quarter hours and charges $2.20. The new limited service will be an immense improvement over the present service, for, while the cars on the two roads connect, and tickets are sold clear through, the present running time is three hours and forty minutes. The two interests mentioned are planning to effect a traffic arrangement with the Cincinnati, Dayton & Toledo Traction Company, whereby limited cars may be operated from Lima to Cincinnati, a distance of 148 miles.

ELECTRIC TRACTION FOR CHRISTCHURCH, N. Z.

A contract for the construction and equipment of an extensive electric traction system in Christchurch, New Zealand, has been allotted. While the award was made to a local concern, practically all the material, equipment, etc., will be manufactured in the United States.

The New Zealand Electric Construction Company, which was organized recently for the chief purpose of developing the water powers in New Zealand, will carry out the work of building the Christchurch lines. Somewhat more than 30 miles of road will be constructed under the existing contract. The value of the contract is £250,000. The municipal authorities will operate the lines. Christchurch has a population of about 50,000. The city is built on a dead level. The existing lines are mostly operated by steam. The Canterbury Tramway Company runs an 8-mile road to Sumner. Another line goes to Sunnyside, and another runs to Port Hill Sydenham—all suburbs of Christchurch. In the city proper about 10 miles of steam and horse lines are operated. The municipal authorities have acquired all these systems, and they will be electrically converted.

The power house will be installed with Curtis turbines and Babcock & Wilcox boilers. The rails—6000 tons—have been ordered from the United States Steel Corporation. The special work will be of Lorain manufacture. The feeder cable will be supplied by the American Steel & Wire Company.

Thirty-five cars will be employed in the first instance. They will be built by the John Stephenson Company, of Elizabeth, N. J. The motors will be of General Electric build. The trucks will be of Peckham manufacture.

IMPROVEMENTS FOR HANDLING TRAFFIC AT CONEY ISLAND

The facilities of the Brooklyn Rapid Transit Company for handling the crowds that will visit Coney Island during the coming season will be greatly increased when the many changes and improvements now being made by the company at that resort are completed. The tracks on Surf Avenue and at the old Culver Railroad terminal have been relaid, switches rearranged and the depot reconstructed in part. The work involves an outlay for labor and material alone of about $107,000, while the acquisition of additional property necessary to carry out its plans cost the company considerably more. The trolley or surface car loops at the Culver terminal, of which there were four last year, have been shortened, and another loop added, making five in all, while, instead of the two tracks for elevated trains, which were so close together last year that there was no platform room between them, there are now four with ample space between the tracks for the reception and discharge of passengers. Then a number of tracks have been laid for the storage of cars and trains and on which extra trains may be kept for use in case of emergency, or should the regular service at any time be insufficient to care for the patrons of the company. To make room for the extra tracks the old buildings and sheds have all been removed from the yard, all that is left of them now being a long, narrow building, which it is planned to fit up for the use of trainmen. The depot building has been torn down in part in the rear, while the interior also has been remodeled, giving much additional room to passengers using any of the lines terminating there, and which will number nearly a dozen in all. The additional elevated tracks will enable the company to run six-car trains over both the Brighton Beach and Culver lines on two-minute headway, while last year one train had to be sent out before another could get in, as there was no room in the yard for switching. On Surf Avenue new tracks have been laid from the West End depot for cars on the Third Avenue and other lines heretofore terminating at the depot. All the improvements now being made will be completed by May 1 next, by which time the company expects to have the new system in full operation.

THREATENED STRIKE IN BROOKLYN

It is said that plans are well matured for a strike of the employees of the surface and elevated lines of the Brooklyn Rapid Transit Company, and that the strike may also involve the employees of the Interborough Company, operating the elevated lines in New York and the Bronx. The employees of both companies have been secretly organized, and at the last of a series of meetings held Monday in Brooklyn some 150 delegates are said to have made returns which show that the men are overwhelmingly in favor of striking in order to secure redress for certain alleged grievances. This is said to be particularly true of the Brooklyn men.

There is not the slightest intimation of what the grievance is of the Interborough employees, but the case of the Brooklyn men is different. Rumors of dissatisfaction have been heard there periodically for some time past. The principal grievance is said to be the question of wages. Some time ago a change was made from a daily to an hourly basis, which, the men say, worked out greatly to their detriment. Officials of the Brooklyn company say the men have no grievance and profess to know nothing of the impending strike. The Interborough management are reticent, but point to the recent wage adjustment made by them, mention of which was made in the Street Railway Journal of March 19.

AN EXCELLENT MACHINE TOOL CATALOGUE

The Niles-Bement-Pond Company, of New York, has just issued a new 750-page catalogue of machine tools, which, without doubt, is the most complete catalogue of its kind ever published.

The catalogue opens with six full-page illustrations of the several works of the Niles-Bement-Pond Company, and following these are thirteen pages of medals and diplomas awarded the constituent companies of this concern. After the medals the main part of the catalogue begins. First are the machines for railroad shop use, including a most complete line of driving-wheel lathes. Fourteen different full-page illustrations are given of these machines, showing all sizes from 51-in. to 100-in. swing, and one or two special machines adapted particularly to the use of modern high-power tool steels. The other railroad tools include three different styles of car-wheel lathes, a large variety of axle lathes, cutting-off and centring machines, quartering machines, car-wheel borers and hydrostatic wheel presses.

The next division of the catalogue is devoted to lathes, including all sizes, from the Pratt & Whitney bench lathe to the massive Bement 125-in. crank-shaft lathe. Fifty pages are devoted to planing machines, and a specially large variety of heavy planers are shown. The large portable rotary planers are among the most interesting machines described in this section of the catalogue. Slotting machines and milling machines take a large number of pages, several very handsome full-page illustrations being devoted to work done on the Pratt & Whitney thread milling machine. Many heavy drills are shown, including vertical drills, radial drills and multiple drills.

Fifty pages are devoted to boring and turning mills. Here again the large mills are most interesting, but more space has been devoted to describing the smaller machines. The 16-ft. and 20-ft. mills are particularly massive. Following the section on boring and turning mills are a few pages devoted to miscellaneous machine tools, and then comes a very complete line of boiler-shop machinery, including plate planers, bending rolls, punching and shearing machines, hydraulic presses, steam and hydraulic riveters. In the latter part of the catalogue the full line of Bement steam hammers is illustrated, together with a number of installations of Niles electric traveling cranes. The last pages are devoted to the small tools made by Pratt & Whitney Company.

In the arrangement of the catalogue particular care has been taken to put the various machines in their logical order, so that any machine can be found without reference either to the table of contents in the front of the book or the complete index at the back. Metric as well as English dimensions are given throughout, and code words are placed under each machine.

The whole catalogue is a remarkably fine piece of press work, the cuts coming out with great sharpness and clearness. Some idea of the size of the book can be obtained from the fact that it weighs about 10 lbs., the entire edition amounting to 75 tons of catalogues. While the catalogue is not intended for general distribution, it will be gladly sent to users of heavy machine tools.

FRANCHISES $16,363,745 HIGHER IN NEW YORK

Increases aggregating $16,363,745 in the special franchise valuations in New York City are shown in the figures for 1904 just made public by the State board of tax commissioners in Albany. The total is $251,521,450, as against $235,157,725 for 1903. This does not include valuations to the amount of $26,600 placed against corporations last year, but not valued this year. There are increased assessments for the large companies, more particularly the Manhattan Railway Company.

The largest street railway items in the list for New York City are:

	1903	1904
Brooklyn Rapid Transit	$26,803,000	$26,878,000
Coney Island & Brooklyn R. R. Co	895,000	895,000
Interurban Railway System	74,386,300	74,790,000
Manhattan Railway Company	47,100,000	50,075,000
N. Y. & Queens Co. Ry. Co	1,040,000	1,110,000

TROLLEYS TO TRANSPORT FIRE APPARATUS

Arrangements have been made with the Schenectady Railway Company by the city officials of Schenectady, Albany, Troy and Amsterdam for transporting fire apparatus between these cities in case of emergency. A large flat car, suitable for taking any of the apparatus will be stored at the car house of the Schenectady Company. In case of fire at any of the other cities the Schenectady apparatus will be loaded and shipped to the scene of the conflagration, and in case of fire in Schenectady the car will be sent to the other cities, there to load the local apparatus.

NEW PUBLICATIONS

Hendricks' Commercial Register of the United States. Published by Samuel E. Hendricks Company, New York. Cloth, 1228 pages. Price $6.00.

This extensive volume is designed to place before buyers and sellers, full lists of manufacturers and dealers in everything employed in the manufacture of material, machinery and apparatus used in architectural, mechanical, engineering, contracting, railroad, iron, steel, mining, mill, quarrying and kindred industries. It contains over 350,000 names and addresses, classified according to States, towns and industries, and should prove of great convenience to those who have occasion to consult lists of this kind.

The Theory of Advertising. By Walter Dill Scott. Published by Small, Maynard & Company, Boston, Mass.; 233 pages. Price, $2.00 net; by mail, $2.15.

The author, who is director of the psychological laboratory of Northwestern University, has given in this book a simple exposition of psychological principles in their relation to successful advertising. Beginning with a few simple and definite principles, he elaborates each one in turn and shows its proper application, using for his examples specimens of actual advertisements. It is interesting to note in connection with the author's criticisms, most of which were printed originally in Mahin's Magazine, that he has received many complimentary letters from advertisers who followed his advice with successful results. The discussion on the preparation of time-tables, about six pages in length, is especially worthy the attention of railway men. The book is written in a very entertaining style and cannot fail to be of use to all who are concerned in making announcements of various natures to the public.

La Machine Locomotive, by Edouard Sauvage. Published by Ch. Béranger, Paris. 379 pages, Illustrated. Price, 5 francs.

This is the fourth edition of M. Sauvage's well-known book on steam locomotives, and was written especially for the use of railroad mechanics and employees. After the introductory chapter on the history and general principles of locomotives, the writer takes up the different parts of the standard machines, commencing with boilers and continuing through the different parts of the steam mechanism, then treats of the body, method of suspension, wheels, brakes, etc. Two final chapters are devoted to the subject of the maintenance of the locomotives, the care required by them, and the repairs to them. Although the Continental type of locomotive is especially considered, there is considerable treatment of American practice.

The Truth About the Trusts, by John Moody. Published by the Moody Publishing Company New York. 514 pages. Price, $5 net.

The long statistical experience and reputation of John Moody has fitted him especially for the compilation of this book, which is undoubtedly the most comprehensive manual published of the large industrial, railroad, mining, financial and electrical corporations of this country. In the introductory chapters of the volume the author points out the purpose of the book, which is to "throw at least partial light upon the momentous and steadily growing trust movement," believing in this way that the impracticability of many of the proposed "remedies" will be shown; and while the book is not a defense of the trust idea in general, the author believes in conservative regulation, and that the trust is in a sense an evolution of the natural growth of the country. He does not, however, minimize the evils which have occurred in their past development, among them that of inflated capitalization, although he points out that many of the trusts, like the Standard Oil Company, are under rather than over capitalized. The book is divided into seven parts, the first of which discusses the greater industrial trusts. Then follow chapters upon the lesser industrial trusts, important industrial trusts in process of reorganization or readjustment, the greater franchise trusts, the greater railroad groups, classified statistics of all trusts, and a general review of the trust movement. In the franchise trusts statistics are given of a number of the largest street railway companies, including those in New York, Brooklyn, Philadelphia, New Jersey and Boston. The book is illustrated with a large number of very interesting diagrams.

Dizionario Tecnico in Quattro Lingue, Tedesco, Italiano, Francese, Inglese, by Ing. E. Webber. Published by Ulrico Hoepli, Milan, Italy. 611 Pages. Price, 6 liri.

There has been up to the present a great lack of technical dictionaries in which any attempt has been made systematically to cover electrical terms, and in this book Mr. Webber is supplying a real need, as the fact that the dictionary has already passed through its first edition testifies. The book is of pocket size, and each page is printed in two columns and in the following order for the volume before us: German, Italian, French, English. In this edition the first edition has been revised and enlarged by the addition of about 2000 terms.

STREET RAILWAY PATENTS

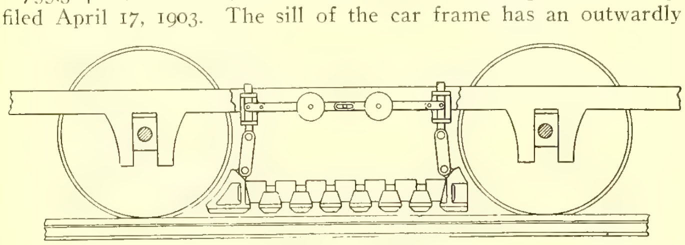
[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED MARCH 22, 1904

755,140. Electric Railway Signal; Bertram M. Kershner, Pittsburg, Pa. App. filed June 21, 1902. A signal wire extends over a block and is normally grounded at one end; the car automatically disconnects one end from the ground and connects it to a source of current supply to actuate the signal.

755,203. Electromagnetic Rail Brake; Karl A. Wilde, Hamburg, Germany. App. filed Dec. 1, 1903. Comprises a plurality of pole pieces provided with tubular extensions detachably connected, brake-shoes carried by the pole pieces, coil boxes mounted thereon and means to prevent angular displacement of the pole pieces.

755,314. Street Car; Charles K. Pickles, Philadelphia, Pa. App. filed April 17, 1903. The sill of the car frame has an outwardly extending flange and a step secured to the flange by means applied under the flange and step.



PATENT NO. 755,203

755,391. Electric Railway Shoe; Henry Rosenfeld, New York, N. Y. App. filed Aug. 19, 1903. The shoe has a V-shaped rib on its contact surface, and is weighted to force the rib into snow or ice on the conductor.

755,468. Rheostat; Arthur C. Eastwood, Cleveland, Ohio. App. filed Dec. 21, 1903. Wiring connections of a controller are avoided by mechanically fastening the contact fingers to a metal frame, to which the resistance circuit is applied and connected.

755,509. Car Fender; George Lanhard and Philip Lanhard, Sublett, Mo. App. filed March 9, 1903. Consists of a frame, a pair of side rails pivoted at their inner ends to the frame front and side buffer-springs, a catch basket mounted between the frame and side rails and automatic connections for securing the side rails when lowered and permitting them to rise when struck to form a catch receptacle.

755,539. Pneumatic Sander for Car Trucks; Charles A. Pratte, Denver, Col. App. filed Oct. 30, 1903. Comprises a sand receptacle

mounted on the truck, and an ejector, also mounted on the truck and connected in operative relation with the receptacle and means mounted on the body of the car for supplying the necessary fluid for operating purposes.

* UNITED STATES PATENTS ISSUED MARCH 29, 1904

755,744. Controller; Frank E. Case, Schenectady, N. Y. App. filed Oct. 1, 1902. Across the face of the controller drum an elongated coil is arranged so that its field of force includes all of the arc gaps, a single coil thus serving to disrupt arcs at all points of the controller.

755,782. Electrical Contact Device; John Lindall, Boston, Mass. App. filed Oct. 8, 1903. A third-rail contact shoe, consisting of a box-shaped piece of metal resting at its extremities against a leaf spring to prevent rattling.

755,788. Car Fender; Albert E. McLean, Toronto, Canada. App. filed Dec. 30, 1903. Consists of fender supporting arms adjustable relatively to the roadbed, fender adjusting stays to adjust the fender support arms, and hold them in their adjusted position and fender platform carried by the fender supporting arms.

755,794. Fender; Charles H. Root, Cleveland, Ohio. App. filed Aug. 3, 1903. A main rear sliding fender and a spring to shoot the same forward, a fore tripping fender hinged at the front end of the main fender, a catch holding the main fender against movement, and connections, independent of the main fender, between the fore fender and the catch, acting when the fender is tripped to release the catch.

755,822. Train Control System; George P. Whittlesey, Washington, D. C. App. filed Sept. 26, 1902. A train control system in which the number of train wires are reduced to four and standard car controllers utilized.

755,825. Railway Brake Apparatus; Granville T. Woods and Lyates Woods, New York, N. Y. App. filed Dec. 31, 1902. Means whereby in the case of the motorman becoming incapacitated, the train may be stopped automatically, or by a passenger, or by a flagman.

755,872. Car Fender; James T. Heron and John J. Crowley. New Bedford, Mass. App. filed Jan. 6, 1904. Details of construction.

755,889. Electric Railway System; Timothy Mahoney, San Francisco, Cal. App. filed April 20, 1903. Details.

755,889. Electric Rail Bond; Jang Landsing, Brooklyn, N. Y. App. filed April 25, 1900. Comprises a strap of metal slitted into narrow strips between its extremities, the strips being bent at succeeding points to afford flexibilty.

755,905. Electric Traction System for Railways; August Meuschel, Montreal, Canada. App. filed May 4, 1903. The driving means are spherical in form and rotate in variable planes, parallel to the line of motion of the car, so that the effective diameter of the driver can be altered without altering the speed of its rotation.

755,999. Electric Trolley Head; John T. Cherry, Plymouth, and Edward H. Clive, Devonport, England. App. filed Nov. 3, 1902. Details.

756,060. Car Fender; Frank A. Schaaf, Cleveland, Ohio. App. filed March 14, 1903. Details of construction.

756,156. Signal Apparatus for Trolley Railways; Almo L. Cheatham, Louisville, Ky. App. filed Aug. 8, 1903. A contact is touched by the trolley wire when it lifts the main conductor in passing, thereby actuating a signal in advance of the car.

756,188. Brake; Frederick Stoltzenburg, St. Louis, Mo. App. filed Oct. 12, 1903. A shaft mounted between two aligned wheels having two eccentrics oppositely thereon, oppositely directed rods having one end connected to the eccentrics, brake-shoes aligned with each other and with the aligned wheels and attached to the outer ends of the eccentric rods, and means for rocking the shaft to simultaneously force apart the brake-shoes and apply them to the opposite aligned treads of the wheels.

ALLIS-CHALMERS COMPANY BUYS CINCINNATI FOUNDRY

The Bollmann-Wilson Company's plant at Norwood, a suburb of Cincinnati, has been sold to the Allis-Chalmers Company, through the Bullock Electric Manufacturing Company, of Ohio, which is the leasing company of the Bullock establishment.

The Bollmann-Wilson foundry at Norwood was established there by Hoefinghoff & Laue at the request of the Bullock Company, which stated that it would take all the castings that the Norwood foundry would turn out. This purchase will give the Allis-Chalmers Company a modern equipped foundry, a shop with an area of 40,000 sq. ft. and six acres of land. The property lies across the street from the Bullock plant on Forest Avenue. It is the intention to improve the foundry property as soon as possible and make additions. Besides the castings that will be needed for Bullock products there will be manufactured at this foundry castings for Allis-Chalmers manufactures.

PERSONAL MENTION

MR. J. W. McCOYL has been appointed superintendent of the Evansville & Princeton Traction Company, of Evansville, Ind.

MR. H. CHAPMAN has been appointed superintendent of construction for the Montreal Street Railway, of Montreal, Que.

MR. F. G. KELLY has been elected secretary of the Topeka City Railway Company, of Topeka, Kan., to succeed Mr. T. W. Berry, who resigned some time ago to go to Chicago.

MR. CHARLES WATSON, a director of the Public Service Corporation of New Jersey, and former secretary and treasurer of the Camden Gas Light Company, of Camden, N. J., has died.

MR. E. W. COE, for some time superintendent of the Cleveland & Southwestern Traction Company, of Cleveland, Ohio, has resigned, and has been succeeded by Mr. J. A. Nestor, of Norwalk, Ohio.

MR. J. J. O'BRIEN, cashier and chief clerk of the Chicago office of the General Electric Company, has become general auditor of the engineering firm of H. M. Byllesby & Company, of Chicago.

MR. W. F. FURBECK, well known in Chicago street railway circles, formerly associated with Chas. T. Yerkes, has recently become connected with the McGuire-Cummings Manufacturing Company, of Chicago.

MR. D. H. SAWYER has resigned as city engineer of Paris, Ill., to accept a position as assistant to General Manager L. E. Fischer, of the McKinley street railway syndicate, with headquarters at Danville, Ill.

MR. FRANK R. PHILLIPS, assistant master mechanic of the Cleveland Electric Railway Company, of Cleveland, has accepted the position of master mechanic of the Cincinnati, Newport & Covington Traction Company, of Covington, Ky. He will assume his new duties at once.

MR. J. BRACKETT RUSSELL, auditor of the Tacoma Railway & Light Company, of Tacoma, Wash., has been appointed to fill a similar position at Manila, Philippine Islands, for the Manila Railway & Light Company, which American capitalized concern is building an extensive system in that part of the world.

MR. W. W. S. BUTLER, who for some two years has been general manager of the Durham Traction Company, of Durham, N. C., has resigned from the company. Mr. Butler has not been well for some time, and will recuperate at Clifton Springs, N. Y., before again engaging in active work. His successor is not yet announced.

AT A RECENT MEETING the directors of the Ingersoll-Sergeant Drill Company adopted unanimously a resolution expressing their deep sympathy at the death of the company's president, the Hon. William Russell Grace, at one time mayor of New York City. Mr. Grace has been succeeded as president by Mr. William L. Saunders, who has been vice-president since 1897.

MR. WILLIAM E. HUTTON, secretary and director of the Interurban Railway & Terminal Company, of Cincinnati, and director of the Cincinnati, Dayton & Toledo Traction Company, has been appointed a member of the Board of Public Service of Cincinnati. It is understood that he will resign his positions with these companies in order to devote his full time to the new work.

MR. M. M. WITHAM, who acted as one of the construction engineers for J. G. White & Company, Ltd., of London, in the building of the Auckland (New Zealand) Electric Traction System, will arrive in New York next week en route for the Philippines, where he will be attached to J. G. White & Company's engineering force engaged in the construction of the Manila electric traction system.

MR. CLAUD T. CAYLEY, vice-chairman of Dick, Kerr & Company, Ltd., of London, sailed from New York for Liverpool on the "Oceanic" on April 6. Mr. Cayley has been making a visit of about three weeks in this country, and about two weeks in Canada, having sailed from England on March 2. Mr. Cayley was for many years chairman of Dick, Kerr & Company. He resigned from that position last December on account of pressure of private business, and was succeeded by Mr. John Kerr, but accepted the office of vice-chairman in order to retain an active interest in the corporation. He reported a very active interest in electric traction among the large steam railroad corporations in England, and that the recent equipment of the Liverpool & Southport division of the Lancashire & Yorkshire Railway, described in the last issue of this paper was attracting wide attention. Mr. Cayley's visit to this country was partly on private business and partly for pleasure.

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, APRIL 16, 1904 No. 16.

Published Every Saturday by the
McGRAW PUBLISHING COMPANY

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues)............................. $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

The Municipal Ownership Vote in Chicago.

The vote favoring municipal ownership in Chicago, as announced in last week's issue, has aroused such general comment among street railway men over the country, and so many have asked, "What does it really mean?" and, "What will be its practical effect?" that it is in order to reply to these inquiries as far as they can be answered at the present time. First of all, the only question of any immediate legal bearing on the situation that was decided by the people of Chicago at last week's election, was the adoption of the Mueller law. By the adoption of this law the citizens of Chicago have empowered the municipality of Chicago to become an owner of street railways. By adopting this law they have simply availed themselves of the powers given by the last Illinois Legislature, which passed the Mueller law mainly because great pressure was brought upon it by citizens of Chicago. It was practically certain before the election that the Mueller law would be adopted for Chicago. However, an act giving the city the legal right to own street railways and the actual acquirement of these properties are two very different matters.

In addition to adopting the Mueller law, the people of Chicago expressed themselves as favoring the licensing of the present companies until such time as the city can acquire the properties. Although nothing more than an expression of the sentiment or opinion of the voters, this expression may have much to do with the method of settling the present franchise controversy. Franchise negotiations had already dragged along to such length before election without settlement, that it had been suggested that some kind of a license plan providing for purchase by the city might be a quick solution that would overcome the present apparent deadlock.

As to why the vote resulted so strongly for municipal ownership there are a number of explanations. In general it may be said that it is to be taken more as a kind of public protest against existing conditions than as an indication of careful study of the situation by the voters. In fact, the vote shows that the more the people think about it, the less favorable they are to municipal ownership. Two years ago when a similar vote was taken, the results showed a larger majority favoring municipal ownership than at this last election. The majority of voters in Chicago have a rather misty idea of the exact status of the franchise question. They simply know that the service is bad, without knowing why, and that a franchise controversy has been going on for the past three years. By a very simple process of reasoning they have concluded that since the service is bad, and there is private ownership now, it might be better to change to municipal ownership, and almost any change from existing conditions would be welcome. They do not stop to consider that the reason the service is so inadequate is primarily the lack of right to invest more capital in improving the service. This right the companies would be only too glad to get and act upon, but it has been constantly denied them by the city. Part of the vote is also due, of course, to the industrious municipal ownership agitation that has been carried on in Chicago. It is perhaps also needless to say that, independent of any other consideration, the city has not the borrowing power sufficient to acquire the properties, as it is very near its constitutional debt limit. Whatever may be the opinion about or results obtained with municipal ownership of street railways in Europe, every fair minded student of American municipal policies must admit that the general constitutional provision against the creation of an excessive debt has been one of the wisest provisions that has ever been adopted in city government in this country.

Single vs. Double Enders

The use of what is known in common street railway parlance as the single ender car, viz., the car with a controller only at one end, has increased considerably in the past seven years. In spite of the fact that many thousand cars are now equipped with controllers only at one end, there are still many managers who are violently opposed to this principle for service in a large city. This opposition is based mainly on the impossibility of turning cars back at a cross-over when the street is blocked by fires, parades or other causes beyond control, and the impossibility of using stub terminals. The sin-

gle ender must have a Y or a loop to turn on, and if it can not be turned in the case of a blockade, it is a case of keep on, or shut down until the blockade is cleared, or else of backing the cars for some distance. The larger the city the more formidable do these difficulties become, and it is probably for this reason that single ender cars are found mainly outside of the very large cities. It is also usually much easier to secure Y's or to make use of cross town routes for switching in a small city than in a large. On the other hand, each intersecting cross town line, if provided with proper curves, and cross-overs to join it to the main line, can be made a turning point, and these cross town lines are most frequent in large cities. Blockades occur more frequently in large cities, so that it is of greater importance to have frequent points where cars can be turned back. That so many systems are successfully operated with single ender cars is due simply to the fact that ample precautions have been taken for turning cars, or that controllers have been provided for emergency use on the rear platforms.

The tendency toward single enders has been due partly to a desire to save the cost and maintenance of one controller, but more especially to the wish to provide the motorman a vestibule by himself, and to have a large and convenient rear platform for passengers. The large platform can be obtained whether the car be double or single ender, but if the large platform is used with a double ender car, and if passengers are to be kept off the front platform, considerable platform space is wasted. It is also usually necessary to provide a vestibule for the front platform, and if the car is a double ender, both platforms must be vestibuled, whereas with single ender cars the rear platform can be left open, to the great convenience of all concerned.

One compromise is to plan the car for single ender operation ordinarily, and to provide a controller on the rear platform for emergency use. But to make this arrangement of much practical value, the usual single ender arrangement of having no steps on the front platform must be changed and a part of the advantages of single ender design thereby thrown away.

Vibration of Motor Coils

The short article elsewhere on rebuilding of a certain type of motor field coil at St. Louis serves to call attention to a fact that seems to be none too well known among motor repair shop men, namely, that vibration or lost motion between the turns of a motor coil of any kind is fatal to insulation. The nearer we can come to a coil that is solid clear through, without the least play or chance for vibration between the turns of wire, the longer our coils will last on electric railway motors. We have known of several cases where this has been conclusively proved. There are probably two reasons for this. One is that vibration between the conductor wires or straps tends to wear the insulation; but the main reason is that a coil that is not mechanically solid gives a chance for moisture to work in when moisture is present, and moisture is sure to be present at times in electric railway service. Of course, a coil might be mechanically solid without being moisture proof, but as a matter of practice, the process of making the coil mechanically solid consists in applying insulating material in such a way that the coil is made both mechanically and electrically solid at one and the same time. Master mechanics that are having an undue amount of trouble with motor armature and field coils, should ask themselves at once whether the coils they are using are so constructed and so fixed in place on the motor that they are solid mechanically and free from openings which will allow moisture to creep in. If they are not it is time to start a reform in the shop. Very often what would appear to be a very solid construction mechanically is one which permits considerable vibration between turns of wire. This is especially the case with field coils wound permanently on a brass shell, and if this construction is adhered to, special precautions must be taken to make the coil solid in the shell, with no chance for motion between the turns or between the coil and shell, and furthermore, the shell itself must be fastened to the pole piece in such a way as to prevent it working loose in time.

Fortunately, insulating material is of itself sufficiently elastic, so that once the turns of a coil are solidly embedded in it and the whole coil is covered with it, we can clamp the coil in place, and by bringing the right pressure to bear on the coil the elasticity of the insulation will serve to prevent lost motion for a long period of time. This is assuming, of course, that the clamping pressure is just sufficient to hold it firmly and sufficiently even not to crush insulation.

An Unwarranted Extension of the Liability Principle

An interesting example of the growing tendency of the public to attempt to hold street railway companies liable for damages on all possible or impossible occasions was illustrated recently in Boston, when a woman living in Mattapan sued the railway company for $2,000 damages, alleging that she caught cold in an open car on a rainy day, and was thereby incapacitated for six weeks. The plaintiff stated that she boarded an open car on Sept. 5, last, when it was raining, to come to town; that the curtain on the left side of the car was fastened down, but that on the right side was only half down; that the rain blew in, and after five minutes she asked the conductor to pull down the curtain. He complied, but did not fasten it, because passengers had to enter and leave the car from that side. The woman still complained, and the conductor advised her to get off and wait for a box car, but she chose to remain, and thus caught cold.

The question of the liability of a company to passengers for injuries of this kind is extremely interesting and one which, if carried to its logical conclusion, would make the company responsible for pretty nearly every disease to which the human frame is susceptible. Undoubtedly a company can be obliged by municipal enactment to provide cars which are properly adapted to the season, but open cars are suitable for September weather, and the woman's own admission showed that the company did its utmost to make her comfortable, up to the point of sacrificing the convenience of the other passengers, as long as she remained in an open car, and that she could have taken a closed car if she had so desired, by a short wait.

We cannot make use of the machinery of civilization without exposing ourselves to some form of danger, whether we take an elevator in shopping expeditions, ride in a steam train from New York to Denver, or burn gasoline in an automobile. The risk may be minimized by careful operation, watchful maintenance and good construction, but the smaller hazards of physical fatigue, loss of time through delays and slight indispositions like "car sickness," or even sea sickness, cannot be reduced to a basis of compensation on the part of the company in whose care we place ourselves. It is a hopeless impossibility to suit every passenger alike, and it will remain so as long as human temperatments and constitutions do not sink to the dead level of being absolutely alike in reference to the barom-

eter, hygrometer, thermometer, anmometer and weather vane. It seems to be inherent in human nature for each person to believe that the conditions which suit him best are those which are, or ought to be, satisfactory to the majority of his fellow citizens. It is impossible to suit everyone, and conductors who are asked by one passenger to close the ventilators, and by the next to open those that are shut, realize this as well as, if not better than, anyone.

Centralized Management of Railway Properties

Year by year the number of engineering firms and companies which make a business of managing street railway properties in different parts of the country is increasing. This class of business seems to be one which is peculiar to the last few years. The methods employed are various, and in some instances the managing firm is not identical with the owners, although, of course, very closely identified with the latter, and has been selected for managing the properties partly on account of its facilities for conducting the engineering work for the properties and partly because it has made a specialty of management.

The engineering and managerial firm is essentially a development of the system of financial syndicates which is a feature now so common in both street and steam railroad work. Twenty years ago there were in existence comparatively few financial syndicates controlling electric railway properties in the country, and these syndicates were composed of a few men only who were associated together quite as much by personal considerations as by business ties. The number of such syndicates, however, has been steadily increasing, and, as a rule, the basis has been financial considerations rather than those of an engineering nature. As the size and importance of the properties controlled by these syndicates increased it was but a natural step to secure the services or affiliation of a competent engineering firm to undertake the construction engineering of the different properties. The next step was the extension of the field of the engineering firm or company already referred to, to include the management of the properties controlled by the financial syndicate on account of the confidence of the capitalists in its engineering and executive ability. Still another variation is the combination by the engineering firm of facilities for financing properties, by means of their association with several syndicates. In this case the part taken is more than that of a financial expert only, as the properties are often discovered, purchased, reorganized and developed on the initiative of the firm, and are then held for permanent investment or marketed on the basis of their earnings.

There are, of course, certain arguments which can be presented against this form of ownership and management. Chief among these is the popular sentiment, which for the most part is only a sentiment, that when a road is owned by capitalists living in the city in which the road operates, local pride and a knowledge of local conditions tends toward the maintenance of a better service than if the road is owned and its policy directed from a distance. We believe, however, that this sentiment on the part of the general public is gradually disappearing with the greater diffusion of wealth. Corporation securities in one form or another, are now such a favorite form of investment among all classes of people having a little money to invest, that it no longer seems as important from a public standpoint to have all, or the greater part, of local enterprises owned in the city or county in which they do business. On the other hand, a great many economies result from centralized management, and it would seem that there is a growing field for this class of consolidation, particularly among the smaller electric railway companies.

It is well known that electric railways of moderate size frequently suffer as much from lack of good management as from anything inherent in the conditions under which they operate. Larger companies have revenues which will keep them out of financial trouble, even with indifferent supervision. With the smaller companies it is only by good management that any profits can be realized, yet it is just this element which they are most likely to lack, and which can be secured by centralized direction. Very often the lack of true economy is due to ignorance on the part of the local owners of the property who are not acquainted with progressive methods, and are not aware of the shortcomings in the operation of their properties. For all such roads the assumption of management by some engineering concern of recognized ability would be the realization of the best results of which the property is capable. The management of the smaller properties is naturally not as attractive to engineering concerns as that of larger corporations, but for those who will make a special study of these smaller propositions, there would seem to be a good opportunity.

The Sightliness of a Company's Work

People are judged by the clothes they wear until we know them sufficiently to obtain another basis for judgment. A prominent street railway manager recently expressed some views to the writer in regard to the sightliness and general appearance of a company's work in a community, and which are worth considering by every public service corporation. This manager believes that whatever his company does in the way of the erection of buildings or any other similar construction should represent the highest standard of work to be found in the vicinity. This does not necessarily imply that all the new buildings which a company finds it necessary to erect should be extravagantly decorated or unnecessarily expensive, but it does mean that what work the company does should be of a solid, substantial, first-class character, second to nothing of a similar class of work in the community. The manager just referred to believes that the same principle should not apply to buildings only, but that so far as possible all improvements should be of a permanent character so that from the character of its buildings and other work the public would understand that the company was in the community to stay, and that it was investing much of the money made by it in permanent improvements in the community instead of simply spending what was absolutely necessary to keep the road in operation with the expectation, as he put it, of getting "kicked off the streets" any day.

There is much sound judgment in this view. Many companies do not need to have it brought to their notice, but it is well for those who maintain that money spent in improving the appearance of a company's property does not pay dividends, to stop and consider the moral effect of a public sentiment which a first-class appearance of all the company's property has. Of course, there are a few citizens who will argue that a company able to maintain the most substantial structures found in a city, is making undue profit, but the great majority have an added respect for the corporation which is "well dressed," and is inclined to add to rather than detract from the general appearance of a city. As regards the rolling stock, it is, of course, that portion of the company's property which is most in evidence, and it has long been realized that nothing has a better effect upon public sentiment than good cars, well-uniformed and alert employees and regular service.

ENGAGING AND EXAMINING MEN ON THE BOSTON ELEVATED RAILWAY

All men who enter the elevated train service of the Boston Elevated Railway are engaged first as brakemen, and work on the rear cars of trains and open side doors on station platforms.

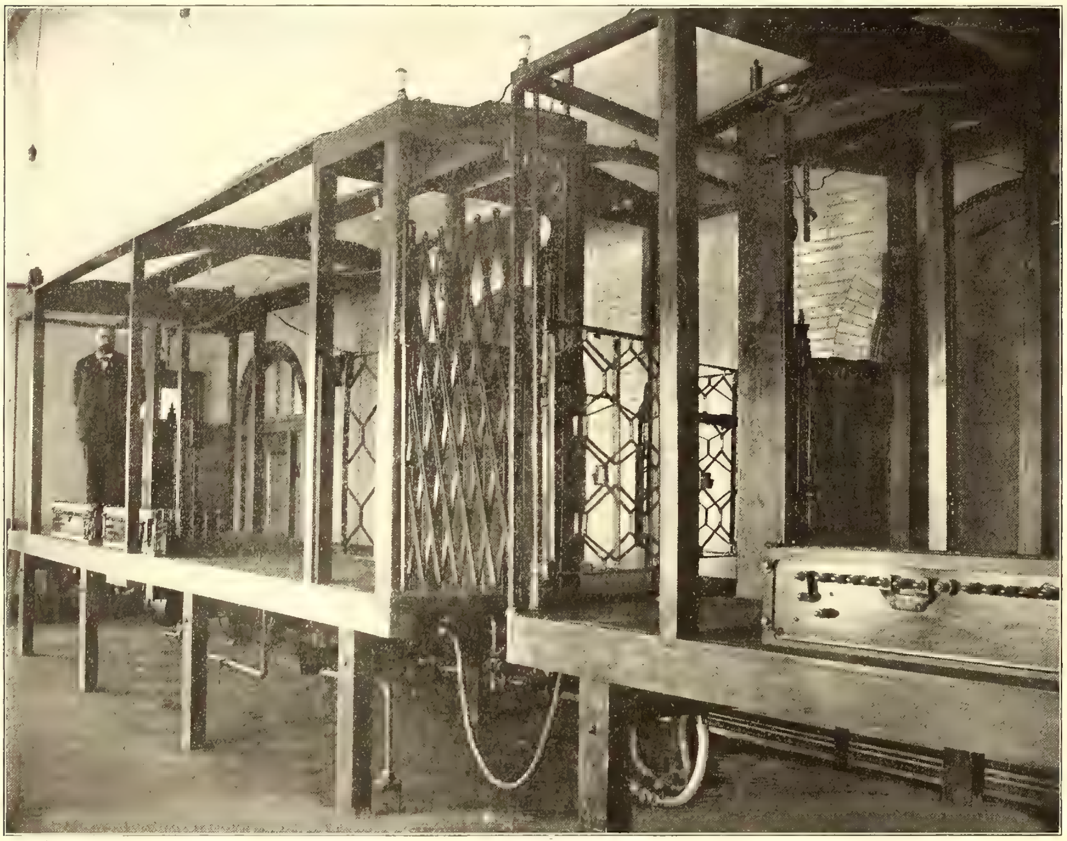


FIG. 1.—SKELETON OF TRAIN USED FOR INSTRUCTION OF MOTORMEN AND GUARDS

From brakemen they are promoted to guards, who are in general charge of the train and are directly responsible for the first two cars, and from this position employees are promoted to that of motormen, all promotions being made in the order of rating, provided the men qualify for the higher grade. The wages paid are: Brakemen, 18½ cents an hour; guards, 21 cents an hour; motormen, 23 cents an hour for the first year, 24 cents an hour during the second year, and 25 cents an hour thereafter. In addition to these wages the men receive what is known as "service-stripe pay." For each five years that a man has been in the employ of the company he is required to wear a "service stripe" on his sleeve, and for each stripe up to three thus worn he receives 5 cents per day in addition to that called for in the schedule mentioned above.

All men to be accepted in the elevated train service of the company must be not less than 21 years or more than 35 years of age, although on the surface division the maximum limit of age is 45 years. Applicants must also be not less than 5 ft. 6 ins. in height, and must be able to read and write the English language intelligently. The application for employment which the man who wishes to enter the service of the company is required to fill out, calls for a statement as to where he has been employed during the previous five years, his reasons for leaving that employment, as well as other questions which are usually included in a form of this kind. This statement has to be sworn to as true, to the best of the man's knowledge and belief, before a notary public.

After his references have been looked up and have been found satisfactory, he is given a physical examination by the company's surgeon, to determine whether he has any constitutional or organic defects which might interfere with the efficient discharge of his duties. About 12 per cent of the men examined by the physician are rejected, the usual cause of trouble being in either the kidneys, heart, lungs or feet. The applicant is then examined for eyesight, color perception and hearing, as will be described in detail later in this article. If this examination is passed successfully, and only about 25 per cent of the total number of men who apply for positions on the elevated division succeed in passing all of the examinations so far described, a certificate of physical completeness is furnished him by the medical examiners. The examinations are, as a whole, more severe than for the surface divisions of the company, and are in charge of H. A. Pasho, superintendent of the elevated lines.

After being accepted for employment the applicant is instructed as to his duties in three ways: orally, by instruction on a model train, to be described later, and in actual service on an elevated train. The school room, shown in Fig. 1, is equipped with a skeleton three-car, full-sized model train as shown, equipped with all of the apparatus used in the elevated service except the trucks, but with the controllers, air and hand brakes, gates and all other parts of a complete train. Here the men are taught by G. H. Benjamin, train master of the Boston Elevated Railway Company, or by one of his assistants, how to couple up cars, make the necessary electrical connections, give and respond to the various signals, operate the gates, etc.; in fact, to carry out the entire duties of the position which they are to fill. In the same room men who have been promoted to motormen are instructed in the manipu-

BOSTON ELEVATED RAILWAY COMPANY.

BUREAU OF ELEVATED LINES.

RECORD OF EXAMINATION OF SIGHT, COLOR-SENSE AND HEARING.

Name. Occupation. No. Date. 190 .

SIGHT.

Acuteness of Vision, without Glasses,	Right Eye.	Left Eye.	Both Eyes Open	Reading Test, both Eyes Open,	Without Glasses.	With Glasses
Distance in feet at which standard test-type are read,				Size of reading test-type read correctly,		
Smallest line of standard test-type read correctly,				Written train orders read correctly (Yes or no)		

Vision with TEST GLASSES was ... satisfactory.

Position Signal Test, without Glasses.	Right Eye.	Left Eye	Both Eyes Open.
Distance in feet at which card with semaphore arms can be read correctly,			

COLOR SENSE.

Test Skein Submitted.	Numbers on the Skeins in Standard Holmgren Color Set, selected as similar to Test-Skeins.
A Green.	
B Rose.	

Selection was HESITATING PROMPT.

Testing Lantern, two lights.	Size of Opening.	Number shown	1	3	2	4	3	5	4	6	5	7	6	8	7	9
		Name given														
	LARGE.	Number shown	8	10	9	11	10	12	11	13	12	1	13	2	1	3
		Name given														

Standard Testing Lantern. One Light.	Size of opening used.	Number of color shown	1	2	3	4	5	6	7
	Number.	Name given.							
	SMALL.	Number of color shown	8	9	10	11	12	13	1
		Name given							

HEARING.

Number of feet at which numbers or words can be repeated correctly when spoken in a conversational tone.	Right Ear.	Left Ear.
Number of feet as which ratchet acoumeter can be heard.	Right Ear.	Left Ear.

Examiner.

EXAMINATION

REMARKS

FIG. 2.—FORM OF RECORD KEPT OF EXAMINATION OF SIGHT, COLOR-SENSE AND HEARING

lation of the controller, cut-outs and the rest of the electrical apparatus.

The first period of duty of the new employee on an actual train is as an "extra" on the front platform of the second car, in company with the regular guard, who also acts as instructor. Here the learner performs the actual duties of a guard, and is taught by the instructor the practical work of a brakeman. No man is finally put in service as a brakeman until he has completed the required course of instruction, both on the platform and in the school room, and has passed an examination upon both courses of instruction and also upon the rules. No brakeman is promoted to guard until he has taken further instruction in the school room and has passed the proper examination for this position. The promotion from guard to motorman follows a similar rule.

A reference has been made to the physical examination for eyesight, hearing and color blindness, and as tests of this kind are more infrequent on electric railway systems than are those for physique, some particulars of the methods followed may be of interest. The tests are given not only to all new men who apply for work, but all men in the elevated train service are re-examined yearly, and a careful record is kept of the results of the tests on a form, a reproduction of which is shown in Fig. 2.

The first test is that of reading the standard oculist charts. The employee is seated at a distance of 20 ft. from the printed chart, as shown in Fig. 3, and the size of type which he is able to read with the right eye and left eye separately, and with both eyes together is recorded. A record is also made of the smallest test type which can be read correctly at a distance of 20 ft. when using a pair of test glasses, which have been secured from an oculist, and which show whether the applicant will have trouble with nearsightedness as he grows older. The standard of the company is that if he can read the letters on a No. 20 test chart with both eyes together, and with at least one eye, and can read the No. 30 chart, which has larger letters, with the other eye, he is accepted. In the yearly re-examination of men who are already in the train service of the company this test is applied with a little more leniency than in the case of new applicants, and in some cases if the employee can read the No. 30 test chart with each eye separately he is passed.

As shown in the blank upon which the results of this examination are kept, all statistics of this sight test are recorded, together with the ability of the man examined to read written train orders correctly.

The next test is that of color perception, which is conducted in two ways, viz., by small skeins of worsted of different colors and by colored lantern lights. In the worsted test, shown in Fig. 4, Professor Holmgren's system for testing defective color perception is used. It consists of showing the employee about 125 small skeins of worsted of various colors, all tagged and numbered, also three large skeins, one light green, one rose and one red. The man who is being examined is given one of these large skeins, and is asked to pick from the collection of small skeins all those of the same general color, irrespective of shade. The numbers on the tags on the different colors selected by him are recorded in the blank under the heading, "Color Sense," as well as whether the selection was made in a hesitating or prompt manner. In applying this test it is found that occasionally some men with good color perception get confused over this test, not knowing just what is required. In cases of this kind it is the practice of Mr. Rideout, who has this matter in charge, to show the man what is desired by making a half-dozen selections himself. The skeins are then again mixed up and the man asked to match the colors. To those who are not color blind, it might be said that a person thus afflicted can distinguish between light and dark shades, but that the skeins appear to be all one color. The same effect can be secured by

FIG. 3.—EXAMINATION FOR SIGHT

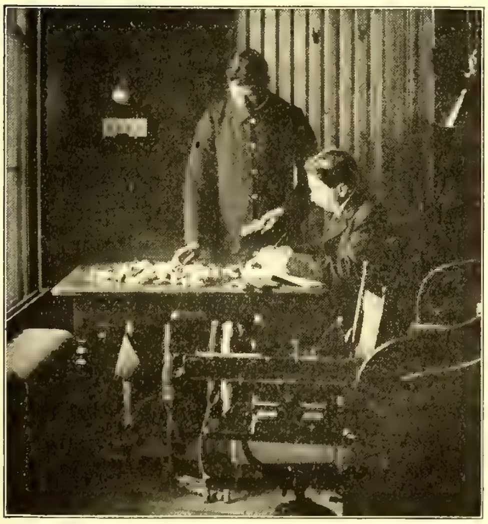


FIG. 4.—EXAMINING FOR COLOR SENSE

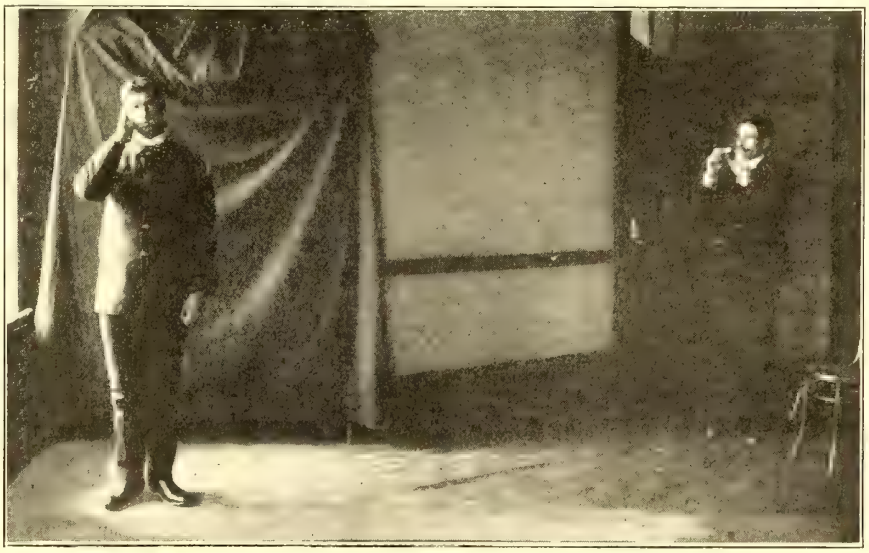


FIG. 5.—EXAMINING FOR HEARING

an ordinary person by looking at the collection of worsteds through green-colored glasses.

The next test is that with the lanterns. For this purpose the company uses a lantern made by Peter Gray, and containing thirteen combinations of colored lights, arranged to show through different sized openings. The colors are called by the applicant when seated in a darkened room and facing the lantern, which is at a distance of 20 ft. As the color of each light is called, it is entered in the record book. Any serious mistake in calling colors in either the lantern or worsted test is sufficient to cause rejection.

The lantern is arranged to show colored lights through three sizes of opening, and is also fitted with a third lens, which is darkened to simulate the appearance of a semaphore light when dimmed by fog or smoke.

Minor mistakes made during this examination, that go to show that the applicant is simply not an expert on color names or shades, do not affect his selection; but if the mistakes are radical, such as calling red green or green red, it is properly believed that the man could not be entrusted to perform his railway duties with safety.

The final test is that on hearing, and is illustrated in Fig. 5. The hearing test consists in having the applicant repeat words

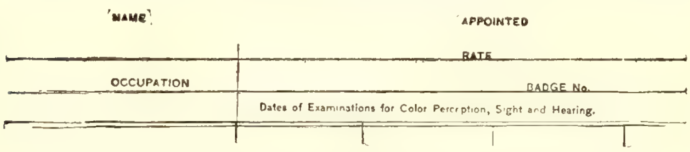


FIG. 6.—UPPER PART OF CARD USED FOR KEEPING RECORD OF DATES OF EXAMINATION FOR COLOR PERCEPTION, SIGHT AND HEARING

spoken to him in ordinary conversation as well as count the ticks from an acoumeter, held at a distance of 20 ft. The acoumeter is simply a ratchet ticker, which is turned by the examiner. The results of this test are also recorded in the blank used for this purpose and shown in Fig. 2.

It is interesting to note that of the new applicants about 8 per cent are rejected for defective color perception, 10 per cent for unsatisfactory vision, 4 per cent for failing to pass satisfactorily with the test glasses, and 1 per cent for defective hearing. From the opening of the road, on June 10, 1901, up to Oct. 21, 1903, about 400 men of the staff have also been re-examined, and of this number 300 have been twice re-examined. Out of this number only two have failed on account of defective color perception, one only on account of defective hearing, and two, who were brakemen, failed to qualify for promotion on account of defective vision.

The date of examination of each man is kept on a card catalogue, a reproduction of which is shown in Fig. 6. This card gives his name, occupation and badge number and the dates of his last examination for color perception, sight and hearing.

MOVING THE PUBLIC FORWARD

Often when all the seats on a car are occupied, and a few people are standing up in the aisle or on the back platform, some loud-mouthed individual will board the car, stand in everybody's way when he could easily move to the front of the car, and if the conductor requests him to move up a trifle, he will remark in a loud tone that the public is being insulted. As a universal rule, standing passengers remain either on the rear platform or near the rear end of the car even when there is plenty of room in the front end of the aisle. This gives the car the appearance of being packed, and some people standing on the street and seeing both ends crowded, refuse to board the car. This involves a serious loss to a company, which if that vacant space could be utilized would be very beneficial.

One way that could be utilized to keep people moving forward in a car, would be by compelling passengers to enter by the rear platform and leave by the front platform. Another would be by obliging them either to get their transfers from the motorman or have them stamped with the time by him. In the latter case the conductor would give out only blank transfers. When the car reached the transfer point, the passengers would hand the transfer to the motorman, and he would stamp the time with a rubber stamp or punch, or the transfer could be run through a dating machine. This would insure a correct time stamp, and a conductor on another line would be justified in refusing to accept a late transfer.

Another means of making passengers move forward would be to keep the hand straps at the rear end of the car out of reach until those in front were occupied. This would not be a difficult matter.

The blocking of passageways in a car is very detrimental, and, as a general thing, the people who do so are the ones who are the loudest in their denunciation of the company. Means should be employed to stop it, even if the aid of the Police Department has to be invoked.

HOTEL ACCOMMODATIONS AT ST. LOUIS

In view of the meeting of the American Street Railway Association in St. Louis on October 12 and 13, of this year, a great deal of interest centers in the hotel accommodations in that city. A number of new hotels are under construction, and among them is "The Inside Inn," which is being built within the grounds of the Exposition, and which will have accommodations for a large number of people. The older and permanent hotels, located in the city of St. Louis, will, however, accommodate a very large proportion of the visitors to that city during the World's Fair, and by many will be preferred to any of the hotels close to or within the grounds.

The two largest hotels in St. Louis, the Southern Hotel and the Planters' Hotel, have adopted uniform rates, which will be in force during Convention Week, and in fact throughout the greater part of the Exposition period. These rates are $10 and $15 per room per day, on the American plan, for one, two or three persons. That is, the rate will be $5 per day per person, but if the room is large enough to accommodate two or three persons and is occupied by a smaller number, the rates are no less than if it was occupied up to its capacity. The Jefferson, which is also a good sized hotel, has the same rates. The St. Nicholas and the Lindell will be conducted on the European plan, the rates of the St. Nicholas being from $5 to $10 per day, and that at the Lindell $5 per day. It will be advisable to engage hotel accommodations early, and the executive committee of the Association recommend that rooms be engaged by June 1. Several of the hotels have also adopted the rule that all rooms must be paid for two days in advance of Convention Week, but if these rooms are not occupied by the persons who engage them and the hotel can rent them to other persons during the period for which they are engaged, the amount so paid in advance will be rebated by the hotel.

In addition, there will be, of course, a very large number of temporary hotels and rooms which will be prepared to offer accommodations to visitors during the Exposition. Before the convention the secretary of the American Street Railway Association will mail to each member a pamphlet giving the names and addresses, with the rates charged for these accommodations.

Another field for creating traffic during the winter seems to have been discovered by the Muskegon Traction & Lighting Company, of Muskegon, Mich. That company has recently acquired an interest in a dancing academy, and is now giving free dancing parties every Tuesday and Thursday evening. The dancing master of the company's summer dancing pavilion at Fruitfort acts in the same capacity in the new academy.

OPERATING FEATURES OF THE LOS ANGELES RAILWAY COMPANY

The Los Angeles Railway Company has worked out some interesting and valuable features in its method of handling men and in the operation of its cars, much credit for which is due to John J. Akin, superintendent of the company, and his able assistants. It is the object of this article to describe some of these features. The points treated include the employment and instruction of the trainmen, descriptive system, assignment of runs, dispatching system, time schedules, inspector system and the claim and accident department.

Form 212—2m 6-26-03

Los Angeles Railway Company

APPLICATION FOR EMPLOYMENT

Los Angeles, Cal., ... *190* .....

To the Los Angeles Railway Company:

I hereby make application for a position with the Los Angeles Railway Company pledging myself if employed to faithfully and honestly discharge the duties of the position to the best of my ability, and strictly comply with the Company's Rules and Regulations.

1. *Age next birthday?* .... *Married or Single?* ....
2. *Where born?* .... *Town* .... *County* .... *State or Country* ....
3. *Description?* .... *Height* .... *Weight* .... *lbs. Color of Eyes* .... *Color of Hair* ....
4. *Complexion?* .... *Physical Defects?* ....
5. *Name of Parents?* ....
   Residence of Parents? ....
6. *Are any persons dependent on you for support (if so whom?)* ....
7. *Name and residence of nearest relative or friend to whom communication can be addressed in case of sickness or injury?* ....
8. *Were you ever injured, if so when?* .... *What Road?* ....
   Extent of injury? ....
9. *Are you engaged in any other business or occupation, if so state nature?* ....
10. *Are you in debt?* .... *For what amount?* ....
11. *Do you use intoxicating liquors?* ....
12. *Do you chew tobacco?* ....
13. *How long have you resided in Los Angeles?* ....
14. *State fully in following schedule where and how you have been employed since leaving school, each year must be fully accounted for.*

FROM		TO		WITH	AT	AS	WHY DID YOU LEAVE
MONTH	YEAR	MONTH	YEAR				

REFERENCES

NAME	PLACE OF BUSINESS OR RESIDENCE

15. *No. letters enclosed?* ....
    Witness ....

(Sign your name in full, no initials)

Instructions:—Heads of departments will require all applicants, except laborers, before entering the service of this Company to write answers to the above interrogatories in their own handwriting; if applicant is transferred to another department a copy of this application must be sent to the head of that department.

FIG. 1.—APPLICATION BLANK

EMPLOYING TRAINMEN

The method used by the Los Angeles Railway Company in employing trainmen is not unusual, but has some interesting details. An applicant is first interviewed by the assistant superintendent, and if, upon general observations and impressions, the man seems desirable, he is required to fill out in his own handwriting a blank form, Fig. 1, giving general description, age, parentage, and other information. The back of this blank has a printed statement, showing the number of the application and other details necessary for filing purposes. Full data is required as to employment since leaving school, and the applicant names four references. No man is hired who is under 5 ft. 6 ins. in height, and the applicant has to be between twenty-five and forty years of age. One of the first questions asked a man is whether he is or has been a member of the Amalgamated Association of Street Railway Employees. No one is ever hired or kept in the employ of the company who has ever had any affiliation whatsoever with this association. It is the company's firm and established policy to allow no union or indication of any to exist among its employees. The men are plainly given to understand this fact, and that any participation in anything of this sort means immediate dismissal. On the other hand, the employees are assured fair and impartial treatment with courteous attention to all grievances, and as a result, the company has a very competent and loyal set of men.

LOS ANGELES RAILWAY COMPANY

HOWARD E. HUNTINGTON General Manager
JOHN J. AKIN Superintendent
[illegible] A. HENDERSON Auditor

LOS ANGELES, CAL.

Mr

Dear Sir

Mr

has applied for a position as .... *with this Company and refers to you as to his general character, ability, etc. By replying to questions below you will be conferring a favor to him. Any information will be appreciated and considered confidential.*

Yours truly,

Superintendent

How long have you known applicant?

Are you related to him, and in what manner?

What employment has he followed during your acquaintance with him?

Has he ever been discharged from any position and under what circumstance?

When did your acquaintance with applicant cease?

What is his general character and standing in the community?

FIG. 3.—LETTER SENT TO REFERENCES

Form 204—2M-9-'03

Los Angeles Railway Company

PERMIT FOR EXAMINATION

.... *Department* *190*

Name	*Actual Employee as*	*Applicant for position as*	*At*

DR. F. K. AINSWORTH
DR. H. G. CATES - Rooms 310-314 Douglas Block, 3rd and Springs Sts.

This will be presented to you by the above named party. I have noted thereon the necessary information as to his employment. Will you please examine him in the manner specified in the Company's instructions, sending regular Certificate of such examination.

Signature of Party to be examined ....

Age .... *Years* .... *Months.* *Nativity* ....

Color of Eyes .... *Color of Hair* ....

Complexion .... *Weight* .... *Height* ....

NOTE—Descriptive part should be filled out by party issuing permit and Signature written in his presence.

FIG. 2.—SURGEON'S PERMIT FOR EXAMINATION

After the man fills out his application, he is given a permit for physical examination, Fig. 2, which he takes to one of the company's surgeons. After a thorough physical examination the physician's certificate is returned to the superintendent's office. To each of the four parties whose names are given as references, is sent a letter form, Fig. 3, signed by the superintendent, requesting information as to the applicant's general character, ability, etc. These replies, which are treated confidentially, have been found of great value in determining an applicant's standing and the desirability of employing him.

When all the information concerning a man is at hand, and it is desired to add more men to the force, he is interviewed

by the superintendent, who at the same time carefully goes over the written application, surgeon's certificate, reports from persons given or references and any general letters of introduction or recommendation which the applicant may present. The superintendent considers the man's handwriting, observes his personal appearance and sizes him up in general. If his face is disfigured, if he has lost a finger, has crossed eyes or other general defects, which in the opinion of the superintendent would tend to impair his usefulness or make an unpleasant impression on the traveling public, he is not employed. The superintendent gives the men a general talk on the more important matters affecting their duties, impressing upon the conductors the necessity for being always courteous and polite The motormen are advised as to their duties and general behavior in case of accidents, and are cautioned as to the observance of what might be called iron-clad rules, such as having the car under control when approaching switch points, stopping at all steam road crossings, etc. This interview is not long, but it gives the superintendent a chance to meet personally every man before he is employed, and also impress upon the latter certain fundamental principles as to his conduct and duties.

FIG. 4.—INSTRUCTION CAR USED BY THE LOS ANGELES RAILWAY COMPANY

The men are then turned over to the assistant superintendent, who gives them a rather lengthy talk, in which the nature of the bond they are required to give the company is explained, as well as other important features, such as uniforms, badges, rules, etc. Each man is given copies of the two rule books the company issues. Mention will be made of these later. Each man is required to sign a contract, his photograph is put on file, and then he is ready for detailed instruction as to his duties in operating a car. The bond is given by a surety company for $500. This costs $5, half of which is paid by the trainman and half by the railway company. The surety company looks up a man's record and character on its own account independently of the investigation by the railway officials.

STUDENT INSTRUCTOR

Instruction on the equipment and in the operation of cars is given the candidates accepted for service by a "student instructor," an experienced trainman, who devotes his entire time to this work. After the men are turned over to him, and until they have passed a rigid examination and have been placed on the extra list of the company, they are designated as "students." These students are taught in groups of from six to twelve, from forty to sixty students receiving instruction each month. Last year a total of 650 students was instructed and examined.

The instructor's first task is to explain the working list, carboard, schedules of runs, running points and other features of operating the cars. The necessity of being prompt in reporting for duty, and in the entire discharge of their duties, is constantly impressed upon the men. The instructor then sees that each student has a good time-piece, and is provided with a uniform cap before the instruction is carried further. The next step is a day or two's car instruction on the special car fixed up in one portion of the car house. This instruction car, which is illustrated in Fig. 4, will be described later. All motormen are given copies of "The Motorman and His Duties." Student motormen and conductors are given separate lists of questions which are to be asked them upon examination. The conductors' question card, Fig. 5, deals principally with the

EXAMINATION

For Student Motormen

1 Give route of University line
2 Name of all rights of way
3 Location of circuit breakers
4 Switches, crossovers, relief point and time points.
5 Give same information of all other lines.
6 Explain canopy switch.
7 Automatic "overhead."
8 Explain the meaning of circuit breaker.
9 What is the meaning of voltage? Watts?
10 What is meant by ampere?
11 What is a commutator?
12 Explain compound windings.
13 Explain the diverter
14. What are the fields of a motor?
15 Explain the necessity of the fuse.
16 What is the meaning of horse power?
17. Explain the necessity of insulation.
18. Explain the necessity of the lightning arrester.
19. Explain the purposes of a magnetic blow out
20 What is the meaning of resistance?
21 What is a choke coil?
22. What are the poles or pole pieces?
23 What is series connections?
24. Explain parallel or multiple connections.
25. What causes sparking?
26 If a telephone wire was broken and hanging across your trolley wire, or if your trolley wire was broken and down on the ground, what would be your action?
27. Explain how you examine your car before leaving car house
28 How many types of controllers have you used?
29. Explain the motor cut-outs of each.
30 Explain the meaning of the pulling points of the controller?
31. Explain the running points.
32 What causes controller to arc, and how prevent it?
33 What would cause your controller to lock when applying current, and how remedy?
34 What would be your action if controller should lock, preventing you from throwing handle to off point?
35 If you were to run onto an insulated rail (grounded rail) and then feed up to three or four notches as car started, and then throw to off point, what will be the result?
36 What are your instructions when running over section of track when rails are under water, or dirt or sand on rails?
37 What is the meaning of slugging a car?
38 Explain the reason for always keeping the left hand on wooden handle of controller when current is on.
39 How does the fast feeding of current show on your controller?
40 What is liable to be the result of feeding controller to parallel on grade?
41 What is the result of throwing to off point from the first point in series? What from first point in parallel?
42 What would be the result if you were to reverse current when brakes were applied?
43 How many different types of motors have we in service? Name the horse power of each
44. What are the motor leads?
45. What leads connect with brush holder?
46 What would be the result if brushes were to wedge or stick in holders?
47. What the result if brush springs were left up from brushes?
48 What the result if brush holders were to become loose and come in contact with the armiture? What would be your action?
49. What the result if insulation was off a motor lead or wire and it was to come in contact with other metal substance? How remedy?
50 What causes open circuit in your armiture?
51. What is the meaning of short circuit? Give example of short circuit in field coils.
52. What is the result of fast feeding on armiture bearings?
53 What is the result on the fields?
54. What the result if armiture bearings were low so armiture would come in contact with pole pieces?
55 What would be your action?
56 If your car lights burn but motors will not respond to current, how locate trouble?
57 Explain how you oil your trolley.
58 If your-trolley tention rods were to break and let pole down on top of car, how get car into barn?
59 Explain the different bearings on a car? And trucks?
60 Explain the motor suspension?
61 Explain the difference between drivers and idler wheels
62. What is the tread of a wheel?
63 What the result if flange was broken on a wheel?
64. If car was derailed, what action would you take to replace?
65. What causes a locked gear?
66 What would be the result, and what your action?
67 What is the meaning of stripped pinion?
68 What is the meaning of pounds pressure of air on car?
69. What are the pressures carried on cars?
70 What would be your action should air gauge show more than regulation pressure?
71. Describe the different types of air valves in service
72: What is the running position on the motorman's valve?
73 What is the meaning of lap?
74. Explain the service application.
75. Explain the use of emergency and its action on brake equipment.
76. What is the reduction from the reservoir for a service stop?
77. What would be your action if, when applying the air, your wheels were to slide?
78 What would cause your wheels to slide with amount of pressure used?
79 Why is it not advisable to run into curves or over switch or special track work with brakes applied?
80 If your pressure was reduced to thirty pounds or less, how would you locate the trouble?
81. If you hear air escaping from rear of car, what is the cause?
82. What the result if, when running in damp or rainy weather, water should get into air reservoir?
83. Why is it *not advisable* to leave handle of valve on lap at end of line or when stopping on a grade for a short time?
84. What make of air pumps or compressors are in service?
85. What is the horse power of each?
86. What is the revolution of armature per minute?
87. Explain the action of the governor
88. Why is it necessary to use air economically?
89 What the result if piston from jam cylinder should force the floating bar past center?
90. What is the usual travel of the jam piston?
91. What the size wire and material used for fuse on car equipped with two 50 H. P. motors?
92. What size for two 25 H. P., or car with one or two 20 H. P. motors?
93. Explain the different types of motor fuse?
94. What ampere fuse used for air pump?
95. What ampere fuse is used for arc lights?
96. What ampere for governor or inside lights?
97. What does a red flag or light signify?
98. What a green flag or light? A white flag or light?
99. What are the different lantern signals used by switchmen at First and Main?, First and Spring, etc?
100. What are the bell signals between motorman and conductor?
101. Do you understand that you must bring your car to a *full stop* at all steam railway crossings and all switches?
102. Do you know that it is your duty to see that your car leaves the terminus on time?
103. Through what part of the city must cars be run at half speed?
104. Over what streets must screens be used on the headlights at night?
105. In what section of the city are motormen permitted to use stools?
106. What is your position at all times when the car is in motion?
107. Do you understand that you are not to enter into unnecessary conversation with a passenger?
108. What is a rule for riding on cars when off duty?
109. What is your duty when passing another car which is discharging or receiving passengers?
110. What is your duty when passenger boards front end of car?
111. Explain the importance of *always sounding gong* when approaching a curve, another car or cross streets.
112. In what position must you leave controller handles when turning car into barn?
113. Do you understand making report on condition of cars when turning in?
114. What lines carry U. S. mail?
115. Name location of all U. S. mail stations.

FIG. 6.—MOTORMAN'S QUESTION CARD (TWO SIDES)

routes of cars and transfers, and students are required to answer practically all the questions satisfactorily before being passed. Many of the questions on the motormen's card, Fig. 6, are technical in nature, and the applicant is not expected to be able to answer all of them.

About the second or third day the students are assigned by the instructor to different runs with regular men. The student is kept on the first run for four or five days, when he is generally proficient enough to be transferred to another line. If he has not shown the proper ability in that time, he is generally regarded as hopeless and is allowed to resign as a student. On the second line he is kept for two or three days, and is then transferred successively to all the lines in the division. As a rule it requires about fourteen or fifteen days to give a student the proper car instruction and break in on all the lines of one division. When he is assigned for the runs, he is required to report at the car house at 5 a. m., so as to take the first run out, and the instructor is always on hand at that time to see that all his men are properly assigned, and also to check up the tardy ones. Each student is given a card, Fig. 7, showing the date, run number, car run, car number, line and name of regular man for each of the lines. When the student has spent the designated time on a line, the regular man signs the card, and notes the time on, time off and total time. The instructor keeps a private report card, Fig. 8, for each student, on which he enters the runs of the students, and after he interviews the regular man, enters on this card the substance of the latter's report on the work of the student. By means of these private cards the instructor is able to keep close track of each student and of the work he is doing on the different lines. Considerable care is exercised by the instructor in selecting the regular men whom he desires to instruct the students. As a rule, the older men, both in years and time of service are selected, and especially those who take an interest in the students and in their instruction, and who will not be apt to ridicule them or jest at their mistakes.

As a rule the applicants who make the best trainmen are those who come from country districts or small towns, but they are naturally sensitive at first, and if laughed at by the regular men whom they are supposed to look to for advice and instruction, they become discouraged and either drop out entirely or receive wrong impressions which are hard to overcome afterward. The experience of the company has been that it is often harder to break into the service men who have been employed by railways in other cities, because they have certain ideas on ways of doing their work, to change which in conformity with the methods in use in Los Angeles, is harder than it is to teach unexperienced men the work fresh from the start.

As has been mentioned before in these columns, the trainmen employed on all the railway systems of Los Angeles are

LOS ANGELES RAILWAY CO.

Student for ....

DATE	RUN NO.	CAR RUN	CAR NO.	LINE	INSTRUCTED BY	A. M.	P. M.	TOTAL TIME	NAME OF REGULAR
				Cummings		On / Off	On / Off		
				Vernon		On / Off	On / Off		
				Washington		On / Off	On / Off		
				Pico Heights		On / Off	On / Off		
				Maple Ave		On / Off	On / Off		
				West 9th		On / Off	On / Off		
				East Side Park		On / Off	On / Off		
				Main Street		On / Off	On / Off		
				San Pedro		On / Off	On / Off		
				East 9th		On / Off	On / Off		
				Aliso Street		On / Off	On / Off		
				Grand and Downey Ave		On / Off	On / Off		
				University		On / Off	On / Off		
				Westlake		On / Off	On / Off		
				Boyle Heights		On / Off	On / Off		
				S. P. Depot		On / Off	On / Off		
				Santa Fe		On / Off	On / Off		

FIG. 7.—STUDENT'S REPORT CARD

Form 375—10-'03-1M.

LOS ANGELES RAILWAY CO.

.... Student ....

DATE	Run No.	Car No.	LINE	INSTRUCTED BY
			Vernon	
			Main	
			Washington	
			Pico Heights	
			Maple	
			West Ninth	
			East Side Park	
			San Pedro	
			University	
			Grand and Downy Av	
			Westlake	
			Aliso	
			Boyle Heights	
			East Ninth	
			S. P. Depot	
			Santa Fe	
			Cummings	

FIG. 8.—STUDENT INSTRUCTOR'S PERSONAL REPORT BLANK

QUESTION CARD

STUDENT CONDUCTORS

NOTICE:—The questions below in regard to transfers must not be interpreted as meaning that you can get a passenger to the point on one transfer. The object is to find out if the student understands how to transfer a passenger who wishes to reach that point.

QUESTIONS

1. What is the route of University line from Agricultural Park? Name each street the cars go on. Direction when turns are made, time for round trip, headway, where do trips end, where are reliefs made? ....
2. Give same information as above of each of the other lines.
3. Where is Elysian Park? ....
4. Where is Echo Park? ....
5. Where is Central Park? ....
6. Where is St. James Park? ....
7. Where is Santa Fe Depot? ....
8. At what other points can a passenger take Santa Fe trains? ....
9. Where is S. P. Arcade Depot? ....
10. At what other points can a passenger take S. P. trains? ....
11. What lines of cars reach Main Santa Fe Depot? ....
12. What lines of cars reach Arcade Depot? ....
13. Where are the principal theatres? ....

TRANSFERS

UNIVERSITY LINE, NORTH BOUND.

14. How issue for W. 7th St? ....
15. How for Vernon? ....
16. How issue for San Pedro St.? ....
17. How issue for E. 9th St? ....
18. How issue for Westlake Line? ....
19. How issue for Arcade Depot? ....
20. How issue for Santa Fe Depot? ....
21. How issue for Belt Line? ....
22. How issue for Central Park? ....
23. How issue for Maple Ave.? ....

SOUTH BOUND.

24. How issue to Belt Line? ....
25. How issue to Main St.? ....
26. How issue for Chutes Park after passing Temple Block? ....

MAIN ST. LINE, NORTH BOUND.

27. How issue at 9th St? ....
28. What lines do you issue to at 5th and Main Sts.? ....
29. How issue to Maple Ave. or San Pedro St.? ....
30. How issue to Brooklyn Ave.? ....
31. How issue to Vernon line? ....
32. How issue to Southern Pacific Depot? ....
33. How issue to Westlake line and N. Broadway? ....

SOUTH BOUND.

34. How issue to Vernon? ....
35. How issue at 9th St? ....

BROADWAY CARS, NORTH BOUND.

36. How issue to Maple Ave.? ....
37. How issue to Arcade Depot? ....
38. How issue to Belt Line? ....
39. What cars transfer East at 5th and Broadway? ....
40. How many places can you issue to the Santa Fe Depot? ....
41. How issue to Main St. car? ....

WASHINGTON ST. CAR, NORTH BOUND.

42. How issue for Spring St. south of 5th St., or Post Office?
43. How issue for South Main St.? ....
44. How issue for 7th and Grand Ave.? ....
45. How issue for San Pedro St.? ....
46. How issue to 1st and Olive Sts.? ....
47. How issue to Vernon? ....
48. How issue to Vernon when West bound? ....

PICO HEIGHTS LINE, NORTH BOUND

49. How issue to E. 9th St.? ....
50. How issue for Main St. car? ....
51. Do you issue Post Office stopovers? ....

MAPLE AVE. & EASTLAKE PARK LINE, NORTH BOUND

52. Where can you issue for Vernon? ....
53. How many points for issue to S. P. Depot? ....
54. How issue for Belt Line? ....

SOUTH BOUND

55. How do you issue to Vernon cars? ....
56. Where do you issue to Main St. cars south bound ....
57. Do you issue to Main St. cars north bound at 5th. St.? ....

BOYLE HEIGHTS LINE, WEST BOUND.

58. What points can you issue to Vernon line? ....
59. Where do you issue to Arcade Depot Line? ....
60. Where do you issue to Belt Line? ....
61. How can West 9th St. cars issue to 7th and Grand Ave.? ....
62. What cars are Westlake transfers punched '2nd & Spring S.' good on? ....
63. Where do South bound Grand and Downey Ave. cars issue for 9th and Figueroa Sts? ....
64. Can a passenger go from 9th and Kohler to Central Park on two transfers? How many and over what lines? ....
65. Transfers punched 9th, and Main from E. 9th. St. line are good on what lines and in what directions? ....
66. Transfers punched 'Temple Block S.' are good on what lines? ....
67. When on 'Chutes Extra' going north on Spring St. with Main St. transfers, where do you issue and to what lines? ....
68. Can a passenger boarding a north bound San Pedro St. car at 7th, and San Pedro Sts. reach the Chutes Park on a transfer? ....
69. If a passenger boards a north bound Grand Ave. car at 3rd, and Broadway, how issue for 9th, and Central Ave.? ....
70. To what lines do south bound Grand and Downey Ave. cars issue at 1st and Spring Sts. and name 3 points of issue to Pico Heights? ....
71. What lines accept transfers punched '2nd and Spring S.' that are issued from the car which operates between Santa Fe Depot and 2nd, and Spring?
72. How must San Pedro and Maple Ave. cars issue for Chutes Park? ....
73. On what lines are Vernon transfers good that are punched '2nd and Spring N.'?
74. Do you issue from Vernon cars to cars south bound at Main or Spring? ....
75. Vernon transfers punched '2nd, and Central E.' are good on what lines? ....
76. When do S. P. Depot cars issue to San Pedro St.? ....
77. When do S. P. Depot cars issue to Main St.? ....
78. How can W. 9th St. car west bound issue to reach Pico and Flower? ....
79. What is your understanding of 'Stoppage' on transfers? ....
80. Name all points where transfers are good after walking one block ....
81. What lines carry U. S. mail? ....
82. What lines carry mail carriers free? ....
83. Between what hours are they permitted to ride free? ....
84. Who are carried free? ....
85. What are the bell signals between motorman and conductor? ....
86. What are the lantern signals? ....
87. What are the flag signals? ....
88. If a package was given you to deliver, what is your duty? ....
89. What is the rule:
    About lost property? ....
    About carrying dogs? ....
    About carrying glass? ....
    About your action in case there is no one to receive mail? ....
90. Have you received instructions about reporting mail carried? ....
91. What is your duty in case of accident? ....
92. Are you permitted to call on any one injured on your car? ....
93. What is your duty in case any one besides an official of the company should ask you about an accident, whether occuring on your car or some other car? ....
94. Would you allow any person to lift a switch for you or do any other work that you should perform? ....
95. What would be your action in case your lights failed to burn? ....
96. What is the rule in regard to reporting for duty? ....
97. What is your position on the car when pulling out or in to car house? ....
98. What is your first duty on arrival at a blockade? ....
99. Is there anything in the rules permitting you to leave a terminus without calling up dispatcher? ....
100. By what time are the cars operated? ....
101. Have you a good watch? ....
102. Have you a full uniform? ....

FIG. 5.—CONDUCTOR'S QUESTION CARD

well educated, and are said to be above the average in politeness and general qualities. One of the reasons given for this is the absence of the union spirit and union agitators so often found inharmonious on systems of many eastern cities. Young men of good characters and good families who have come west to grow up with the country, find that they can get steady employment at good wages with the railway companies, and when they find that the trainmen stand high in the estimation of the citizens, they are content in the work.

The employment of a student instructor has proved very successful with the Los Angeles Railway Company. He not only instructs the men in their duties as outlined above, but in reality acts as their confidential friend and adviser. He is regarded as one of their own number, and the men are made to feel that he is always at their disposal to answer questions, explain the equipment and give general pointers as to their conduct and duties. While the superintendent and assistant superintendent are always courteous to the men and willing to hear a grievance from any one of them, the men frequently go to the student instructor first and get his advice. In this way many matters are often settled without reaching the superintendent and taking up his time.

After the students have passed through the proper instruction they are examined thoroughly by the instructor, not only the printed questions being used, but any other that may seem necessary. If he passes the examination, the instructor makes a report to the superintendent on form Fig. 9, for conductors, and form, Fig. 10, for motormen, noting his competency for the performance of his duties. About 25 per cent to 30 per cent of all the applicants fail as students and are frequently not reported back to the superintendent. After examination the men are put on the extra list.

To a certain extent the student instructor is held responsible for the conduct of the trainmen. If a man is reported by an inspector as negligent in the performance of part of his duties, he is generally remanded to the instructor for further instruction. When not actually engaged in giving instructions, the instructor rides over the different lines, observing the work of his students, and also inspecting the regular men.

The instructor is also required to inform himself thoroughly in all new apparatus adopted in the system, and to see that all men, students, extras and regulars are instructed in its use. Examples of such new apparatus are the magnetic brakes recently placed on the Westlake line, and the Ohmer recording fare register, placed on two other lines as an experiment not long ago. The present incumbent of the position of student instructor is Al. A. Crank.

INSTRUCTION CAR

For the instruction car above referred to, and illustrated in Fig. 4, an old cable trailer was fitted up. The seats and windows were removed, leaving nothing but the floor, roof and skeleton frame. The car was mounted on two old trucks, each of which is equipped with a No. 3 Westinghouse motor. The motor wheels are blocked above the floor, so that they may be revolved without removing the car, and the action of the motor is observed through trap doors. At one end is a G. E. K-2 controller, although the car is wired as if for a K-10 Westinghouse controller. The car is equipped with a Christensen automatic air brake system, with brake-valve stands at the controller end. For convenience in inspection, the air compressor, governor and storage tank are mounted on the platform of the car, as are also the resistances, choke coil and fuses. The cable with motor, controller, light and compressor leads is open, and the wires are spread out on a board along one side of the car. Each lead is tagged so that its function may be explained. A regular arc headlight is provided on one end of the car, and the interior lighting is represented by a series of five lamps controlled by a standard plug switch. An Ohmer fare register of the new recording type is mounted inside with rod and cord. For convenience in inspection the trolley arm and base are mounted on a separate stand in another part of the room. The entire car equipment is a working exhibit. In order to reduce the regular railway voltage so that the motors will not operate at too high a speed without the load, resistances are mounted on top of the car, as shown in the illustration.

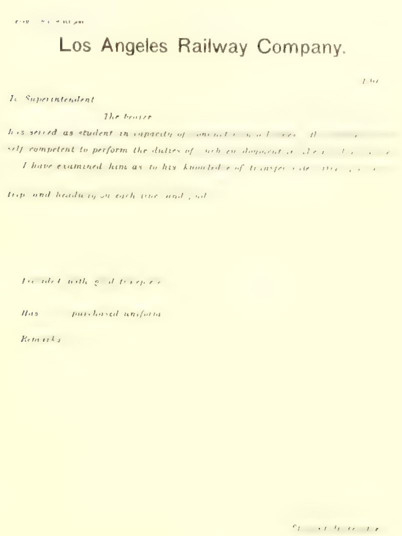


FIG. 9.—STUDENT INSTRUCTOR'S REPORT TO SUPERINTENDENT FOR CONDUCTORS

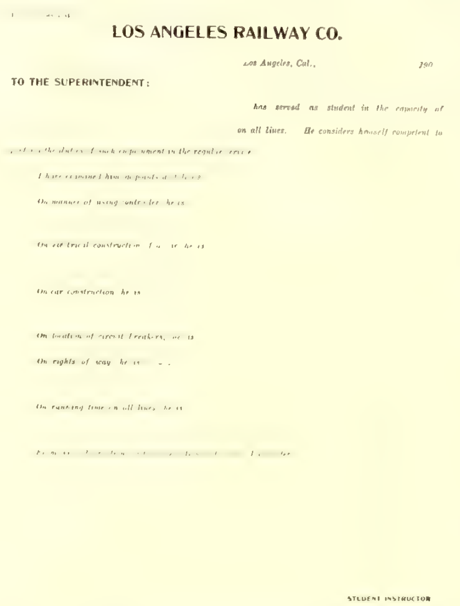


FIG. 10.—STUDENT INSTRUCTOR'S REPORT TO SUPERINTENDENT FOR MOTORMEN

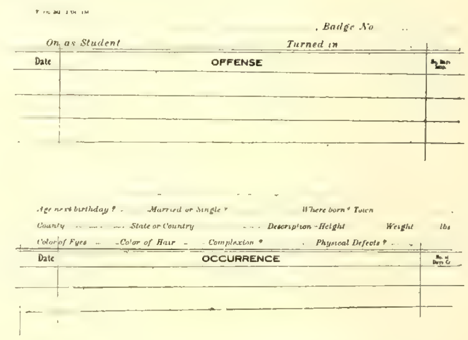


FIG. 11.—DISCIPLINE RECORD CARD (TWO SIDES)

With the aid of this car the instructor gives the students practical and detailed instruction on the operation and functions of all the apparatus. Prospective conductors, as well as motormen, are given car instruction, though their's is not so thorough as the motormen's. But it is sometimes necessary for a conductor to handle the car, and it is advisable for him to have a fairly good acquaintance with its equipment. After the apparatus on the instruction car is explained the students are taken into the shop, where they are shown motor, controller and cars undergoing repairs, and are then taken to the car house where the location of equipments on a standard car is explained.

The instructon car is soon to be moved to a new and larger room which will be provided with an exhibit of every class of equipment used on the system. Exhibits will also be displayed of burnt brushes, damaged armature and field coils and other damaged apparatus, so that the instructor will be able to call attention to the results of improper handling of the car.

Student motormen are required to be able to trace the course of the current through all of the car equipment, and to

describe the uses of the car equipment. They must also name and describe the different types of motors, their general appearance, horsepower, field coils, suspensions, bearings, case, commutator, armature, brushes and holders. In the case of the brakes they describe the shoe-hangers and locate the gooseneck, adjusting rods, brake beams, floating bar, equalizing bar, piston, air compressor and governor, and explain what gain, travel, etc., mean.

RULES AND RULE BOOKS

The railway company issues, for the use of its trainmen, two rule books. One of these is a collection of the permanent rules and regulations governing the duties of conductors and motormen, and in it are given all the rules which are not subject to change during the year. In the other book, which is revised and issued annually, are included all the rules that are subject to change, such as transfer rules, names of cross streets for the different lines, and rights-of-way rules for street crossings, curves and intersections of other tracks. In this book are also printed the location of all the postoffice stations in the city, and the location of the company's private telephones, which are used in the dispatching system. Bulletins affecting the ordinary routine of train operation are posted from day to day in bulletin books in the trainmens' rooms at the headquarters of the two divisions. When a bulletin affects a rule in either rule book, the change is made by the men in their books.

MERIT SYSTEM

For the discipline of the trainmen, the company employs a modified form of the Brown system. Large cards, like that reproduced in Fig. 11, made out, one for each man, are arranged alphabetically in a case so that they may easily be inspected by the men. Each offence is noted on the card with the record or demerit, and in case of meritorious services, credits are given. The smallest demerit mark is a reprimand, the next is five days' suspension, and other suspensions are made in multiples of five. The card has on one side the man's name, badge number, time taken on as a student, time turned in for service and blank space for offenses. On the reverse side are given his age, whether married or single, when born, height, weight, color of eyes and hair, complexion, physical defects, and blank space for credits.

Unlike the regular Brown system, discharges are not dependent upon certain number of demerits. Gross disregard of rules, carelessness and similar offenses which result in accidents are generally punished by discharge. Also, if a man fails to report for duty three times, he is given to understand that it means dismissal. When any number of days suspension is marked up against a man, he is not actually laid off. The suspension stands against him, but he continues to work, and consequently does not lose his wages. Merit marks are also regulated in multiple of five days, and of course, offset demerits. The fact that the record can be inspected by the men creates a desire to have as clean records as possible. Bulletins posted on the first of every month in a frame especially provided for the purpose, record all the offenses and demerits, as well as credits given, without, however, mentioning places or names. Notices of demerits or credits are always mailed immediately to the men.

For the superintendent's use a private record is kept in a large ledger, the page number corresponding to the trainman's badge number, thus affording a ready means of referring to any case. Every offense reported against the men is recorded in this book, and every time a secret inspector rides with a man a record is made with relation as to whether the man was "O. K.," was one or more fares short, or whatever else was noticed by the inspector. For economy of space, abbreviations are made for certain offenses, as "1 F. S.," means one fare short, etc., and numerals are also used to designate other breaking of rules and discipline. Every accident is also recorded by a number, which is given to the accident by the claim department. Record of good deeds in the operation of the service is also made. In this way a complete record is kept of every trainman employed by the company, notation also being made of date of entering service and date of leaving the service, and whether by resignation or discharge. In case of a man leaving and another taking his badge, both records are made on the same page.

The merits or demerits are generally determined by the superintendent or assistant superintendent, although for small offenses such as tardiness, the operating foremen at the car house are empowered to give the reprimand or punishment. For some small offenses, such as conductors punching transfers incorrectly, the student instructor reprimands the men, no record being made, however, in such case. As a rule the disciplining is done by the superintendent or his assistant, and all the records are kept in his office.

Week Days - Relief Point Temple Block.

Working Run	Car Run		On	Off	On	Off	Time
42	1	West 9th Street	5:25	10:50			
	2	"			12:35	5:47	10:37
43	4	"	5:40	11:05			
	5	"			12:50	6:02	10:37
44	7	"	5:45	12:10			
	8	"			1:05	6:17	11:37
45	9	"	5:55	12:50			
	10	"			1:15	6:27	11:37
		Week Days - Relief Point Car House.					
46	2	Vernon	5:30	11:32			
	7	"			12:32	4:50	10:20
47	4 (Owl)	"	4:50	10:38			
	13	"			12:14	5:14	10:48
48	7	"	5:50	12:32			
	11	"			2:08	6:48	10:22
49	11	"	5:45	11:08			
	6	"			12:38	5:36	10:21
50	13	"	5:55	12:14			
	15	"			2:02	6:04	10:21
51	15	"	6:05	11:02			
	10	"			12:44	6:02	10:15
		Relief Point Arcade Depot.					
52	5	Depot Line	5:55	11:22	12:42	6:02	10:47
53	6	"	6:00	11:27	12:47	6:07	10:47
54	8	"	6:10	11:37	12:57	6:17	10:47
		Relief Point Temple Block.					
55	1	San Pedro	5:35	11:08			
	4	"			12:25	5:05	10:23
56	3	"	5:40	12:18			
	7	"			1:42	5:26	10:22
57	7	"	5:55	10:54			
	2	"			12:11	5:47	10:35
58	6	"	6:00	11:01			
	3	"			12:18	5:54	10:37
		Relief Point 2d & Spring.					
59	1	Westlake.	5:30	10:48	12:02	5:04	10:19
60	5	"	5:45	11:41			
	6	"			12:46	5:15	10:23

FIG. 12.—SAMPLE PAGE OF WORKING LIST

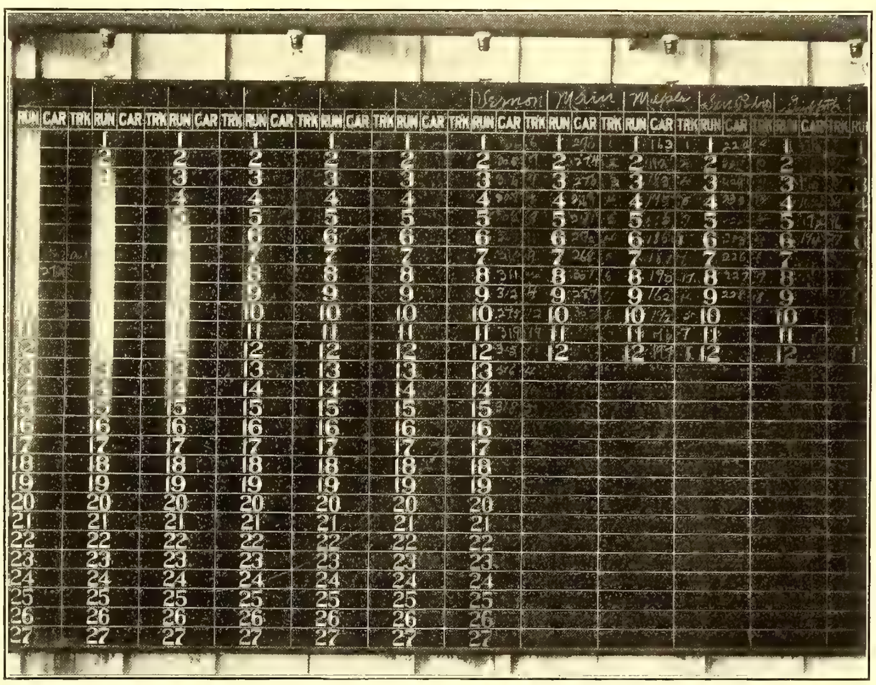


FIG. 13.—CAR BOARD IN CAR HOUSE

WAGES, UNIFORM AND BENEFITS

The same wages are in effect as those on the Pacific Electric Railway Company's system, viz.: Extra men 22 cents an hour; regular men, during first five years, 22½ cents an hour; after five years, 23½ cents; after ten years, 24½ cents; after fifteen years, 25½ cents. The runs are arranged so that the men work from nine to eleven hours a day, the average being about ten hours and forty minutes. No premiums are given the men. However, at the time of the recent agitation by some visiting "delegates," who endeavored to form a union and were unsuccessful, the men who were loyal to the company were advanced two years in service, meaning a raise in all their wages. About thirty men who were implicated in the movement were summarily discharged.

The men are required to buy their own uniforms before being put to work, but they are allowed to choose between four or five clothing houses. All are furnished with badges which they are required to wear on the outside of the coat upon the left side. Conductors are supplied with punches, a record of the punch marks being kept in the superintendent's office, since each man has a different punch. Screw-drivers and pliers are given to the motormen, and they are also required to see that each car is equipped with a monkey-wrench, a fuse and oil can.

The men are each required to pay 50 cents a month for the hospital fund, which entitles them to all medical and surgical attention. As a matter of convenience, the company also makes collections from the men for accident insurance, which is carried by one company. This insurance is not compulsory, and continues in force as long as the premiums are paid.

The company has about 700 men in its service, including about 200 extra men.

RUNS

In order to proportion the length and desirability of the runs as nearly equal as possible, there are provided day, night and swing runs, each having an aggregate length of from ten to eleven hours. The day runs are the first ones out of the car houses in the morning. They have from an hour to two hours for lunch at noon, and leave work between 5 and 6 p. m. The night runs go on duty between 11 a. m. and 1 and stop work for the day between 11 p. m. and 1 a. m. They, of course, bring the last cars into the car house. The swing runs report early in the morning with the day runs, have from three to five hours off during the middle of the day, and close their day's work between 7 and 10 p. m., bringing the first cars into the houses as a rule. On its two divisions the company, at present, has seventy day runs, ninety-eight night runs and eighty-six swing runs, making two hundred and fifty-four regular runs. There are fifteen extra men on trippers, which principally take care of the Ascot Park racing travel in the afternoon.

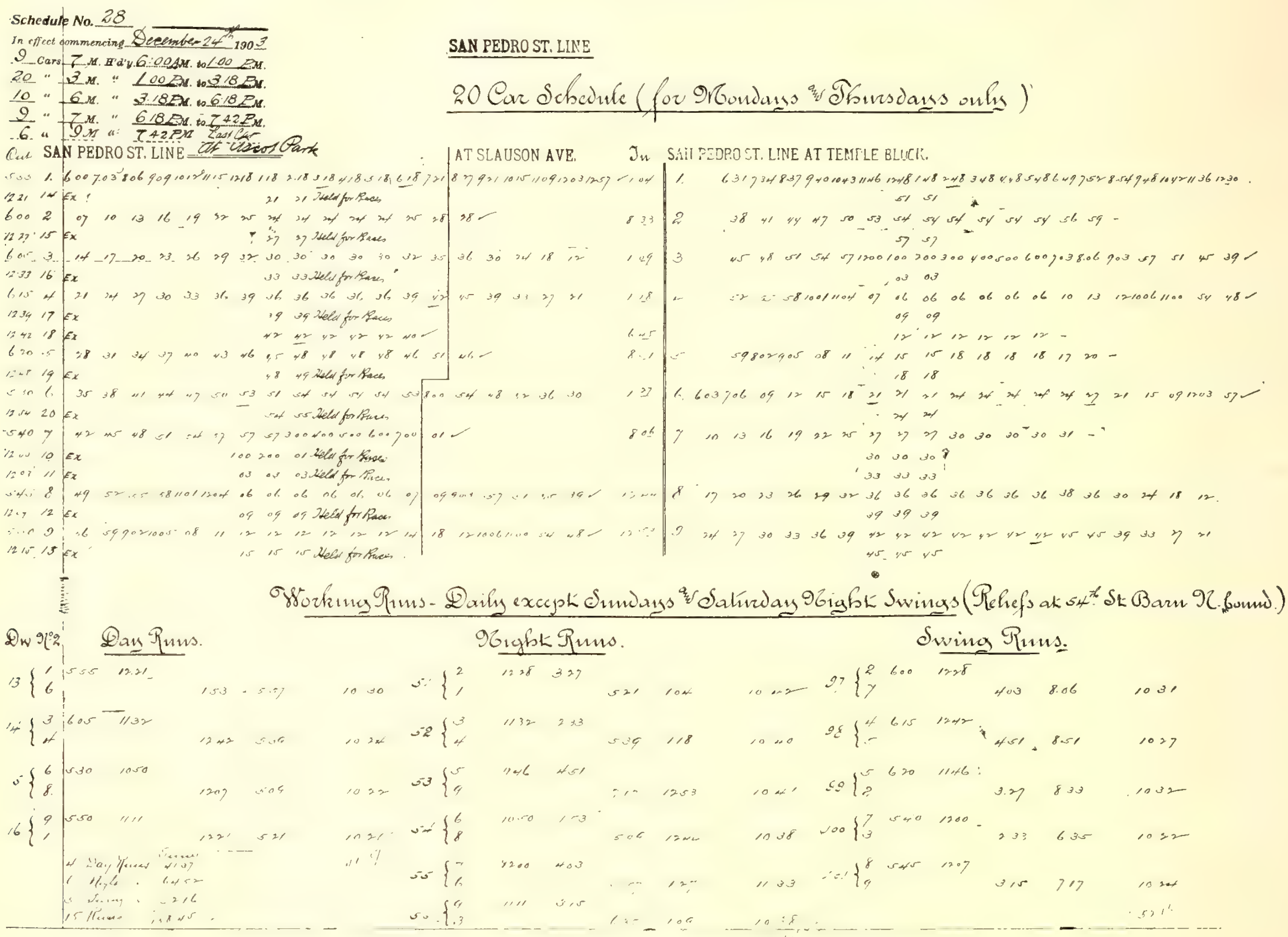


FIG. 15.—DISPATCHER'S LOOSE LEAF TIME SCHEDULE

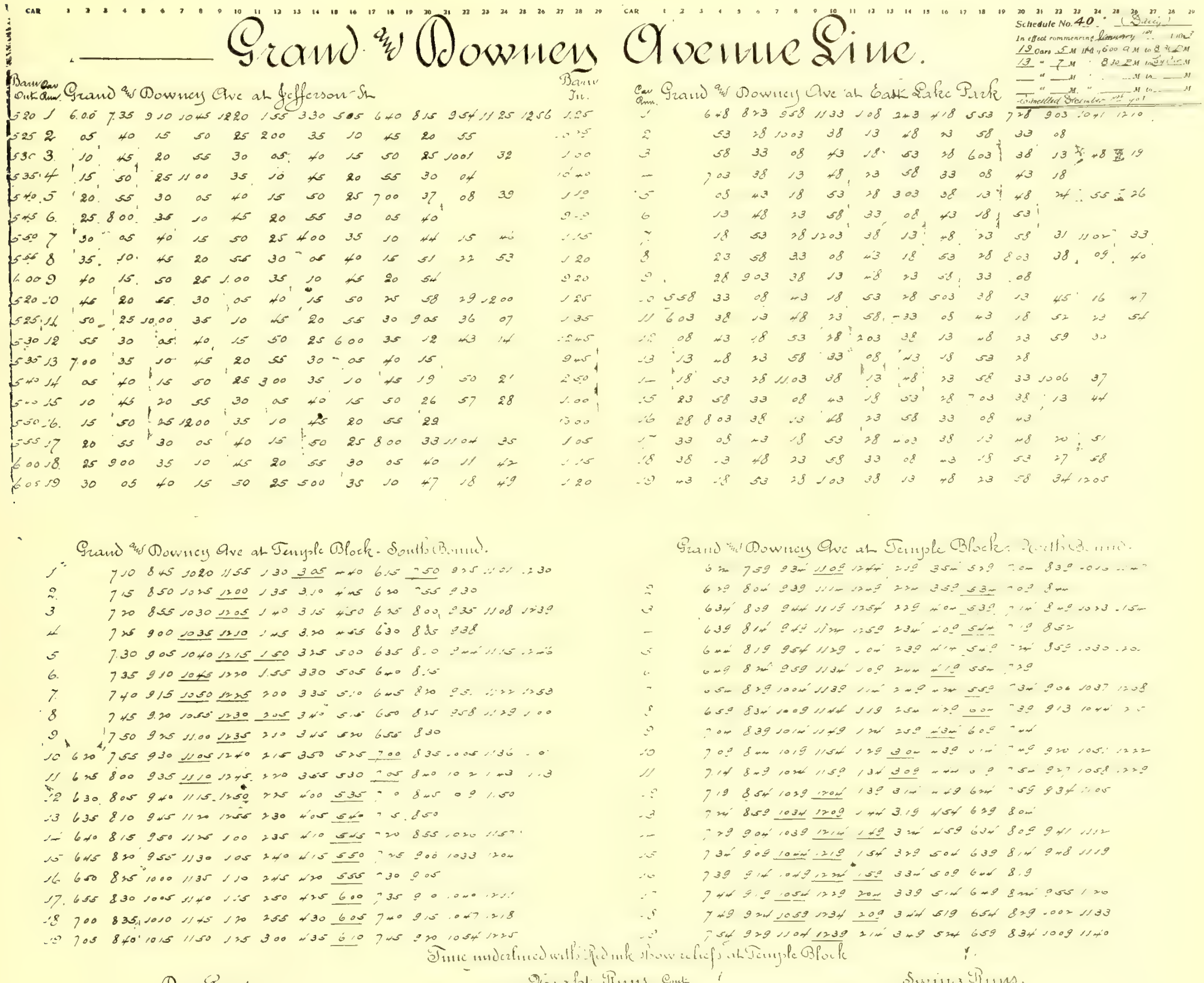
Los Angeles has no need for putting on the heavy tripper service that is generally required in the morning and evening in all large cities, and even in other places of the same size. Los Angeles has few manufacturing enterprises to necessitate such a service, and, on the other hand, on account of the large number of tourists and transients that are always in the city traveling back and forth between the parks, depots and places of amusements, there is a large traffic scattered throughout all hours of the day. This makes an ideal load for a street railway company to handle, as it can maintain regular service all day, and count on a very even distribution of passengers.

WORKING LIST

For the designation of the runs the company issues a "work-

ing list," or time list of runs, which possesses some interesting features. The list is typewritten and fills about fourteen pages. It is divided into day, night, swing, Sunday and extra runs or trippers. At the top of the list for each line is given the relief point, and in columns are placed the number of the working schedule time for leaving the terminal points for each trip during the day, the relief times being underscored in red ink.

The lists work out in the following manner: Suppose a crew is assigned to working run No. 49 on the Vernon line. By



11	4	Grand & Downey Ave.	5:35	10:35	12:10	5:44	10:34
12	5	"	5:40	12:15	1:50	5:49	10:34
13	7	"	5:50	10:50	12:25	5:59	10:34
14	8	"	5:55	12:30	2:05	6:04	10:34
15	13	"	5:35	10:34	12:09	5:40	10:30
16	14	"	5:40	12:14	1:49	5:45	10:30
17	15	"	5:45	10:44	12:19	5:50	10:30
18	16	"	5:50	12:24	1:59	5:55	10:30
19	6 12	" "	5:45	10:45	12:04	5:35	10:31
20	17 3	" "	5:55	10:54	12:00	5:34	10:33
21	18 19	" "	6:00	10:59	12:39	6:10	10:30

Night Runs.

106	1 12	Grand & Downey. "	11:09	3:05	5:35	12:45	11:06
107	3 1	" "	12:05	5:39	7:50	1:25	11:09
108	4 5	" "	10:35 12:15	12:10 1:50	5:49	1:10	10:31
109	6 4	Grand & Downey. "	10:45	4:19	5:44	10:40	10:30
110	7 8	" "	10:50 12:30	12:25 2:05	6:04	1:20	10:26
111	9 3	" "	12:35	4:34	5:39	1:00	11:20
112	10 17	" "	11:05	3:04	6:00	1:05	11:04
113	11 19	" "	11:10	3:09	6:10	1:20	11:09
114	13 14	" "	10:34 12:14	12:09 1:49	5:45	12:50	10:15
115	15 16	" "	10:44 12:24	12:19 1:59	5:50	1:00	10:20
116	17 7	" "	10:54	2:04	5:59	1:15	10:26
117	17 10	" "	2:04	6:00	7:00	1:25	10:21
118	18	"	10.59	2:09	6:05	1:15	10:20
119	18 11	" "	2:09	6:05	7:05	1:35	10:26

Swing Runs.

210	1	Grand & Downey	5:20	11:09	3:05	7:50	10:34
211	2 13	" "	5:25	12:00	5:40	9:45	10:40
212	5 16	" "	5:30	12:05	5:55	10:00	10:40
213	9	"	6:00	12:35	4:34	9:20	11:21
214	10 6	" "	5:20	11:05	4:19	9:10	10:36
215	11 2	" "	5:26	11:10	5:34	10:25	10:36
216	12 10	" "	5:30	12:04	3:04	7:00	10:30
217	19 11	" "	6:05	12:39	3:09	7:05	10:30

FIG. 16.—TIME SCHEDULE

ing run, which is in reality the crew number; the number of the car runs, the line, the times on and off for both portions of the day's work, and the total time of the run. When a crew, after relief, takes a run on another line, it is noted in the column containing the name of the lines. The sample page of the working list, shown in Fig. 12, will explain its nature. Copies of this working list are posted in each car house. There are also posted time schedules of each line, giving reference to the working list, the crew finds that its first car run is No. 11, leaving the car house at 5:45 a. m., and being relieved at the car house at 11:08 p. m., when the night crew, having working run No. 141, takes the car. The first crew has a relief until 12:38 p. m., when it assumes car run No. 8, taking another car this time from swing run No. 237. At 5:36 p. m., after ten hours and twenty-one minutes work for the day, the crew goes off duty, turning the car over to night run No. 139.

After the crew determines the numbers of its car runs, by reference to the time schedule for the Vernon line, the men note the schedule times for leaving the terminals for both runs. Another list gives the running time for each line, and then by referring to the car board, Fig. 13, they find that the car for run No. 11, of the Vernon line, is No. 319, and is located on track No. 19.

Form 202

LOS ANGELES RAILWAY COMPANY

SUPERINTENDENT'S DAILY REPORT

TO THE MANAGER:

I have to report for the 24 hours beginning at 5 o'clock a. m., ... 190.. , as follows:

LINES	MILEAGE		REMARKS
	MOTOR CARS	TRAIL CARS	
University			
Westlake			
Santa Fe			
Pico Heights			
Vernon			
Maple Avenue			
Depot			
Grand & Downey Aves			
Boyle Heights & 7th St			
Washington Street			
West Ninth Street			
East Side Park			
Main Street			
San Pedro Street			
East Ninth Street			
Aliso Street			
Cummings Street			
Mateo Street			
Total			

Accidents

FIG. 17.—SUPERINTENDENT'S DAILY REPORT OF MILEAGE, ETC.

CAR BOARD

This car board is divided into twelve columns for the different lines, and the run numbers are painted in silver on a red strip under each line. Two blank columns are left for chalking up the car and track numbers after each run. This board is kept up by the car house foreman, who is under direct supervision of the master car builder. After the cars come in at night they are carefully inspected, and if it is found that repairs are necessary, they are sent to the shop and others put in their places, the proper correction being made on the board. The operating staff has nothing to do with the arrangement of the cars or posting of this car board.

SENIORITY LISTS

Conductors and motormen are allowed to choose their runs according to their seniority of service. There really is not very much difference in the desirability of the runs, but they are chosen by the men to suit their own personal convenience. In the office of the superintendent and division foreman are racks containing cards for the trainmen, arranged according to seniority. Each card bears the man's name and date of his employment. Every six months there is a "shake-up" or re-assignment of runs according to the men's choice. Typewritten copies of the seniority lists are posted every three months, so the men may keep informed of their relative rank. Nothing affects their seniority except vacancies by reason of discharge or resignation.

DISPATCHER'S OFFICE

MEMORANDUM OF EMPLOYEES

Los Angeles, ... 190 .

NAMES	TIME	REPORTED LAST
LINE WAGON		
BLY		
CARNES		
HUTCHINSON		

Dispatcher

FIG. 14.—MEMORANDUM OF EMPLOYEES FOR DISPATCHER'S USE

EXTRAS

The company keeps about 200 men on its extra list, these being the men who have just been turned over for work by the student instructor. The extras are assigned to work in rotation, the first man given a run on any one day being next in rank than the last man assigned to a run on the previous day. Whenever possible the extras are given their choice of taking the runs assigned to them or not. If they do not take it, they, of course, lose their opportunity to work until it is their turn again. No extra man is kept on one run longer than a week as a rule.

It has been found that the extras work on the average about twenty-five days out of the month. They report daily for roll call at 10 a. m. and 5 p. m. Fifteen crews are required to show up in the morning fifteen minutes before starting time of the first car out, so as to cover all runs. One crew is always kept at each car house all the time for emergency work.

DISPATCHING SYSTEM

The Los Angeles Railway Company was one of the first companies in the country to install a telephone dispatching system, and the office of dispatcher has grown to be a very important one in the actual operation of the road. For the use of the dispatchers, eight circuits enter the office, and the company's thirty-four private telephones are located on those circuits. Each conductor is required to report each trip to the dispatcher through telephones placed in boxes at terminals of all lines. Emergency telephones are also placed at different points on the system, so that accidents and blockades may be quickly reported. The chief dispatcher has connection with all the officials of the company, the power house, the chief surgeon, hospital, police headquarters and fire department. He keeps in close touch with two car equipment repair men and one truck repair man, and the line wagons and the emergency car, record being kept of their movements on the memorandum blank, shown in Fig. 14, so that there is but little delay in reaching any of them in case their services are needed.

BOARD NO. ... SHEET NO.

LOS ANGELES RAILWAY COMPANY

TO THE SUPERINTENDENT *DISPATCHER'S OFFICE,* *190*

The following statement shows the cars reported out of order, nature of trouble, delays in traffic, and other matters connected with the Operating Department on this Date.

Dispatcher on duty from a. m. to m.; from to p. m. *Dispatcher on duty from m. to p. m., from p. m. to m.*

CAR NO.	LINE	N. S. E. W.	TIME FROM	TIME TO	MIN.	PLACE	NATURE OF TROUBLE	SWITCHED BACK AT	REPLACED BY CAR NO.	FROM	N. S. E. W.	TO HOUSE OUT	TO HOUSE IN	REPORTED BY	TO WHOM REPORTED	TIME

FIG. 18.—TROUBLE REPORT

All electrical trouble, of course, is noticed first by the power house operators, who report it immediately to the chief dispatcher. The latter has a map of all the feeder lines showing the location of section insulators, so that upon orders from the power house he can instruct the crews of the first cars passing certain insulators to pull them. In the dispatcher's office are also maps showing all cross-overs on the system, city street maps, lists of fire alarm boxes, etc.

The chief dispatcher makes out all time schedules and working lists of runs, taking what time is necessary. While he is thus employed his place at the dispatcher's board is filled by an extra man, who is generally called in from service as motorman. When through with his special work he goes back to his position on the board. Two day dispatchers and two night dispatchers are required for the dispatching work.

TIME SCHEDULES

In making up a time table for a new line, the time necessary to make the run is first determined, as well as the running time between important cross-overs. Then the headway of the cars is decided upon and the leaving time at terminals is then arrived at for each car run. With this information the chief dispatcher works out his time schedule for the line on a blank, 12½ ins. x 16¾ ins. in size (Fig. 15). If a different service is put on for Sunday or any other day of the week a separate sheet is made out for that day. On these or separate sheets are noted the working runs that are necessary to handle the service on that line. These sheets are numbered and kept in a loose-leaf file, which is known as the chief dispatcher's schedule file. As changes are made, of course new sheets are inserted in the place of the obsolete ones. Each sheet has an index stamp on one corner, which contains space for the number of the schedule, the date it was put in effect, and blank spaces for indicating the number of the car and the headway for each change during the day. An index book is kept of all schedules made out so that they may be quickly referred to.

From this chief dispatcher's schedule file are made up the

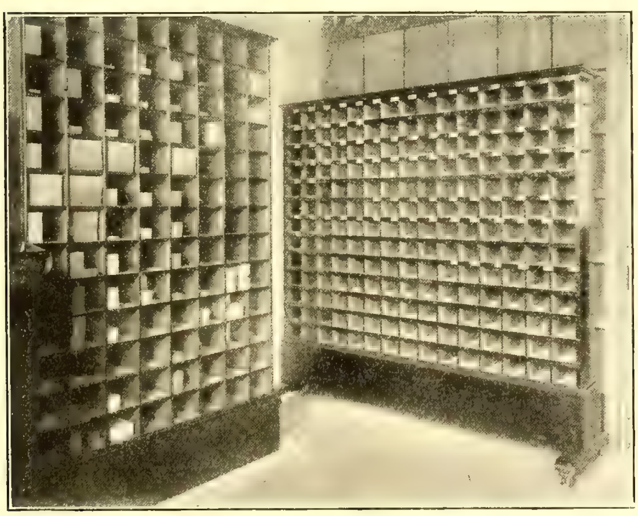


FIG. 20.—TRANSFER AND TRIP SHEET CASES IN CAR HOUSE

time schedules that are posted in the car houses for the use of the trainmen. These schedules are put on sheets 20½ in. x 25 ins. in size, Fig. 16, a separate sheet being used for each line. The scheduled time for leaving each terminal, and on long lines, a central point on the line are noted in black ink, and the time out of the barn and in at night, as well as the number of the car runs are indicated in red ink. The time underlined in red ink indicates reliefs at the relief point.

From the tabulation of working runs on the chief dispatcher's schedule are made up the typewritten working list spoken of above. If there is room, that part of the list affecting one line is pasted on the bottom of the time schedule (Fig. 16).

Each of the two dispatchers has upon his desk a large sheet on which he records the actual leaving time of every car, as reported by the conductors. For reference he has beneath his working sheet a sheet containing the scheduled leaving time of all lines under his supervision. When a car is replaced by another, switched back on a cross-over or switched by a different route in time of blockade, note is made of it on the sheet by the dispatcher.

MILEAGE AND TROUBLE REPORTS

From the dispatcher's sheet the actual mileage of every car on the system is obtained, the computation being made daily by clerks under the direction of the assistant superintendent. Records of the mileage of the different lines are kept on separate sheets, the aggregate mileage being reported to the general manager every fifteen days. A daily report of the

Form 124-7-25-'03-3m. **LOS ANGELES RAILWAY CO.**

Date .... 190 ..

Foreman's Report of Register Change, or Car.

To the Audit

Car No. .... *Line* .... *was run in Car House*

by Conductor .... *, at* .... *M., on accouut*

of .... *with Register No.* .... *Closing at* ....

and Replaced by Car No. .... *with Reg. No.* .... *commencing at* ....

This Slip must be forwarded to the Auditor immediately upon the change of any car during the day, or when car goes to shops.

.... *Foreman*

FIG. 19.—FOREMAN'S REPORT OF CHANGE OF CAR

mileage of each line, with mention of accidents, is made daily to the general manager on Form 202, Fig. 17.

The dispatchers also note on their sheets all trouble occurring during the day, and make a full report of it on a separate blank, Fig. 18, 10¾ins. x 14½ins. in size. The report, covering the work of one day, is placed on the superintendent's desk the following morning. It notes the car number, line, direction car was going, time, place, nature of trouble, where switched back, number of car replacing damaged one, where it was taken from, names of men reporting and to whom reported, etc. This trouble sheet generally gives the superintendent his first detailed information of damaged cars and unusual features in operating, and generally serves as a basis of investigating the action of trainmen, and placing responsibility for accidents.

An additional check on replaced cars is obtained from the foreman's report, made on blank, Fig. 19, which is forwarded to the auditor immediately upon the change of any car, or when a car goes to the shops.

REPORTING FOR DUTY

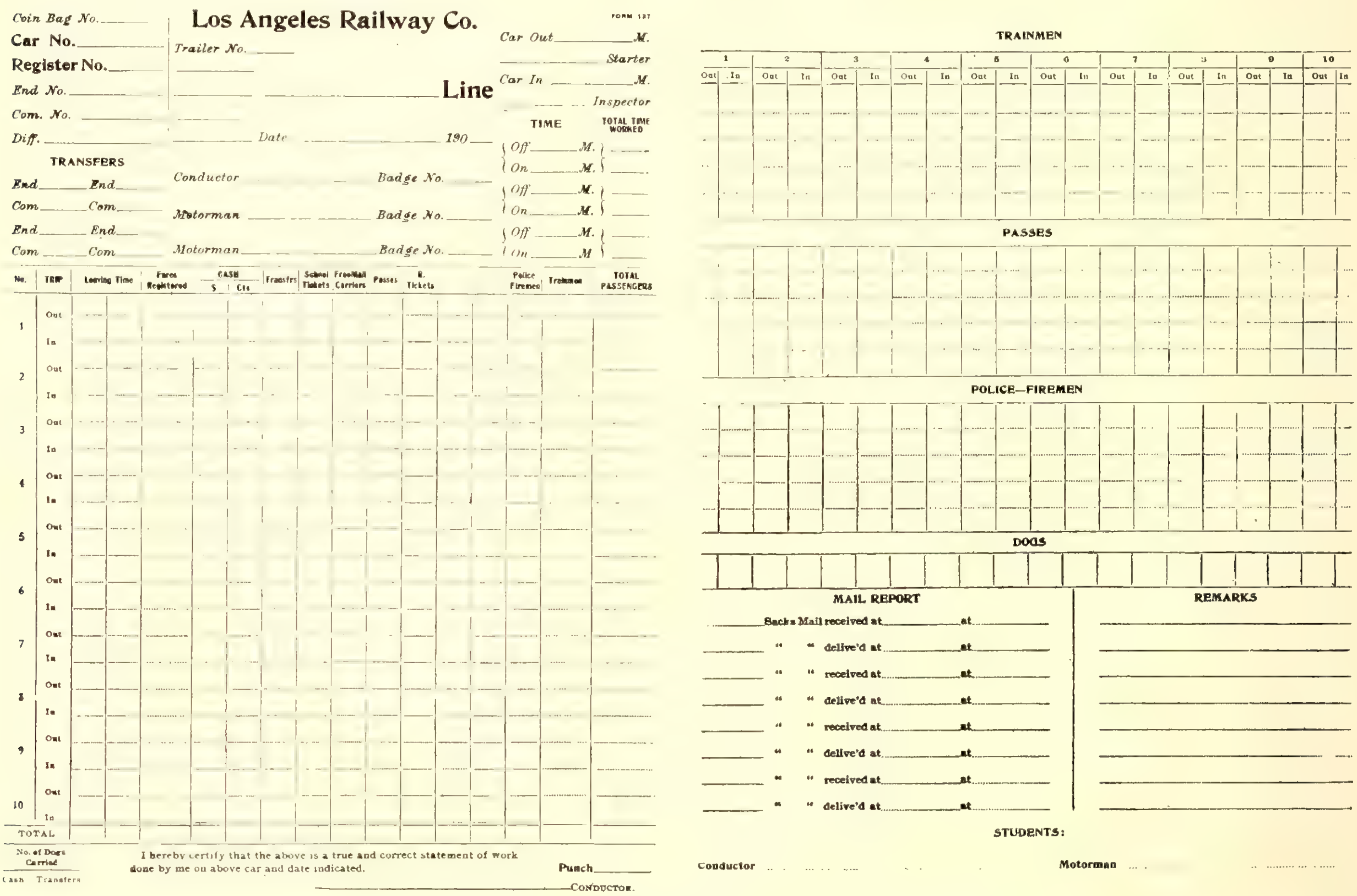
All trainmen marked up for duty in the morning are required to report at least fifteen minutes before the starting time of their cars, and to be on the car at least three minutes before their leaving time. Three days' suspension is entered against the records of all men who do not observe this rule. All trainmen desiring to lay off for a time not to exceed three days, are required to notify the operating foreman before 5 o'clock p. m. the previous day. Permission for lay-off longer than three days has to be obtained from the superintendent. In cases of emergency or sickness, night regulars or swing men must notify the operating foreman before 10 o'clock a. m. personally or by telephone, so that extras may be assigned to their runs.

TRIP SHEETS AND ENVELOPES

In each division headquarters are two large cases, such as that illustrated in Fig. 20, one for keeping transfers for different lines, and the other (the one shown at the right) for the trip sheets, envelopes, cash bag and bunches of transfers for each working run. Above each pigeon-hole is the number of the run, and on a white slip the number of trip sheets and envelopes required for that run. These cases are filled up each evening for the following day.

On the trip sheet, Fig. 21, the conductor is required to enter the exact time he leaves the terminus, fares registered, total cash, transfers, tickets, policemen, firemen, trainmen and free passengers in the proper column, every half trip. On the back of the trip-sheet are entered the badge numbers of all employees carried, numbers of passes and numbers of policemen and firemen carried. Under "Dogs" are entered the number of dogs, for which 25 cents fare is received. The reverse side of the trip sheet also contains space for mail report and for noting name of student, conductors or motormen carried. Each conductor makes out one of these trip-sheets for each car on which he runs during the day, turning them all in at the receiving office at the end of the day's work. At the same time he turns in all cash collected during the day in a bag provided for the purpose. Attached to each bag in a printed tag, Fig. 22, giving the conductor's name, lines, car numbers, bag number, amount and date. On the reverse side of the tag the auditor's clerk notes whether the cash is over, short, in error or correct. These bags are dropped through an opening in the trainmens' room into a chute, which leads to an iron safe that is located in a separate room. The interior of the safe is so arranged that the bags cannot be withdrawn. The safe has a double lock, and can be opened only in presence of the auditor's clerk and division foreman.

At the end of each half trip each conductor makes a copy of his trip-sheet on the envelope, Fig. 23, entering the number of the trip in the first column. The amount collected for dogs is entered on the line marked "Miscellaneous." All transfers, tickets and everything collected except cash are enclosed in this envelope, and at the end of every in-trip it is sealed and deposited on the next trip out in a box specially provided for the purpose. These envelopes form a check for every round trip on the trip-sheets, and being deposited every full trip, can be collected as often as required by the auditor and examined.



Coin Bag No. / Car No. / Register No. / End No. / Com. No. / Diff.
Los Angeles Railway Co. — FORM 127
Trailer No. — Line — Date 190
Car Out M. Starter / Car In M. Inspector
TRANSFERS: End End / Com Com / End End / Com Com
Conductor Badge No. / Motorman Badge No. / Motorman Badge No.
TIME: Off M. On M. / Off M. On M. / Off M. On M. — TOTAL TIME WORKED
No. | TRIP | Leaving Time | Fares Registered | CASH $ Cts | Transfrs | School Tickets | Free Mail Carriers | Passes | R. R. Tickets | Police Firemen | Trainmen | TOTAL PASSENGERS
1–10 Out / In; TOTAL
No. of Dogs Carried — Cash Transfers
I hereby certify that the above is a true and correct statement of work done by me on above car and date indicated. Punch — Conductor.
TRAINMEN 1–10 Out In
PASSES
POLICE—FIREMEN
DOGS
MAIL REPORT: Sacks Mail received at at / " " delive'd at at / " " received at at / " " delive'd at at / " " received at at / " " delive'd at at / " " received at at / " " delive'd at at
REMARKS
STUDENTS: Conductor — Motorman

FIG. 21.—FRONT AND BACK OF CONDUCTOR'S TRIP SHEET

Conductors are supplied with miscellaneous report blanks, Fig. 24, upon which they report all cases of altercation with passengers, any derailment, broken trolley, headlight, car windows or any other damage to property of the company. These reports are turned in with trip envelopes. Another blank to be mentioned later is used in accident cases.

MOTORMEN'S DAILY REPORTS

All motormen are required to make a report on the condition of the cars on blanks, Fig. 25. One card embodies the report for one car for the day. Each motorman fills out the card when he leaves the car and hands it to his relief. The last man puts the report in a box at the car house. The motorman reports "O. K.," or "B. O." for bad order for the trolley, fuse box, canopy switch, controller, armature, bolster and holders, fields connections, resistance boxes, lamp circuit, bearings, motor suspension, brakes and trucks. By means of these reports the equipment foremen quickly locate all damaged parts after the cars have been turned in at night.

PAYING MEN

The trainmen are paid weekly for the second week preceding. The company has a small car fixed up as a pay car, which is stationed at car house No. 1 on Tuesdays from 10 a. m to 1 p. m., and at car house No. 2 on Wednesdays from 9 a. m. to 1 p. m. The men call for their pay during their relief, and consequently on their own time.

TRANSFER SYSTEM

The Los Angeles Railway Company has practically a universal transfer system, the difference being that no transfers are issued which would enable a person to return to the same section of the city from which he started for one fare. On account of the system not being entirely universal, a large number of transfer rules are required. In only one or two instances does the company transfer to the other railway systems. Transfers are issued to the conductors at the division headquarters, and a daily report covering all the trans-

fers issued is made to the auditor on blank, Fig. 26. The conductors also record the number of transfers issued on their trip-sheets and envelopes, so a good check is obtained on all transfers.

INSPECTORS AND SECRET SERVICE SYSTEM

Under the immediate direction of the superintendent are two day and two night inspectors, who are constantly out on the system instructing the men on any points that seem necessary, and looking after the general operation of the cars. These inspectors virtually represent the superintendent in the actual handling of the men. In case of blockades and large crowds, they take charge and relieve the congestion of the lines, keeping in touch with the chief dispatcher as often as is necessary. The men who fill these positions are usually experienced trainmen who are thoroughly familiar with the city and the railway lines. They make a general report daily of what they think is necessary to be called to the attention of the superintendent.

The company has a secret service system, the force varying from two to ten men, as occasions demand. These men ride upon the cars and observe the number of passengers, fares collected and registered, and other features of operation. Their reports are made by mail to the superintendent's office, each "operator," as he is called, giving a detailed account of his work for the day. These men also observe the actions of the men off duty, and especially observe if they frequent saloons or questionable resorts. From their daily reports are entered marks against the records of the men in the superintendent's private record book already referred to, note being always made if a man is reported "O. K." This system not only serves to quickly locate dishonest or careless employees, but also protects the honest men. If a man's record is believed to be questionable, one or two operators are detailed to watch him, and it is not long before evidence against him is obtained or the questionable report cleared up.

Over ....

Short ....

Error ....

.... Correct

Form 136—50m-10-'03.

Conductor ....

Lines ....

Car Nos. ....

Bag No. .... Amt. ....

Date ....

FIG. 22.—FRONT AND BACK OF CASH-BAG TAG

Form 203-10m-8-'03

Los Angeles Railway Company

MISCELLANEOUS REPORT BLANK

In all cases of altercation with passengers, derailment, broken trolley, headlight, car windows or any other damage to property of the Company, make report on this blank. Be expressly careful to state exact locality and every particular that would be necessary to a complete understanding of the case.

Car No. ——— *Going* ——— *Line* ———

Date ——— *Time* ——— *M. Place* ———

Conductor ——— *Motorman* ———

SUBJECT:

PARTICULARS

——— Motorman or Conductor

In all cases of damage to property, obtain the names and addresses of as many witnesses as possible. This blank is not to be used in accident cases.

FIG. 24.—CONDUCTOR'S MISCELLANEOUS REPORT BLANK

ACCIDENTS AND THE CLAIM DEPARTMENT

In case of accidents, however slight, the conductor and motorman on the car make up a report on an accident blank, Fig. 27, stating the car number, line, time, place, condition of track and brake, name and address of person injured, extent of injury, extent of damage to car or other vehicle damaged, name and addresses of owner and persons in charge, and then giving a statement of the whole matter, with any other information which may seem valuable. This report is signed by both conductor and motorman. A blank form is printed on the back which the injured party may fill out in case he exonerates the crew of the car. Conductors are supplied with small blanks, Fig. 28, on which they obtain the name, residence and business addresses of witnesses.

Form 126 1,000,000. 1-03.

Motor .... Trailer .... Line

FARES REGISTERED 1903

Motor Trailer

.... Miscellaneous ....

TRANSFERS

End ....
Com ....
Issued ....
End ....
Com ....
Issued ....

TRIP		TIME		Fares Registered	CASH		Transfers	School Tickets	Free Mail Carriers	Passes	R. Tickets	Compl'y Tickets	Special Tickets	Police Firemen	Trainmen	Total Passengers
					$	Cts.										
	OUT															
	IN															
TOTAL																

.... Conductor Badge No. ....

FIG. 23.—CONDUCTOR'S TRIP ENVELOPE

After this report is submitted to the superintendent, the testimony of witnesses and other interested parties is taken down by a stenographer and typewriter. The physician's certificate is obtained, and, in the more important cases, a blueprint is secured of the scene of the accident. If the accident was a fatal one, a certified copy of the inquest is obtained, and all these papers are filed for future reference.

The superintendent, John J. Akin, settles all claims himself or through the assistance of his claim agent. In cases of large claims, the company's attorneys are consulted, but the power of settlement remains with the superintendent. The public is always treated very courteously and every complaint considered. The superintendent attends all inquests and arranges to have present all witnesses he thinks necessary.

The company has been very successful in the handling of its claim department, and few cases are carried into court.

Form 204—2m-8-03 *No*

LOS ANGELES RAILWAY CO.

ACCIDENT BLANK.

In case of any accident, however slight, this blank must be filled out, in ink and returned to the Superintendent's office.

Car No. .... *Line* ....

Motorman .... *Conductor* ....

Accident (trip leaving) .... *at* .... *M.,* *190*

Exact time .... *M. Exact place* ....

Condition of track (slippery or not) .... *Was brake in good order* ....

Full name and address of person injured ....

Extent of injury ....

Extent of damage to car or other vehicle ....

Name and address of person in charge ....

Name and address of owner ....

Number of passengers on at the time ....

Having answered the foregoing questions correctly, give a statement of the whole matter in the following space with any other information which may seem valuable

FIG. 27.—ACCIDENT REPORT

During the nine years of the corporate existence but three judgments have been entered against it. During the year 1902, seven units, involving alleged damages of $125,000, were brought against the company, and it won them all. During 1903, out of a total of five suits, it lost but one. The amount paid out by the company in settlement of damage claims averages about 2½ per cent of the gross earnings.

Form 315—1-04-35 M

LOS ANGELES RAILWAY CO.

Motorman's Daily Report of Condition of Cars.

Car No. .... *Date* .... *190*__

Line ....

NOTE: Mark O. K. or B. O. and fill in time of taking and leaving car, and sign in same column. Explain on back of this card if necessary and sign name to same. Each motorman to fill out and hand to his relief; last man to put in box at barn.	SIGN HERE			
Took Car at	M	M	M	M
1 Trolley				
2 Fuse Box				
3 Canopy Switch				
4 Controller				
5 Armature				
6 Brushes and Holders				
7 Fields				
8 Connections				
9 Resistance Boxes				
10 Lamp Circuit				
11 Bearings				
12 Motor Suspension				
13 Brakes				
14 Trucks				
Left Car at	M	M	M	M

FIG. 25.—MOTORMAN'S DAILY REPORT ON CONDITION OF CARS

Form 205 8-03 -10M

Name of Witness ....

Residence ....

Address ....

FIG. 28.—BLANK FOR WITNESSES' NAMES AND ADDRESSES

Form 134A 2M 3-03

LOS ANGELES RAILWAY COMPANY

Daily Report of Transfers furnished to Conductors and issued on .... *190*..

Conductors must turn in all unused transfers each night. Whenever they deviate from this rule, notation to this effect must be made in the "remarks" column.

The terminal number will be the closing number of the package or packages of transfers delivered to conductor, and for the ending number add one to the terminal number where the whole package of transfers are used. On broken packages the ending number will be the same as the commencing number of the transfers when furnished to the conductor subsequently. All transfers made void by being erroneously punched by conductor must be reported separately on this form and sent to the auditor daily with the report.

	Run No	Car No.		Conductors		Serial	Terminal	Issued		No.	Remarks
		Out	In	Out	In	No	No	Com No	Ending No.	Issued	

FIG. 26.—TRANSFER REPORT

LOST ARTICLE DEPARTMENT

The lost-article department is operated under the supervision of the assistant superintendent. All articles found by the conductor and motormen on the cars are turned in with a report as to time and place, and those not claimed within sixty days are returned to the men who found them. A list, notifying the men to whom articles are returned, is posted twice a month.

OPENING OF THE NEWCASTLE BRANCH OF THE NORTH-EASTERN RAILWAY

The Northeastern Railway is one of the principal railroad companies of Great Britain and, as announced some time ago in this paper, the company is equipping electrically a short section of its system in the neighborhood of Newcastle. Full commercial service with electrical service was put in operation March 29, although experimental trains were operated as early as Sept. 27, last year. There are 37 miles of double track and four miles of branches, equivalent to 82 miles of single track, equipped with electric power. The running time of the trains as compared with steam trains has been reduced 25 per cent.

The equipment was installed by the British Thomson-Houston Company, and the third-rail system is in use, the current returning to the generators through the track rails. The power distribution is at 6000 volts, and the current is furnished by a local electrical power company; 600 volts are used on the third rail. There are seventy motor cars and an equal number of trail cars, and the multiple-unit system is used. The opening of the line on March 29 was made quite an occasion, and a number of the directors of the company and distinguished guests were present. Trains are run at a headway of fifteen minutes, and twenty seconds only are allowed for each station stop.

ELECTRIC RAILWAYS OF NEW JERSEY

Situated as it is between Philadelphia and New York, New Jersey has always been very prominently identified with steam railroad development, as all of the large trunk lines reaching New York, with the exception of the New York Central Railroad and the New York, New Haven & Hartford Railroad, have their land terminals in New Jersey. Up to within recently there was no through electric line between either Philadalphia and New York or Trenton and New York. The through connections to Philadelphia, however, have now been completed practically between New York and Philadelphia, and through parties have been carried from Jersey City to Trenton. It will be impossible at present to operate through cars between New York and Philadelphia, on account of a difference in gage, the lines through the northeastern part of the State having been equipped with 4 ft. 8½-in. gage, whereas the Trenton lines and most of those south of that city follow the practice in Philadelphia and other cities in Eastern Pennsylvania, and are equipped with a 5-ft. or a 5-ft. 2-in. gage.

A glance at the map shows the present condition of the connecting electric lines between New York and Philadelphia. As will be seen, when Trenton is reached on the trip south, two routes are open to the traveler, one on the east and the other on the west side of the Delaware river. The line is almost a straight one between the two cities from Milltown south, and if that between Milltown and Elizabeth is built as projected, the distance, although not the running time, by the electric and by the steam road would be almost the same.

The principal factor in the electric railway development in New Jersey, and almost the only factor in the northeastern part of the State, is, of course, the vast combination known as the Public Service Corporation, which owns all of the lines in Hoboken, Jersey City, Newark, Elizabeth and the Oranges, a district which is very densely populated, and which is the largest as well as one of the most attractive suburbs of New York City. The Public Service Corporation was formed on May 6, 1903, under the laws of the State of New Jersey, as a consolidation of the North Jersey Street Railway Company, the Jersey City, Hoboken & Paterson Street Railway Company; Elizabeth, Plainfield & Central New Jersey Railway Company; the Orange & Passaic Valley Railway Company, and the United Electric Company. The company also leases a large number of other lighting, railway and gas properties, and controls also the gas and electric lighting interests of the greater part of the State. The consolidation is of such recent date that no further discussion of the property is necessary here. A part of the projected extensions of the company is shown, including one through Ridgewood to the New York State line at Suffern.

The only important railway system in Northern New Jersey which is not controlled by the Public Service Corporation is that belonging to the New Jersey & Hudson River Railway & Ferry Company. This company owns a ferry running from West 130th Street, New York, to Edgewater, N. J., whence a line runs north to Englewood and west to Paterson. The same company owns a line running south from Hackensack to Arlington, a suburb of Newark.

Trenton, the State Capital, enjoys the distinction of being the terminus of more independent electric railways than any other point in the State. The Trenton Street Railway Company was the first on the field, and it owns practically all the local system, with branches to Princeton, Pennington, and Yardville. An extension from Pennington to Hopewell will be built at an early date, the contract having been given.

The New York & Pennsylvania Traction Company operates the Trenton, Lawrenceville & Princeton Railroad, under a steam charter, and the combination of street railways extending to Newtown, Pa., 12 miles. Altogether 25 miles of road are operated. Freight is carried on the Princeton line, being hauled direct from the Philadelphia & Reading Railway tracks in cars belonging to that company. The Trenton, Lawrenceville & Princeton Railroad is the only strictly electric railroad in the State which hauls regular railroad freight cars, including the "battleships" loaded with coal. All this hauling is done with the passenger cars, after hours.

The Trenton & New Brunswick Railroad extends from a point in Hamilton township, near Trenton, to Milltown Junction, 3 miles south-

Street Ry. Journal

east of New Brunswick, on the Middlesex & Somerset (Public Service) system. Cars are run to Adeline (near Broad) and Liberty Streets, Trenton, over the tracks of the Camden & Trenton Railway, and a special car conveys the passengers to and from State and Warren Streets (2½ miles) in the business center of the city. Cars enter New Brunswick over the Middlesex & Somerset tracks. The Trenton & New Brunswick Company has a steam railroad charter, but has carried very little freight. The New Jersey Short Line Company has been chartered within the past few weeks for the express purpose of extending the line northward from Milltown Junction to Elizabeth, where, it is understood, connection will be made with the Public Service lines, and the cars run through Newark into Jersey City.

The Camden & Trenton Railway extends for 29 miles from State and Warren Streets, Trenton, paralleling the Trenton Street Railway for nearly 4 miles, southward to Bordentown, Florence, Burlington, Beverly, Riverton, Riverside, Palmyra and West Palmyra, where connections will be made with the Camden & Suburban. The Camden & Suburban is building a line from Camden to West Palmyra, and it is expected that the short break now existing will be closed within a few weeks. It will then be possible to run cars right through from State and Warren Streets, Trenton, to the Philadelphia ferries, in Camden, and this will be done through traffic arrangements between the two companies. The Camden & Trenton connects with the Trenton & New Brunswick at Adeline and Liberty Streets, Trenton, but as already stated, no cars can be run through, owing to the difference in gages.

The Trenton, Lakewood & Atlantic Railroad Company is practically a new corporation, and proposes building a line from Trenton to Lakewood and the seashore, presumably to Point Pleasant. Trenton, Lakewood & Atlantic interests control the Point Pleasant Traction Company, and a contract has been let for the building of the section between Point Pleasant and Lakewood. George O. Vanderbilt, of Trenton, is the president.

The Delaware Valley Traction Company has a charter and most of the rights of way for a line from Trenton to Lambertville, but has done nothing toward building, except the planting of poles in the city of Lambertville, where it holds a franchise on Main Street. The Trenton, Newhope & Lambertville Street Railway Company, a Pennsylvania corporation, and a part of the New Jersey & Pennsylvania Traction system, has begun construction on a line from Yardley, Pa., to Newhope, and it will cross the new Delaware bridge (now building to replace one destroyed by floods) into Lambertville, $10,000 having been paid as an option to secure it. Cars will will be run direct from Warren and Hanover Streets, Trenton, to the center of Lambertville, over the New Jersey & Pennsylvania Traction Company's lines, when this is completed. It is, therefore, a question as to whether the Delaware Valley Traction Company will build or not.

The Philadelphia, Bristol & Trenton Street Railway enters Morrisville, Pa., opposite Trenton, where it connects with the New Jersey & Pennsylvania Traction Company, but its lines do not enter New Jersey.

North of Trenton the electric railways are largely in the Public Service system. The only railway in operation in the western part of this half of the State is the Phillipsburg Horse Car Railroad, which is operated by electricity under the control of the Lehigh Valley Traction Company, of Allentown, Pa. The Easton & Washington Traction Company has given a contract for a line from Phillipsburg to Washington, and it will be extended to Hackettstown and Lake Hopatcong. Other branches will extend from Washington to Belvedere, and from Washington to Clinton. This company is controlled by the Hay Brothers, in Easton, Pa., who operate the Northampton Traction lines.

The Morris County Traction Company has built some track in Dover, Wharton and Rockaway, and expects to have a part of the line in operation this summer. Rights of way and franchises are being secured for the Morris County Traction all the way from Lake Hopatcong to Elizabeth, via Rockaway, Morristown, Summit, etc.

The Delaware Valley Traction Company is also securing rights of way from Morristown to Caldwell, for an electric railway. There are several other projects in Morris County, but none of them has as yet been chartered.

The only other actively projected lines north of Trenton, aside from those mentioned, are from Princeton to Somerville, and Somerville to Morristown. James Brown, Jr., of Somerville, controls a right of way for 8 or 9 miles. Several surveying parties have been over both routes, and one or two have been securing rights of way, but no charters have been taken out. Under the New Jersey laws, though, the charter is merely a question of depositing the necessary amount of money. A line from New Brunswick to Princeton is also hinted at, recently, by New Brunswick parties.

South of Trenton the first active electric railway is the Burlington County Traction Company, which, in turn, is controlled by the People's Traction, of Philadelphia. This line extends from Morestown to Mount Holly, and will soon extend to Burlington, a part of the track having been laid. Regular cars will operate from Mount Holly to Camden at an early date. An extension from Mount Holly to Pemberton is projected.

Camden is the electric railway center of South Jersey, but two companies control practically all the lines there. The Camden & Suburban covers Camden and the nearby suburban towns as far as West Palmyra, Moorestown and Haddonfield.

The Camden, Gloucester & Woodbury Railway, which is controlled by the Public Service Corporation, extends from Camden to Woodbury, touching at National Park and Washington Park. It also extends south to Mullica Hill. Further extensions to Paulsboro and Clayton are talked of, but no construction work has begun.

The Paulsboro Traction Company has a project on foot for building from Woodbury to Paulsboro.

The only electric railway system in the half a hundred miles from Mullica Hill to Cape May, is the Bridgeton & Millville and Millville Traction lines. The former extend from Bridgeton to Millville, and from Bridgeton to Port Norris. Freight is carried, this being the only line in the State which operates a traction charter secured at the time that freight could be carried under that act. The Millville Traction Company's line extends from Millville to Vineland.

Returning to the Atlantic Coast, and beginning at South Amboy, the first electric railway is the Jersey Central Traction Company, a part of the Vandegrift system, which is about completed from South Amboy to Keyport, and is in operation from Keyport to Red Bank, this latter having been opened since the first of April. Extensions are also planned to Atlantic Highlands.

The Monmouth County Electric Railway extends from Red Bank to Long Branch, via Eatontown, and the Atlantic Coast Electric Railway extends from Long Branch, through all the shore towns, to Belmar, from which point there is a break to Point Pleasant. The Point Pleasant Traction Company has a local line, and will build an extension to Lakewood.

The Brigantine Transportation Company is next down the coast. The company operates 9 miles of road and supplies the city's lighting. Practically all the business is done in the summer.

The West Jersey & Seashore Railroad (Pennsylvania Railroad) controls the electric railway system in Atlantic City, with the Atlantic City & Suburban in the field from Atlantic City to Pleasantville. The Delaware Valley Traction Company

also made a vigorous fight for a terminal here last year, and has several miles of road laid on the meadows. The Delaware River & Atlantic, for which a contract was recently let, will be a high speed line from Gloucester City, opposite Philadelphia, to Atlantic City. According to the officers, this road will be the highest class in the country. It will be entirely upon private right of way.

Ocean City has a local electric railway, the Ocean City Electric Railroad.

Cape May has the Cape May, Delaware Bay & Sewell's Point Railroad, operated by electricity and controlled by the Philadelphia & Reading Railway, which also controls the Ocean Street Passenger Railway.

South Jersey has not as yet become a prolific field for electric railway operations, although it offers the advantage of a nearly level country, and, in some sections, a good population per mile.

The only electric railway in South Jersey controlled by the Public Service Corporation is the Camden, Gloucester & Woodbury, which is a South Jersey Gas, Electric & Traction Company corporation. The American Railways Company controls the Bridgeton & Millville Traction Company.

Although not in New Jersey, Staten Island, with its electric lines, is also shown on the accompanying map. There are only two lines in Staten Island, both of which are controlled by H. H. Rogers, of New York, and an early consolidation is likely. The roads are still operated separately, with Charles L. Spier as president of one line, and secretary and treasurer of the other, and with S. F. Hazelrigg, general manager of the Atlantic Coast Electric Railway, as manager of both.

DROP LETTER BOXES ON CARS

San Francisco, March 9, 1904.

EDITORS STREET RAILWAY JOURNAL:

Will you kindly let us know the extent to which drop letter boxes are being carried on individual passenger cars of the electric railways in this country. Are these boxes installed with the sanction of the Government, and how are the deliveries made to the postoffice? Where are the boxes located on the cars as a rule, and is the operation of the cars delayed by persons who are not passengers posting letters? I do not refer to the operation of regular mail cars, which is common in many cities, but to the use of drop letter boxes on ordinary passenger cars.

A. B. C.

This practice is followed by a number of roads, including those in Ottumwa, Des Moines and Burlington, Iowa; Salt Lake City, Utah; Duluth, Minn., and Hartford, Conn. In some of these cities an arrangement has been effected directly with the postoffice department at Washington, while in others the service has been installed on the initiative of the railway companies. As a rule, the cars are equipped with the ordinary form of cast-iron mail boxes, such as are used on street corners. These boxes are attached either to the side of the car or, where single-ended cars are used, as in Des Moines, to the rear platform. They are so arranged that a person can drop a letter from the street whenever the car stops. Opinions among railway managers conducting this service differ as to whether the posting of letters in this way delays the operation of the cars, but if so, the delay is slight, and where the service is a local one, is not of very great moment. The letters are removed from the cars by a mail carrier, and are usually emptied at the nearest point at which the cars pass the postoffice. The boxes form a part of the mail system of the Government, and the same protection is extended to them as to the other drop letter boxes.

Where a contract is entered into directly with the Government for this service, a payment is made for it. As a rule, the service is much appreciated by the public, as it expedites the transmission of mails.

STATISTICS ON WHEEL COST IN EUROPE

As outlined in this paper for Dec. 6, 1902, most of the Continental tramways are using steel-tired wheels, whereas the general practice in Great Britain, up to within recently, certainly, has been the employment of chilled-iron wheels. There is a tendency, however, at present in Great Britain, toward the use of steel-tired wheels. In explanation of this and of the practice on the Continent, it ought to be said that the full grooved rail is almost universally employed, and that the grooves in these rails are very much narrower than in the United States. As it is very difficult to make a chilled-iron flange with any depth of chill to fit these narrow grooves and yet provide it with a backing of gray iron, chilled-iron wheels in Europe have in many cases chipped badly on the flange. The use of steel-tired wheels in Europe, however, is not universal, and in a few large cities like Milan and Buda-Pest, chilled-iron wheels have been and are being used successfully and very extensively.

The accompanying table, which has been supplied this paper by a well-known tramway engineer in Europe, gives some recent quotations on cost of cast-iron, steel-tired and cast-steel wheels as used in different cities, principally on the Continent.

	Diameter Inches.	Weight Lbs.	Cost Per Lb. (Cents).	Cost Per Piece (Dollars).	Delivery.	Date.	Manufacture.
Cast Iron Wheels	33	340	4.0	13.60	Paris	1900	French
" "	--	---	2.64	------	"	1904	English
Steel Tired Wheels	34	340	7.8	26.52	Jeumont	1900	French
" "	20	160	11.8	19.00	"	"	"
" "	30	---	------	12.50	Brussels	1904	Belgian
" "	31¾	---	------	19.00	London	1903	English
" "	30½	295	9	20.25	Paris	1900	French
Cast Steel Wheel Center	29	166	5.0	8.30	"	1903	"
Rolled Steel Tires	29½ Interior	268	3.1	8.30	"	1902	"
" "	15½ Interior	153	3.1	4.74	"	"	"
" "	30 Interior	243	3.1	7.53	"	"	"
" "	--	---	2.7	------	Brussels	1904	Belgian
" "	--	---	2.0	------	"	"	"
" "	--	---	------	5.50	Haarlem	"	German
Pair Steel Tired Wheels and axle mounted	--	---	------	55.60	"	"	"
Pair Steel Tired Wheels and axle mounted	33	-----	------	52.00	Liverpool	"	English
Pair Steel Tired Wheels and axle mounted	33	---	------	31.40	Antwerp	"	Belgian
Pair Steel Tired Wheels and axle mounted	33	---	------	41.60	"	"	"
Pair Chilled Cast Wheels and axle mounted	33	---	------	26.00	Liverpool	"	English

The gage of track in most cases is 4 ft. 8½ ins., although a few of the roads given in the table are of narrower gage.

Considerable attention has been given in Europe to the quality of the steel in the tire and the material composing the center of steel-tired wheels. Soft steel has been used to some extent for tires, and is considerably cheaper than hard steel, but experience has proved that it is more expensive in the long run. The centers are usually forged, but it is now becoming quite frequent to use cast-steel for this purpose. It would appear that the cast-steel will give enough longer life to warrant its increased first cost over the forged iron centers.

The following are extracts from some steel-tired wheel specifications prepared by Mr. Fell for the Sheffield Corporation Tramways. These specifications are the result of a number of tests, and they are, therefore, practical in the best sense of the word:

CENTERS

The centers to be 26¾ ins. diameter, to be of cast-steel, having a tensile strength of from 30 tons to 35 tons per square inch and an elongation of at least 15 per cent in 2 ins. They must be capable of withstanding a test load, applied by static pressure to the center, of at least 50 tons, without producing any permanent set, and also a load of at least 100 tons applied in the same manner, without showing signs of breaking up. The above loads to be applied to the hub of the wheel in a testing machine, the rim resting against four bear-

ing blocks about 3 ins. wide, fixed on the stationary portion of the machine. The whole of the centers to be carefully turned and stepped on the rim for the reception of the tires.

The hub to be faced on both sides of the wheel and bored for the axles. The weight of the finished center not to be less than 164 pounds.

TIRES

The tires to be of specially tough rolled crucible or Siemens-Martin steel, having a tensile strength of from 50 tons to 55 tons per square inch, with a minimum elongation of 11 per cent to 8 per cent in 2 ins. The tires to be shrunk on the wheel centers, and secured to the same by an approved method, so that it will be impossible for the tire to work loose sideways, or circumferentially. The weight of finished tire to be not less than 166 pounds.

MILEAGE

Every tire must run at least 5000 miles per 1/8 in. thickness without breaking the flange, loosening, or showing any other signs of defect down to a minimum thickness of 3/4 in.

REBUILDING G. E.-57 FIELD COILS AT ST. LOUIS

In rewinding the field coils of G. E.-57 motors in the shops of the St. Louis Transit Company, some important changes from the original way of constructing these coils have been made by W. O. Mundy, master mechanic, and his assistant,

FIG. 1

FIG. 2

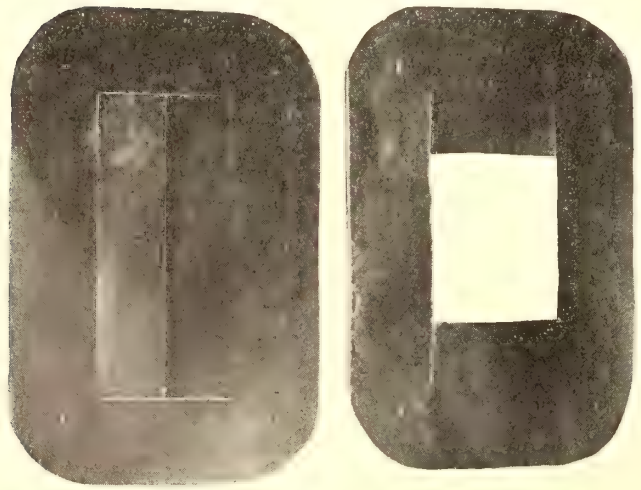


FIG. 3

Chas. Remelius. As all know who are familiar with the first construction of the field coils of the G. E.-57 motor, the coil consists of flat bare copper strap wound with a strip of asbestos between the turns. The asbestos is somewhat wider than the copper strap. Two such strap wound coils make up one field coil. They are wound side by side on a brass shell. The brass shell carrying the coil is slipped over the pole piece. The two coils are separated from the brass shell and from each other by heavy micanite board. It was found at St. Louis that frequently one or two turns would be short-circuited by contact at the edges of the copper strap. The vibration of the brass shell on the pole pieces as the shell wore down at

FIG. 4

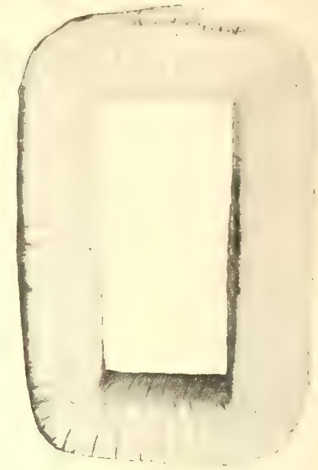


FIG. 5

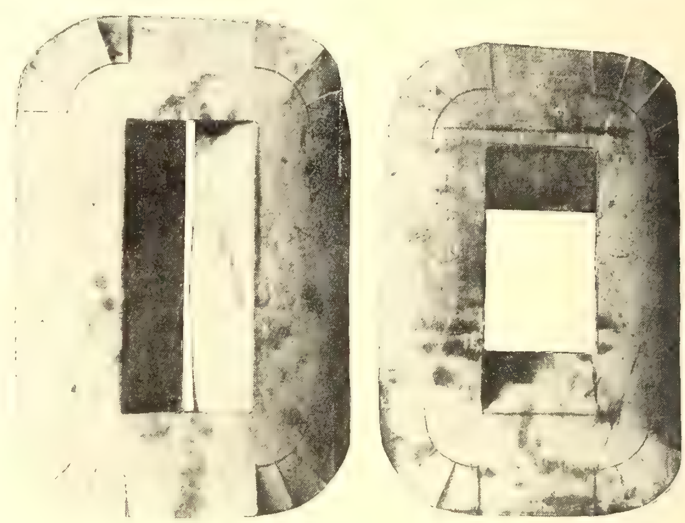


FIG. 6

FIG. 7

the points planed off for its bearing on the motor casing, and the vibration of the coils in the brass shell proved ruinous to insulation in many cases.

The new plan is to wind up the two sections of the field coil separately on a wooden form, using the copper strap and asbestos just as before. This leaves a coil like that shown in Fig. 1. It is then taped as in Fig. 2. The coil is then dipped in insulating paint. After this dipping it is covered with empire cloth. The two pieces of empire cloth to cover it are cut as in Fig. 3. The cloth is held in place by a layer of tape, which is wound over the whole coil. This leaves the coil as shown in Fig. 4. The two coils are then laid side by side and connected together and are covered with canvas, micanite and red board cut as in Fig. 6, and the whole is wrapped in canvas, making the

completed coils look like Fig. 5. The whole is then dipped again in insulating paint.

Instead of using the brass shell for mounting on the field poles, two pressed-steel forms made in the company's shops are used. These are shown in Fig. 7. As the pole piece is drawn in place the insulating covering of the coils is pressed so as to hold the field coil firmly and prevent vibration. Another advantage incidental to this method of constructing field coils as compared to the old method is that the transformer test for short-circuited coils can be applied, while with the coil wound on a brass shell the transformer test, of course, can not be applied, because the shell itself acts like a short-circuited turn.

CARS FOR FORT SCOTT, KANSAS

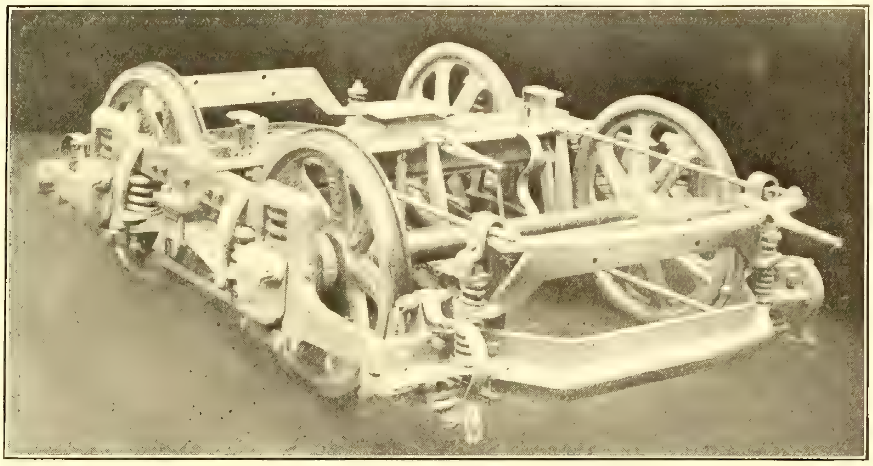
The Fort Scott Gas & Electric Company has lately received a number of fine cars like the one illustrated, built by the American Car Company, of St. Louis. The railway company operates 9 miles of lines in Fort Scott and vicinity, and owns a popular summer resort known as Town Hill Park. Fort Scott is 125 miles directly south of Kansas City, close to the Missouri border, and is an important center for mining and shipping of bituminous coal. It has a population of 10,500, and is one of the most thriving cities in the State. The cars are handsomely finished in cherry, with decorated birch ceilings. The upper window sashes are stationary, and the lower arranged to drop into pockets in the sides, and have hinged covers for the openings. The sashes in the vestibules also drop. The cane upholstered walk-over seats have a capacity for thirty-six passengers. Upper truss rods are shouldered high upon the posts, and half-inch sill plates are upon the outer side of the side sills. The cars measure 25 ft. 4 ins. over the end panels, and 34 ft. 9 ins. over the vestibules; from the end panels over vestibules, 4 ft. 8½ ins. They are mounted on Brill "Eureka" maximum traction trucks having 4 ft. wheel base, 33-in. driving wheels, and 20-in. pony wheels.

The Brooklyn Rapid Transit Company has determined to reinforce all of the elevated railway structures throughout the city. The present viaducts were not designed for the heavy motor-equipped trains now in operation, so the changes that have had to be made by many of the steam railroads in late years, owing to the great change in rolling stock and train loads, has extended to passenger lines within a single city. The work is in charge of Boller & Hodge, of New York.

EXTERIOR OF CAR FOR THE FORT SCOTT ELECTRIC RAILWAY COMPANY

INTERESTING TRUCKS FOR TURIN, ITALY

The J. G. Brill Company recently shipped ten trucks of its No. 27-G-E-1 type to Turin, Italy. The brake system of these trucks is of unusual interest, as both outside and inside brakes are used, which work independently so far as the levers and brake-rods of the truck are concerned, but which are operated simultaneously by a lever attached to the car body. The top brake-rods, just inside the wheels and attached to the horizontal brake lever shown in the picture, operate the outside brake-shoes, while the upright lever at the center operates the inside shoes. The former are adjusted by crown nuts on the brake-rods outside the brake-beams, while the latter receive their adjustment by means of a connecting rod at the lower ends of the live and dead levers. The wheel base is 4 ft.; the axles are 6 ft. 4⅞ ins. diameter, and journals 3½ ins. in diameter. The wheels used are 33 ins. in diameter and the gage is 4 ft. 8⅞ ins. The side frames are solid forged in a single piece, a method of construction peculiar to the builders. The bars between the yokes are 1½ ins. thick x 4½ ins. deep at the center. The pedestals are 3½ ins. thick, and the extensions 1⅜ ins. Double corner brackets, forged from a single billet ⅞ ins. thick, secure the transoms to the side frames, together with single corner brackets ¾ in. thick. The pedestals are fitted with steel gibs.


TRUCK USED IN TURIN, ITALY


INTERIOR OF CAR FOR THE FORT SCOTT ELECTRIC RAILWAY COMPANY

FINANCIAL INTELLIGENCE

WALL STREET, April 13, 1904.

The Money Market

Money rates are still extremely easy, despite certain influences which would seem to favor a higher market later on. Call funds have gone begging on the Stock Exchange this week at 1½ per cent. Relatively, time money quotations are fully as low. For sixty days 3 per cent is the ruling figure, while for the long periods contracts are offered freely at 4 per cent. In addition to last week's gold exports of $3,500,000, another million was engaged Monday. These withdrawals have made no impression whatever on exchange rates, which continue at the shipping level. It is quite certain, therefore, that exports will keep on, and will probably reach a large quantity before the present month is out. Another factor pointing toward higher money is the continued expansion in the bank loan account, which has now reached the stupendous figure of $1,032,000,000. The more recent increase in loans is due partly to the fact that the trust companies and other lending institutions outside of the Clearing-House have retired from the market, finding it more profitable to keep their balances on deposit with the banks than to lend them out on such low terms as the situation offers. But it is also true that the Clearing-House members are anxious to avail themselves of every opportunity to place their unemployed funds on demand and short time loans, for the purpose it would seem of forcing up the money rate. In this latter circumstance appears the chief reason to believe that the present exceptionally easy conditions will not last for very much longer. On the other hand, there is nothing in the outlook to suggest anything but a very moderate hardening of the market. The gold for Europe has been more than replaced by the arrivals of Japanese specie, which last week amounted to $5,000,000. More of these arrivals are looked for in the immediate future. Meanwhile the shrinkage which has often been noted during the last few months in the volume of interior trade is operating in two ways to increase reserves at this city. It is causing an extraordinary inflow of country bank balances, and it is reducing the payments of the banks on interior revenue to such an extent that the Treasury is left a debtor on current transactions. From now on for the next two months and a half the accumulation of currency from these two sources should be fairly constant. The movement will probably be sufficiently heavy to offset the gold which Europe takes. Under these circumstances it may readily be seen that the chances for much of an advance in money rates are small.

The Stock Market

The advance on the Stock Exchange has continued unremittingly during the past week, and there are no signs as yet that the rise is about to culminate. The excitement over the Union Pacific episode and the whole Northern Securities controversy has subsided. Fears that the dispute over the control of the Northern Pacific might lead to an open rupture have been allayed by the assurance of both contending parties that they will leave their differences to the decision of the courts and will abide by the outcome. In consequence the dealings in Union Pacific shares have ceased to overshadow the general trading, and the upward movement has shaped itself on other lines. All trustworthy indications point to the activity of the large financial interests on the side of rising prices to a greater degree than at any time in the last two years. The reasons underlying the advance ought scarcely to need much elaboration. With money as easy as it is now prices of securities are made to seem genuinely low. This is one phase of the situation. The other lies in the assurance which recent events have greatly strengthened that general business throughout the country is on the mend, and that although no return is likely to the flush time of 1902, the much-dreaded commercial reaction is a thing of the past. Trade reports are telling a more cheerful story; the steel corporation in its recent statement showed that earnings of the steel trade are rapidly recovering their lost ground, while railway traffic receipts are also gaining in a most satisfactory manner. Taken all in all, the railway statements for the month of March not only showed a great improvement over the preceding month's, but a considerable advance also over a year ago. The government crop report revealing a condition of only 76 per cent for winter wheat, does not make a very auspicious beginning for the crop season. But it is far too early yet to start a crop scare. With good growing weather from now on there is still opportunity for the wheat plant to repair some of the winter's ravages. Altogether the prospect is distinctly brighter than it has been for a very long time, and joined to the fact that the efforts to advance prices have seemingly been undertaken seriously by representatives of substantial capital, there is good cause to look for the upward tendency to continue.

The local traction stocks have come in to more prominence in the week's dealings with brisk advances in Brooklyn Rapid Transit and Metropolitan. Manhattan has hung behind the rest, and there are, in fact, some evidences of this stock being well supplied, for what cause does not appear. An important speculative party has been bullish on Metropolitan ever since the recent break in the stock, taking the position that it was cheap on its merits, even though the earnings of the company have fallen behind the 7 per cent dividend. The price seems to have been marked up this week partly at the expense of a short interest which found itself unable to cover at last month's low figures. The advance in Brooklyn Rapid Transit has, of course, been a purely speculative move, the animus of which is the time-worn argument that the season for heavy earnings is approaching.

Philadelphia

In the Philadelphia dealings of the week prices have again failed to improve to the extent that might have been expected from the course of the general speculation. Philadelphia Traction gained a half point to 96, which is the highest it has sold in some time. There was a good deal of small investment buying in this issue. Philadelphia Electric was active and stronger, moving up from 5⅞ to 6 3-16, and holding most of the advance. With these two exceptions, however, prices were barely altered on the week. Union Traction, which last week touched 50, did not go above 49¾. Philadelphia Company, although as active as usual, remained almost stationary around 39. One or two sales of the preferred were reported at 44. A few fractional lots of American Railways were dealt in at 43¾ and 43⅞. United Traction of Pittsburg preferred sold at 48¾, and one lot of Fairmount Park Transportation at 25.

Chicago

The Metropolitan Elevated has borrowed $1,100,000 for the purpose of acquiring more property and making further extensions and more improvements. The loan is secured by a deposit of extension mortgage bonds, which are a lien on the new property. Announcement of this transaction has been followed by fresh liquidation in the company's shares. A hundred Metropolitan common sold this week at 16¼, down ¾ of a point from the last previous sale. A hundred Metropolitan preferred sold at 49½, after which 700 shares were offered down as low as 47. A little selling was also induced in South Side Elevated when the news came out that the stockholders had ratified the proposition to increase the capital stock by $7,000,000. Support was forthcoming, however, on the decline, and after selling at 90⅛ the stock recovered to 91½. Union Traction issues have been a trifle better, the common improving from 5¼ to 5⅜, and the preferred gaining a point to 31½. A single lot of North Chicago sold at 71, and West Chicago at 43¾. City Railway changed hands at 165. Lake Street Elevated receipts, with the $2 assessment added on to the price, sold at 3¾. A single sale of Northwestern Elevated common occurred at 17, and one transaction in the preferred at 45.

Other Traction Securities

All the Boston tractions have shared in the general market improvement of the week. Boston Elevated, on comparatively large transactions for that stock, rose from 139 to 140½, West End common, from 92½ to 93, and West End preferred, from 110½ to 111½. All these represented the highest quotations reached in a long while past. The Massachusetts Electric issues were more active, the common especially, which has lain dormant lately, rising from 19¼ to 20½. The preferred sold as high as 75 and as low as 74⅛. No sales occurred in United Railways of Baltimore stock during the week, but the bonds were fairly active, the incomes changing hands between 53 and 52¾, and the general 4s between 90 and 90¼. Lexington Street Railway 5s were a feature of the Baltimore dealings, advancing nearly four points, from 96½ to 100. The move seemed to be entirely speculative. Norfolk Street Railway 5s gained a half-point, from 106 to 106½. Charles-

ton Consolidated 5s sold at 85, Atlanta Street Railway 5s at 106, Anacostia & Potomac 5s at 96, City & Suburban of Baltimore 5s at 113½, and 50 shares of Consolidated Traction stock at 72½. On the New York curb, Interborough Rapid Transit again monopolized the interest so far as the traction group was concerned. The stock declined from 110½ to 108¾ on sales of 800 shares, after which 500 shares sold on a recovery to 109. New Orleans common sold at 9½, and 350 shares of the preferred from 30 down to 27 and back to 27¾. Two small lots of American Light & Traction sold, one at 47 and the other at 49¼. Nassau Electric 4s declined from 79¼ to 78½.

Speculation in Miami & Erie Canal continued strong in Cincinnati last week. Over 1000 shares of the stock changed hands at 1¾ to 2½, the closing price being 2. Five thousand dollars worth of the 5 per cent bonds sold at 30. Cincinnati, Newport & Covington preferred sold at 85½ and the common at 30½, the demand falling off considerably from previous weeks. Cincinnati Street Railway advanced to 183, the highest in many months. Detroit United sold off to 64½ on several small sales. Twenty-two thousand dollars worth of Cincinnati, Covington & Newport first 5s sold at 109, and $19,000 worth of Cincinnati, Dayton & Toledo 5s at 81½, the latter selling in small lots.

At Cleveland, Cleveland Electric was active at 75, sales being about 300 shares. Northern Texas Traction sold at 32¾, a slight increase over previous figures. Northern Ohio Traction declined a trifle during the week and the last sale was at 14¾, total sales, 300 shares. Northern Ohio Traction & Light 4s sold at 55¾, a trifle lower than previous mark.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid April 5	Closing Bid April 12
American Railways	43	43
Aurora, Elgin & Chicago (preferred)	—	a55
Boston Elevated	139	140
Brooklyn Rapid Transit	44¼	46⅝
Chicago City	—	160
Chicago Union Traction (common)	5	5½
Chicago Union Traction (preferred)	30	30½
Cleveland Electric	72½	74⅞
Consolidated Traction of New Jersey	62	63
Consolidated Traction of New Jersey 5s	105	105
Detroit United	64	64
Interborough Rapid Transit	109	108
Lake Shore Electric (preferred)	—	—
Lake Street Elevated	1½	3½
Manhattan Railway	142	142¾
Massachusetts Electric Cos. (common)	19	20¼
Massachusetts Electric Cos. (preferred)	74	75
Metropolitan Elevated, Chicago (common)	a17	15
Metropolitan Elevated, Chicago (preferred)	48	45
Metropolitan Street	113¼	115½
Metropolitan Securities	80	80
New Orleans Railways (common)	8½	9½
New Orleans Railways (preferred)	29	28
New Orleans Railways 4½s	a78	74
North American	84½	85
Northern Ohio Traction & Light	14½	13
Philadelphia Company (common)	*38⅞	38⅝
Philadelphia Rapid Transit	13¾	13¾
Philadelphia Traction	95¼	95¾
St. Louis (common)	11	11½
South Side Elevated (Chicago)	90	91½
Third Avenue	120	120½
Twin City, Minneapolis (common)	91	93¼
Union Traction (Philadelphia)	49½	49½
United Railways, St. Louis (preferred)	52	53
West End (common)	92½	92
West End (preferred)	110¾	111½

a Asked. * Ex-dividend.

Iron and Steel

No particular developments are to be noted in the iron trade during the past week. The only important item of news was the announcement that the Steel Corporation had delayed for the time being any further purchases of raw material—action which was construed in some quarters as not reflecting entire assurance over the pig iron outlook. Nevertheless, pig iron prices have held firm. More activity is reported in structural shapes, and the bar trade is flourishing. The ending of the bricklayers' strike in this city removes all fear of a general tie up in the buildings industry, such as wrought such havoc with the steel business last summer. This, of course, is a highly encouraging incident. Quotations are as follows: Bessemer pig iron, $13.85; Bessemer steel, $23, and steel rails, $28.

Metals

Quotations for the leading metals are as follows: Copper 13⅜ to 13½ cents, tin 28 cents, lead 4⅝ cents, and spelter 5⅛ cents.

AGREEMENT BETWEEN THE GENERAL ELECTRIC COMPANY AND THE ALLGEMEINE ELECTRICITATS GESELLSCHAFT

At a special meeting of the stockholders of the Allgemeine Elektricitäts Gesellschaft, held in Berlin, Feb. 27, to consider the amalgamation of that company with the Union Elektricitäts Gesellschaft, a report was submitted by the chairman outlining the relations to be established between the consolidated company and the General Electric Company, of America, and its other affiliated companies in Europe, such as the French and Mediterranean Thomson-Houston Companies, the Austrian and Russian Union Elektricitäts Gesellschaften and the Union Electrique, of Brussels. The element which unites all of the companies of this vast group is the interchange of patents and experience.

Under the new agreement the territories of the Allgemeine Elektricitäts Gesellschaft and the General Electric Company and its branch companies are defined as follows:

The exclusive territory of the General Electric Company comprises the United States of America and Canada, that of the A. E. G. Germany, including Luxembourg, Austria-Hungary, Russia in Europe and in Asia, Finland, Holland, Belgium, Sweden, Norway, Denmark, Switzerland, Turkey and the Balkan States. With regard to the territories of the various branch companies in Europe, separate agreements have been made. For the other continents, including South America, a joint working of the two large concerns is proposed, an arrangement which will no doubt result in a profitable joint undertaking. The subject of the Italian territory will be considered a little later on. The present condition of affairs will hold good in Spain and also in Greece.

The General Electric Company and the A. E. G. will form a company, with a capital of 3,000,000 marks, for the exploitation of the Riedler-Stumpf and the Curtis steam turbine patents in the territory of the A. E. G. In this combination the Curtis patents are valued at 1,800,000 marks and the Riedler-Stumpf patents at 1,200,000 marks. The A. E. G. has secured a license to supply all non-European countries with this turbine, with the exception of the United States and Canada. In these latter countries the General Electric Company has secured the Riedler-Stumpf rights.

The rights for the use of the Curtis patents for marine engines have been secured by the International Curtis Marine Turbine Company. This company has given a license to the A. E. G. for its European territory, while the A. E. G. has allowed the Marine Turbine Company to use the Riedler-Stumpf patents for its marine work.

For the purpose of working the steam turbine patents of Professors Riedler and Stumpf, the A. E. G. has formed a "Company for the Introduction of Inventions, Ltd." The patents have now passed into the possession of the Vereinigte Dampfturbinen Gesellschaft, and in the United States in the hands of the General Electric Company, the marine having been secured by the Marine Turbine Companies, and the inventors, Messrs. Riedler & Stumpf, derive part of the profits from the facilities granted to the A. E. G.

A similar contract as that concluded with the General Electric Company has been made with the British Thomson-Houston Company for the export trade. Various additional rights have been granted to the British company, such as a financial participation in the branch companies of the A. E. G. and of a company which may eventually be formed in Great Britain for the manufacture of Nernst lamps. The A. E. G. reserves also the right to also supply turbines in addition to other manufactures.

Similarly to the relations with the British company there also exists an exchange of patents and experience with the French Thomson-Houston Company. The A. E. G. will restrict its French establishment to the sale of its manufactures in France, and will supply engines and steam turbines to the French company only. This company has secured the option to draw shares of the Soc. Française d'Electricité A. E. G. up to a certain amount. On the other hand, the French Thomson-Houston Company guarantees to the A. E. G. a demand of dynamos in proportion with the turnover of apparatus up to the present time.

From the various agreements the A. E. G. will commence immediately to form the following companies:

(1) A company for the manufacture of turbines, turbo-generators and accessory apparatus. The Allgemeine Dampf-Turbinen Gesellschaft is to be equipped with a share capital of 5,000,000 marks, to be paid in as required. The shares are subscribed for by the A. E. G. For the establishment of a factory it is proposed to use the land, buildings and plant of the U. E. G., the working of which has been absorbed by the A. E. G. The above-mentioned real estate will be left to the Allgemeine Dampf-Turbinen Gesellschaft for a number of years, with the option of its purchase outright. The technical management will be in the hands of Dir. Lasche, who up to the present has been looking after the turbine construction work of the A. E. G.

(2) The above-mentioned Turbine License Company. This company has already been formed under the name of Vereinigte Dampfturbinen Gesellschaft M. B. H. (United Steam Turbine Company, Ltd.).

(3) An Italian company, with a capital of 6,000,000 liri. To this company will be transferred the organizations of the A. E. G. and the Thomson-Houston Company, as well as the Italian turbine patents of the entire group.

(4) An arrangement somewhat similar to that existing between the A. E. G. and the U. E. G. has been arrived at between the Société Belge d'Electricité A. E. G. and the Union Electrique in Brussels. A formal amalgamation of these two companies may take place in the future.

Although the expense in connection with the companies enumerated, the purchase of patents and the sums advanced represent a considerable amount, this is still further increased by the taking over of the shares of the Austrian U. E. G. in which the Berlin U. E. G. is largely interested, and which for this reason and also for the purpose of establishing suitable works in Austria it seemed desirable entirely to re-organize.

The report then cites the financial arrangements which have been made to obtain the necessary capital to carry out the program outlined, which includes the transfer of the property of the U. E. G. to the A. E. G. in return for the sum of 6,500,000 marks in new A. E. G. stock which a syndicate has agreed to purchase at the rate of 210 per cent, giving a cash fund of 13,650,000 marks. There would then be a liquidation of the U. E. G. by the issue of an exchange of shares for A. G. E. shares in the proportion established by the joint interest understanding, viz., 3:2.

The report also states that the A. E. G. has procured control of Brown, Boveri & Company, of Baden, by the purchase of shares to the amount of four and a half million marks, secured by the issue of three and half million marks worth of certificates of new shares of the A. E. G. The Brown, Boveri Company, however, will continue to work independently and under the same management as at present.

ANNUAL REPORT OF METROPOLITAN WEST SIDE ELEVATED, CHICAGO

The annual statement of the Metropolitan Elevated Railway Company for the fiscal year ending Feb. 29, 1904, shows a surplus of $216,100, which is equal to 2½ per cent of the preferred stock. No dividends were paid on the preferred last year, enabling the company to extinguish the floating debt. In the directorate R. Somers Hayes was succeeded by C. H. Requa. B. L. Smith and F. L. Higginson, Jr., were re-elected. Among other things, President MacAllister, in presenting his report, said:

"A new coal handling plant has been constructed at Forty-Sixth Avenue on the Garfield Park line, in place of the old apparatus which had become inadequate to the needs of the company. This plant will greatly facilitate and economize the handling of fuel for the power house and stations, and furnish much needed storage room for a reserve supply.

"Some progress has been made in the construction of the new terminal station at Fifth Avenue, between Van Buren Street and Jackson Boulevard. The work has been retarded on account of inability to get possession of the property on Franklin Street; also by delay in the receipt of material. The improvement will be completed during the summer, and in ample time for the heavy fall and winter traffic. The board of directors realizes that this station is very much needed, as our service has not been satisfactory during the 'rush hours' for the past two years, and no material relief can be had until the new terminal station is in operation.

"The increase in traffic has been fairly satisfactory during the year, and was particularly gratifying at the stations which were put in operation last year, on the extension of the Douglas Park line. On account of the closing of the theaters on Jan. 2, 1904, and during the time they were closed, this company lost considerable traffic. The traffic delivered to your company by the Aurora, Elgin & Chicago Railway has shown a satisfactory increase during the year, partially due to that company having put in operation on May 26, 1903, a branch line from Wheaton to Elgin, Ill., thus opening additional territory.

"The operating expenses were comparatively high for the year, due to increase in cost of supplies, fuel and labor, wages having been materially increased March 15, 1903, by decision of a board of arbitration. Although the increased wages continued throughout the year, other expenses decreased during the latter part of the year, and the result has been much more satisfactory than for the first part.

"The board of directors, in view of improvements made during the year, and those contemplated, and in view of present general financial conditions forbidding sale of bonds on terms that could be considered, deemed it wise to pass the dividend for the fiscal year."

The comparative statement for two years follows:

	1904	1903
Passenger earnings	$2,065,701	$1,976,326
Miscellaneous earnings	81,453	63,679
Total earnings	$2,147,154	$2,040,005
OPERATING EXPENSES		
Maintenance of way and works	$64,330	$55,306
Maintenance of equipment	149,022	137,119
Conducting transportation	726,790	670,738
General expenses	102,196	89,544
Total expenses	$1,042,338	$952,707
Net earnings from operation	1,104,816	1,087,298
Other income	6,030	9,524
Net income	$1,110,846	$1,096,822
CHARGES		
Interest on bonds	$474,353	$454,619
Rental Pennsylvania Company	11,900	11,900
Other rental	20,351	20,351
Loop rental	207,258	198,054
Taxes	139,533	140,870
Total charges	$853,395	$825,794
Balance	257,451	271,028
Preferred dividends	......	261,243
Old claims	41,350	30,767
Surplus for year	$216,101	*$20,982
Add surplus previous year	10,856	31,838
Total surplus Feb. 29	$226,957	$10,855

*Deficit.

The balance sheet compares:

Assets—	1904	1903
Cost of road and equipment	$29,249,758	$28,988,401
Metropolitan West Side Elevated railway preferred capital stock in treasury (2,919 shares)	291,900	291,900
Metropolitan West Side Elevated railway first mortgage 4 per cent bonds in treasury	192,000	192,000
Securities on hand	......	4,124
Material and fuel on hand	66,061	37,573
Accounts receivable	86,116	98,954
Trustee, extension 4 per cent bonds	1,860	76,538
Cash	221,714	298,173
Totals	$30,109,409	$29,955,573
CREDIT BALANCES		
Liabilities—		
Capital stock, preferred	$9,000,000	$9,000,000
Capital stock, common	7,500,000	7,500,000
First mortgage 4 per cent bonds	10,000,000	10,000,000
Extension 4 per cent bonds	3,000,000	3,000,000
Coupons unpaid	......	32,720
Interest accrued, not due	52,693	45,843
Taxes accrued, not due	117,779	120,676
Dividends due	......	130,700
Accounts payable	205,332	81,458
Reserve fund for replacement of property	6,648	2,933
Balance, profit and loss	226,957	......
Totals	$30,109,409	$29,955,573

MAYOR HARRISON ON MUNICIPAL OWNERSHIP

Mayor Harrison of Chicago says regarding the ownership of street railways by the city of Chicago: "Municipal ownership in our present financial condition is impossible. We have no money to take over these traction interests, and even if we had the companies would not sell them to us. I would like some of these people who have been so insistent for municipal ownership to come to the front and tell us how it is to be done."

CAR HOUSE BURNED AT BUFFALO

The car houses of the International Traction Company, of Buffalo, N. Y., in Main Street, burned with a fury that the firemen could not abate Tuesday morning, April 12. The houses and between thirty-five and forty cars were destroyed. The loss is placed at $200,000, fully covered by insurance. How the fire started has not been ascertained. There are some indications that it was of incendiary origin. It began in the paint shop, in the Main Street end of the building, which was of wood, and the wind, blowing from the west, rapidly carried it to the other end at Jefferson Street. Many of the cars destroyed were practically new and were of the summer type.

OHIO ASSOCIATION TO MEET AT CLEVELAND.

President Harrie P. Clegg of the Ohio Interurban Railway Association announces that the second meeting of the association will be held at the Hollenden Hotel, Cleveland, Thursday, April 28. A very interesting and instructive programme will be prepared for this meeting, and it is hoped that the attendance will be very large.

J. H. Merrill, of the Western Ohio Railway, of Lima; F. W. Adams, of the Toledo, Fostoria & Findlay Railway, of Fostoria, and F. W. Coen, of the Lake Shore Electric Railway, of Cleveland, have been appointed transportation committee to effect an agreement with as many companies as possible for the use of the interchangeable coupon book which was adopted at the meeting held in Dayton last month. The form of book was described in the STREET RAILWAY JOURNAL of April 9. Companies desiring to become parties to the agreement or interested in the plan, are requested to correspond with the members of this committee at the earliest possible date. Thus far, thirteen leading Ohio roads have signed the agreement, and it is expected that a number of others will come in before the Cleveland meeting.

The officials of the association desire it to be understood that membership in the association will not be confined to the State of Ohio alone, but that representatives of all roads throughout the Central West are eligible for membership and to become parties to any agreement that may be made by the association. Already the association has members in Indiana, Michigan, Pennsylvania and West Virginia.

THE NEW YORK RAPID TRANSIT BILLS PASS

The two bills prepared by the Rapid Transit Commission of New York were passed by the Legislature last week and are now before the Governor. As they were hastened in their passage by an emergency message from the Governor, there is no doubt that they will receive his signature, Mayor McClellan's approval being a foregone conclusion. One of the bills makes minor but needed changes in the law. The other makes it possible to proceed at once with the construction of new rapid transit subways. It removes the limit of expenditure under the law, now standing at $50,000,000, and enables the Rapid Transit Commission to lay out routes supplementary to those already adopted and to invite bids for their construction and operation.

THE STRIKE ON THE CAMDEN INTERSTATE RAILWAY

As far as the Camden Interstate Railway Company is concerned, the strike on its lines is over. As stated in the STREET RAILWAY JOURNAL of April 9, regular service has been given since April 1, and traffic now is normal. In order clearly to understand the situation, it is necessary to review the conditions from their beginning. It seems that the company had a contract with the men, whereby matters of difference arising between them should be submitted to arbitration. This agreement has been fully lived up to by the company, as the only matter of difference subject to arbitration was submitted to the board and is now pending before the arbitrators. The real cause of the strike was the discharge of two men for violating certain rules of the company. The union wanted these men reinstated. This the company refused to do, stating that its right to hire or discharge employees could not be abridged, as its success depended mainly on efficient and careful employees. As a result of this refusal of the company to meet the demands of the union the strike was declared on March 24.

The new 50-ton electric locomotive of the Cincinnati, Georgetown & Portsmouth Railway Company has been placed in service. This is the first electric locomotive to be used in the vicinity of Cincinnati. With a similar locomotive, which is expected to arrive soon, it will replace the steam locomotives now used in hauling freight.

FRANCHISE COMMISSION BILL IN OHIO

The bill to create a State public service board to grant franchises to city and interurban street railroad, gas, electric light, heat, power and water companies, has been introduced in the House at Columbus by Dr. Lefever, of Mountville.

The bill provides for a board of three members, to be appointed by the Governor, to have salaries of $6,000 a year each. This board will exercise control over street railways, interurban railways, artificial gas, electric light, heat, power and water companies. In case of disagreement between public service corporations and City Councils or County Commissioners, with reference to franchise grants, appeal may be had to the new board within thirty days, and it shall have power to grant franchises, regulate fares and other charges and authorize the construction, maintenance, extension and operation of public service plants. In short, the determination of practically all the conditions under which quasi public corporations are to operate in the municipalities will, by the terms of the bill, be placed in the hands of a State created commission of three members with absolute powers. Perhaps the paramount issue in the bill is the proposition to give the board power to regulate and fix street and suburban railway fares.

THE NEAR-SIDE ORDINANCE IN NEW YORK

The advocates of the present near-side ordinance in New York received a set back last week when President Fornes, of the Board of Aldermen, who is advocating its repeal, made public a letter from President Vreeland, of the New York City Railway Company, stating that the change had not diminished accidents. The letter also said:

During the past ten years, since I have been in charge of the operation of street railroads in this city, the proposition of establishing the so-called "near-side" stop has very frequently been brought up, and I have always constantly opposed it, because I knew that all the attempts to establish it in other cities have been received with dissatisfaction by the traveling public.

As you know, I had no part in securing the passage of the ordinance under which it was recently inaugurated. The city officials and a considerable number of citizens seemed to desire to give it a trial and I offered to co-operate. You are as well able to judge as I of how much it has been appreciated by the public.

Largely as a result of this letter, the Board of Aldermen voted on April 13 to repeal the ordinance. If signed by the Mayor, as there is no doubt it will be, the old condition of affairs will be resumed.

THE "JIM CROW" LAW AT RICHMOND

Owing to the trouble the Virginia Passenger & Power Company, of Richmond, Va., has been having with people who insist on expectorating in cars, the company is having copies of the State law covering this offense printed to put up in all cars. The law giving conductors the authority to seat passengers is also being printed to be put up in all cars. As soon as posted, probably by April 15, both laws will be rigidly enforced.

The following is the seating law as passed by the last Legislature, and which will be rigidly enforced:

NOTICE TO THE PUBLIC

The conductor of this car is authorized by law to separate white and colored passengers and to designate the portions of this car, or the seats therein, which may be occupied by white passengers, and which may be occupied by colored passengers, and to change such designation from time to time, and to require any passenger to change his or her seat when and as often as he may deem necessary and proper.

Any person failing or refusing to obey the direction of the conductor is liable to a fine of $25, and may be also ejected from the car for such refusal.

The conductor and motorman of this car are made by law special policemen while on duty.

(See Secs. 41-47 of chapter 4 of an act concerning public service corporations, approved Jan. 18, 1904, acts of Assembly, extra session, 1902-3-4, pp. 990-91.)

In accordance with this act white passengers will occupy seats in the forward portion of the car, and colored passengers will occupy seats in rear.

In open cars the two extreme rear seats are for smokers.

The following is the State and anti-expectorating law, which will be posted and enforced at the same time:

Chapter 595—An act to prohibit expectorating or spitting on any part of any car or coach owned or operated by any urban, suburban or interurban electric railway, etc.

1. Be it enacted by the general Assembly of Virginia, that it shall be unlawful for any person to expectorate or spit on any part of any car or coach owned or operated by any urban, suburban or interurban electric railway in this State, and that any person violating the provisions of this act shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be fined not less than $1 nor more than $10 for each offense.

2. All corporations, person or persons owning or operating in this State any urban, suburban or interurban electric railway shall post in their cars or coaches, in some prominent place, printed in large type, a copy of this act.

3. This act shall be in force from and after its passage.

A QUICK-ACTION BRAKE FOR STREET CARS

A patent was recently granted to Wm. S. Howland, of Jamaica, Long Island, N. Y., for the invention of a system of mechanical car braking that involves novel features, departing radically from the usual hand brake system. In general principle this system has much in common with the automatic air-brake system, in that mechanical pressure is held in reserve, which may be released gradually or instantaneously for applying the brakes.

In this system the brake-shoes are hung with spring pressure applied so as to hold them normally against the wheels for full braking effect. For operation of the car the brake-shoe pressure is released by means of the usual form of brake handle, the normal use of which is here, however, to pull the brake-shoes off of the wheels by compressing the pressure springs. In this way it may be seen that any accident to the brake rigging will release the spring pressure and throw the brakes full on, tending to quickly stop the car.

The method of holding the brake-shoes normally against the wheels is that of using a system of springs acting through the usual equalizing levers of the brake system beneath the car. These springs are drawn into compression in removing the shoes from the wheels, and the system is held in this position by the latch on the motorman's brake-shaft upon the platform; when it is desired to apply the brakes this latch is merely released, when the shaft may be allowed to unwind to let the brakes go on with full or part force, as required. In this way the brakes may be released at leisure, or instantly with full force, in emergency.

In addition to this an emergency system of brakes is added by another similar system of heavier and stiffer springs acting through a separate equalizing lever, so that when released it serves to throw added spring pressure upon the brake-shoe system. This emergency brake is applied and released in a manner similar to that used for the main brakes, a separate brake-handle being located upon the platform for it.

This system has many of the advantages of the automatic air brake in that power is always held in reserve when running and can be instantly applied when necessary, the release being accomplished at leisure, and moreover that any accident to the system tends to throw on full braking pressure. The inventor is a practical man of long experience in street railway work, and is now connected with the Long Island Electric Railway, at Jamaica, N. Y.

A PLAUSIBLE IMPOSTOR

A correspondent from Chattanooga writes that a person, who is undoubtedly the impostor exposed in the STREET RAILWAY JOURNAL for Jan. 4 and March 29, 1902, recently swindled a number of persons in that city—as well as in Richmond, Va. This time he is representing himself to be Wm. F. Campbell, of the house of Wm. Campbell & Co., Toronto, large importers of shellac, and owners of a secret formula for cutting shellac. It is needless to say that this claim is used only to secure money from his victim. The impostor usually represents himself to be either an Englishman or a Canadian, is about 5 ft. 7 ins. in height and from 30 to 35 years of age, weighs about 130 lbs., has iron-gray hair and is smooth shaven. He can also be recognized by his front teeth, which are very prominent and somewhat irregular and discolored.

SOME RECENT BABCOCK & WILCOX INSTALLATIONS IN EUROPE

A late computation shows that throughout the world the total horse-power of the Babcock & Wilcox make of boiler now in use reaches 4,500,000, and that many of the latest electric power stations in Europe are equipped with this type of steam generator. Thus in 1900 the city of Vienna placed an order for thirty-two Babcock & Wilcox boilers, each of 300 sq. meters heating surface, and capable, with the engines in use, of developing 600 to 650 ihp each; and in the same year the Midland Electric Power Corporation, of Great Britain, placed an order for eight of these boilers, each having 4780 sq. ft. of heating surface, or having an approximate capacity of about 1000 ihp. The city of Manchester next placed, in 1901 and 1902, some notable orders for these boilers for its municipal power station, aggregating fifty-one boilers, viz: four for Dickenson Street, having 3140 sq. ft. of heating surface; eleven for Bloom Street, having 5140 sq. ft. of heating surface, and thirty-six boilers for Stuart Street, twenty-four each with 3580 sq. ft., and twelve each with 5730 sq. ft. of heating surface.

Then came the largest boiler order of modern times, placed with the English company by the Metropolitan & District Electric Traction Company, Ltd., for its great Chelsea Power Station, consisting of sixty-four boilers, each of 5200 sq. ft. of heating surface, into which are being fitted 128 of the company's chain-grate stokers. This order as a whole undoubtedly holds the record for both boilers and stokers. After this it seems insignificant to speak of the order placed by the Japanese Imperial Navy for twelve boilers, each of 4394 sq. ft., for its arsenal and steel works, and of the eighteen boilers, each of 3140 sq. ft. of heating surface, for Bolckow Vaughan & Company's steel works, and the ten boilers for the Carville power station, each of 4500 sq. ft. of heating surface, or the twenty B. & W. boilers for the Paris Metropolitan Electricity Works. The steam turbines here represent 20,000 kw, and the boilers are of the company's marine type, with mechanical stokers, superheaters and economizers.

Among great power undertakings the boiler is also greatly in evidence. Thus the Newcastle-on-Tyne Electric Supply Company has already been referred to, partly in connection with its Carville station, and its works at Neptune Bank there are ten Babcock & Wilcox boilers, eight each of 4020 sq. ft. heating surface, and two of 4780 sq. ft. heating surface. The Midland Power Company has already been referred to.

The North Metropolitan Electrical Power Company has six boilers, with superheaters and chain-grate stokers, each of 4400 sq. ft. heating surface. The Yorkshire Electrical Power Company has also six, each with a capacity of 20,000 lbs. evaporation per hour, while the Lancashire Electric Power Company have six, of equal capacity. The Clyde Valley Electrical Power Company has ordered sixteen, each of 4400 sq. ft. heating surface. The Bankside Electricity Works has forty-five; the Chelsea Electricity Supply Company twenty-two; the Central London Electric Railway sixteen; the County of London & Brush Company thirty-six; the Dublin United Tramways twelve; the Glasgow Corporation thirty-six; the Islington Electricity Works, with ten, etc. The London United Tramways have eleven; the London Electric Supply Corporation eighteen; the Leeds Electricity Works twelve; the Metropolitan Electric Supply Company sixty-four; the Metropolitan Railway Company ten; the West Ham Electricity Works seventeen, and the Westminster Electric Supply Company seventeen, without referring to any other of the 200 electricity works in the United Kingdom alone.

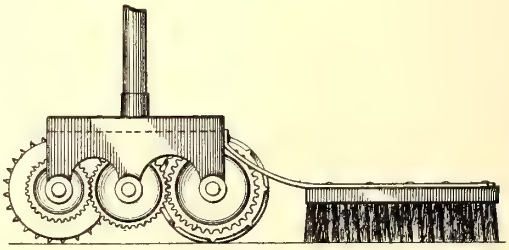
Babcock & Wilcox, Ltd., of London, have also supplied a very large number of boilers for the navies of the United States, Great Britain, Japan, and other countries, and are now building at their Renfrew works boilers having 8000 sq. ft. of heating surface. These may be relied upon to give upwards of 1500-hp as an ordinary working load in conjunction with the modern high-class condensing engines now manufactured, while their overload steaming capacity is known to be considerable.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED APRIL 5, 1904

756,288. Flexible Sliding Panel or Front for Articles of Furniture or Other Purposes; Hermann Romunder, Milwaukee, Wis. App. filed Jan. 12, 1904. The panel or front is made up principally of wood-veneer plates, the grain of alternate layers being reversed.



PATENT NO. 756,502

756,316. Electromagnetic Railway Switch; Rollin A. Baldwin, South Norwalk, Conn. App. filed Dec. 18, 1902. A single armature is acted upon by two solenoids to throw the switch in opposite directions and cut-outs automatically throw the current into the proper solenoid and hold it there until the solenoid has done its work.

756,411. Car Fender; Albert G. Roberts, Peterborough, Can. App. filed Aug. 17, 1903. Details of construction of that type of fender in which the fender is hung under the car and thrown to

operative position when a swinging gate mounted in advance thereof encounters an obstruction.

756,502. Mechanism for Removing Ice from Electric Conductors; Benjamin J. Jewett, Brooklyn, N. Y. App. filed Oct. 29, 1903. Two rotary cutters and a driving wheel mounted in a frame, gears connecting the driving wheel with the cutters and a brush attached to the frame and trailing behind the cutters.

756,523. Automatic Power Cut-Out for Electric Railways; Harry F. Pieper, New York, N. Y. App. filed Jan. 5, 1904. Circuits and apparatus so arranged that a car on a block using either power current or lamp current will prevent another car from entering the same block from behind, by taking current therefrom.

756,547. Trolley Pole; Edwin A. Wakefield and George W. Morse, Mechanic Falls, Maine. App. filed Dec. 18, 1903. Mechanism whereby the pole is lowered in case it rises above the wire.

756,550. Trolley; Charles M. Wilson, St. Louis, Mo. App. filed Feb. 18, 1904. A spirally-grooved trolley wheel in which the spirals are so arranged as to conduct the wire when displaced back to the center.

756,579. Emergency Brake; George E. Carnes, St. Louis, Mo. App. filed March 23, 1903. Details of construction.

756,757. Third-Rail Electric Railway System; John D. Wilkins, Chicago, Ill. App. filed July 24, 1903. A third-rail covering consisting of a string piece made in two longitudinal sections bolted together.

PERSONAL MENTION

MR. W. T. COOKE has resigned as superintendent of motive power of the St. Louis Transit Company, of St. Louis, Mo. His successor has not yet been announced.

MR. C. P. WILSON, formerly chief steam engineer of the Chicago City Railway Company, has recently taken a similar position with the East St. Louis & Suburban Railway Company.

MR. H. CHAPMAN, of the Montreal Street Railway, of Montreal, Que., has been appointed superintendent of construction of that company to succeed the late Mr. Vinden, who died some weeks ago.

MR. C. H. TAYLOR has retired as treasurer of the Northern Texas Traction Company, of Fort Worth, Tex. Mr. Taylor will be succeeded by Mr. Geo. F. Clifford, who has been cashier of the company.

MR. W. RUTHERFORD, general manager of Dick, Kerr & Company, Ltd., of London, is spending a few days in New York. Mr. Rutherford's visit is purely for pleasure and recreation. He expects to visit Canada before his return to England.

MR. C. A. DENMAN has resigned the superintendency of the Richmond Street & Interurban Railway Company, of Richmond, Ind., and has been succeeded by Mr. Albert Gordon, formerly connected with the Lafayette Street Railway, of Lafayette, Ind. Mr. Denman will go into the telephone business in the South.

MR. GUY L. FAIRBROTHER has resigned as superintendent of the Rutland Street Railway Company, of Rutland, Vt. His resignation took effect April 1. Mr. Fairbrother says he has made no plans for the future. Mr. M. P. Jones, formerly superintendent of the Norfolk Street Railway Company, of Norfolk, Va., has been appointed to succeed Mr. Fairbrother.

MR. GEORGE M. HOADLEY, who has been connected with the Bemis Car Truck Company for more than twenty years, has just severed his connection with that company and will represent the Peckham Manufacturing Company in the Southern territory. Mr. Hoadley, through his long experience, is recognized to be one of the best-posted men on electric railway trucks in the country, and the Peckham Company is to be congratulated on having secured his services.

MR. S. E. ROBB has resigned as vice-president and a director of the Galesburg & Kewanee Railway Company. His place has been filled by the election of Mr. Frank M. Lay, who is the manager of the Boss Manufacturing Company, of Kewanee and Galesburg. The company has announced that a number of improvements will be made soon, among which will be the completion of the line to Galva, the grading for which has already been completed. The company will also build the west end extension to the Kewanee Boiler Company's factory.

MR. A. B. DuPONT, retiring vice-president and general manager of the St. Louis Transit Company, was the guest of honor at a banquet tendered him at the Mercantile Club of St. Louis, on Saturday, April 9, by his fellow associates of the company. The dinner was quite elaborate, the menus being done in leather and carrying a picture of the guest of honor and of one of the recently purchased street cars. In speaking of his plans for the future, Mr. DuPont said that he and Mrs. DuPont would go to Detroit for a month and then spend several months in Europe. After returning from Europe Mr. DuPont expects to locate permanently in St. Louis.

MR. A. D. SCHINDLER, formerly division superintendent of the Santa Fe Railroad between San Francisco and Bakersfield, Cal., has been appointed general manager of the Pacific Electric Railway Company, of Los Angeles, to succeed Mr. Epes Randolph, who will in the future devote most of his time to his Arizona interests. Mr. Schindler is a young man. He was born in the Middle West and served as a civil engineer with the Southern Pacific Railroad. Resigning from this position, he entered the engineering department of the United States Government along the Pacific Coast, and finally became associated with the construction of the San Francisco & San Joaquin Valley Railroad, which is now a division of the Santa Fe. He was appointed superintendent of that division at the time it was turned over to the system in the spring of 1900.

MR. H. A. WALDRON, assistant superintendent of the Chicago & Joliet Electric Railway, has resigned to become superintendent of the Urbana & Champaign Electric Street Railway at Champaign, Ill. Mr. Waldron has been in railway work for six years. When a mere boy he entered the employ of the Springfield (O.) Electric Light & Power Company, but soon left the company to return to school. His next business connection was with the Springfield (O.) Street Railway Company, where he was rapidly promoted until he came to Willow Springs, Ill., as chief clerk and paymaster of the Dupage Construction Company, building the Chicago division of the Chicago & Joliet Electric Railway Company. He remained with this company until it completed its contract, and was then placed in charge of the operation of the road. In March, 1902, Mr. Waldron was appointed assistant superintendent of the entire system of the Chicago & Joliet Electric Railway Company.

MR. JAMES W. HINKLEY, president of the United States Casualty Company and president of the Walker Company, of Cleveland, before its absorption by the Westinghouse Company, died suddenly Monday, April 11, at his home, Eden Hill, Poughkeepsie, N. Y., of apoplexy. Mr. Hinkley was born in 1850 in Port Jackson, Clinton County, N. Y., and was educated at the Smith and Converse Academy and at the West Point Military Academy. Subsequently he removed to Poughkeepsie and became owner of The News Press. Later he purchased and assumed editorial control of The New York Daily Graphic. This connection brought him in contact with prominent men of each of the political parties, but particularly with the leaders of the Democratic party in New York, and he soon took an active interest in the work of the party. At the time of his death he was president of the Poughkeepsie City & Wappingers Falls Electric Railway Company, a director of the Poughkeepsie Trust Company, and of several New York banks. He is survived by his wife and eleven children.

MR. JOHN SCULLIN, who before the consolidation of the traction interests of St. Louis was connected with the Union Depot Company of that city, has been appointed director of transportation of the Louisiana Purchase Exposition. He will succeed Mr. George W. Ristine, who resigned last October, and whose duties have in the interval been performed by Mr. C. L. Hilleary, the traffic manager. Mr. Scullin, as director, is made the chief of operation of Exposition transportation within the grounds, and will also have jurisdiction over the intramural railway and its superintendent, as well as the superintendent of terminals, both of whom will report to him. The entire system of handling freight, exhibits and passengers on the site will be in his hands. He also will manage the Exposition's interest in the General Service Company. The superintendent of terminals is Mr. G. M. Carson, but there is at present no superintendent of the intramural railway. Some time ago the traffic manager of the intramural released his control, and it was turned over to President Francis. Mr. Scullin is one of the foremost railroad builders and managers in the West. He began as a contractor, doing much of the early work on Texas and other Southwestern systems. Later he entered the street railway field in St. Louis, building and managing for many years the Union Depot system, which was sold to the United Railways Company when the consolidated system was formed. Mr. Scullin was one of the owners of the St. Louis, Kansas City & Colorado line when it was sold to the Rock Island. He also built and is largely interested in the St. Louis & Northern Arkansas Railroad.

NEWS OF THE WEEK

CONSTRUCTION NOTES

ALAMEDA, CAL.—At a meeting of the West End Alameda Improvement Association April 1, City Trustee William M. Bowers stated that he had received the assurance from Manager Julius Kruttschnitt of the Southern Pacific Company in an interview a day or two before that an electric service to replace steam roads is to be installed for the suburban system, taking in the lines in this city and Oakland. "I asked Mr. Kruttschnitt," said Mr. Bowers, "why work was not proceeding on the construction of the $150,000 depot at the Alameda. He stated that the company was about to install an electric service, which had necessitated a change in the plans for the new depot, but that work would proceed in a short time. He informed me that the railroad officials felt that a change to electricity as a motive power was a necessity, and that the plans were now in the hands of the engineers."

LOS ANGELES, CAL.—The City Council has voted to advertise for sale an electric franchise along West Eleventh Street, upon petition of property-owners along the way, and has furthermore stipulated that the minimum price shall be $2,500.

LOS ANGELES, CAL.—Present plans seem to indicate that the Pacific Electric Railway will extend its line from Long Beach, now constructed nearly to Anaheim Landing, along the coast to a point where it will meet the Southern Pacific line from Smeltzer Station to Santa Ana. At this point the electric line will operate over the steam track to Newport Beach and Santa Ana. This will give excellent service to Newport, the popular seaside resort of Orange County, in which Mr. Huntington is interested.

LOS ANGELES, CAL.—The Los Angeles-Pacific Railroad Company is ready to go ahead with its proposed loop line, extending from the Soldiers' Home, near Sawtelle, to Santa Monica canyon. It is the company's intention to swing the line west along the Santa Monica bluffs, from the canyon to a connection with the main road. This road will open for settlement, with first-class transportation facilities, a large portion of the great Jones-Baker ranch, which is controlled by the company. The line will be double-tracked and built for high speed.

OAKLAND, CAL.—The Oakland Transit Consolidated has purchased from J. H. Macdonald the franchises for the street railroad connections in East Oakland known as the Fourth Avenue cut-off.

SAN DIEGO, CAL.—Through the Title Insurance & Trust Company, of Los Angeles, D. J. Kelley has filed the appropriation of 25,000 miners' inches of water from the San Luis Rey River to be used at Potrero, just below Warner's ranch. Kelley is reported to have made the filing in the interests of H. E. Huntington for the development of power for the electric railway from Los Angeles to San Diego.

WASHINGTON, D. C.—The Senate Committee on the District of Columbia has ordered a favorable report on Senate bill 2833, to authorize the extension, construction and operation of the Great Falls Old Dominion Railroad into the District. The bill proposes to allow the company to come into the District from the northern terminus of the aqueduct bridge and run eastwardly to the union station, and thence to the northeastern part of the District. Before the company shall have the right to lay its tracks in Bladensburg road between Maryland Avenue and Mount Olivet Cemetery the road shall be widened, without expense to the District of Columbia, to a width of 90 ft. between building lines. The terms on which there shall be a division of expense between the new company and the Capital Traction Company in the use of the tracks of the latter are prescribed.

LEWISTON, IDAHO.—Judson Spofford and associates have asked the City Council of Lewiston for a franchise to be granted the petitioners to operate and maintain an electric street railway over the streets and alleys of the city. A copy of the proposed franchise was submitted, showing the streets to be operated on, the line circling the city for 6 miles. The franchise provides that in good faith rail shall be laid within one year, and at least 2 miles shall be built and in operation by Dec. 31, 1905. The franchise is to run twenty-five years. The petitioners represent the Lewiston & Southeastern Electric Railway Company, which has completed a survey and is now ready to promote the building of an electric railway between Lewiston and Grangeville, with a branch line running to Nez Perce.

BELLEVILLE, ILL.—President John R. Piercy and General Manager Isaac R. Smith, of the Southern Illinois Electric Railway Company, with headquarters at Mount Vernon, Ill., were in Belleville March 29. The company claims to have obtained franchises in all of the cities along the right of way. The line is to be built from Salem, in Marion County, to Belleville, where it will connect with the East St. Louis & Suburban Railway.

EDWARDSVILLE, ILL.—Preliminary work on the St. Louis division of the Decatur, Springfield & St. Louis Electric Railway, an interurban line which will connect many places through the central portion of Illinois, will be resumed at once. The company has already completed large portions of the track between Decatur and Springfield, and between the latter place and Carlinville. E. J. Noonan, of La Salle, and W. H. Caton, of Ottawa, engineers in the service of the company, arrived in Edwardsville April 8, and in the evening met in consultation with some of the officers of the company. What territory shall be traversed between Edwardsville and Carlinville has not been definitely decided. It is stated that preliminary surveys will be started at once.

GALESBURG, ILL.—Plans are now being made by the promoters of the Western Illinois Traction Company for the taking up of the construction work on the lines in this city and on the interurban right of way between Monmouth and Galesburg, where it was left last fall. The laying of the track on South Eleventh Street will soon be begun, and will be pushed on East Broadway to the square, and from there south on Main street and south to the terminus of the line at the Burlington Depot. The first move of the company will be to ask the local Council to grant it a new franchise on East Broadway, from Second to Eleventh Street. This move is taken in response to several questions which have been raised as to the legality of the petition on which the Council granted the company a franchise on Broadway last fall.

KEWANEE, ILL.—The Galesburg & Kewanee Railway Company has announced that a number of improvements will be made soon, among them the completion of the line to Galva, the grading for which has already been completed. It will also build an extension to a local boiler factory.

EVANSVILLE, IND.—The Evansville & Eastern Electric Railway Company has incorporated to build an electric railway from Evansville to Rockport by way of Newberg and Yanketown. The officers of the new company are: J. C. Haines, president; J. W. Fuquay, vice-president; M. S. Sontag, treasurer; L. C. Friek, secretary; W. I. Rudd, F. W. Reitz and W. L. Sontag, directors. The equipment will consist of eight modern passenger coaches and several freight cars. The line will be 32 miles long. W. L. Sontag, who conceived and built the Princeton line, will be the chief factor in the promotion of this road.

GREENSBURG, IND.—The promoters of the Columbus, Greensburg & Richmond Interurban Railway are contemplating a survey to run parallel with the Big Four line the entire way from Columbus to Greensburg. C. N. Wilson, general manager, says the line will be constructed between Columbus and Greensburg. It will be double track the entire distance.

INDEPENDENCE, IND.—Ties are being distributed along the route of the Union Traction Company's proposed road between Independence and Coffeyville, and the announcement is made that construction work will be begun in a few days. The Darsey Construction Company, of Terre Haute, Ind., has the contract for construction.

INDIANAPOLIS, IND.—The Indianapolis & Northwestern Traction Company re-elected the old officers at the annual meeting held here April 6. The directors discussed a number of extensions which will probably be made to the system this season.

WABASH, IND.—The specifications for the track equipment and building of the Wabash & Rochester Electric Railway have been completed, and the promoters are busily engaged in preparing for beginning the grading.

TRIPOLI, IA.—A company is being organized here for the purpose of building an electric railway from Anamosa through Independence to Tripoli, and up the river to Nashua, thence to Mason City.

TOPEKA, KAN.—The Topeka Railway Company intends to spend $25,000 in installing new amusements at Vinewood Park. The principal new feature will be a "scenic railroad." Another new feature will be a merry-go-round. An electric fountain will also be one of the new attractions.

COLUMBIA, KY.—W. K. Azbill, of Columbia, says the plan to build an electric railway between Columbia and Lebanon, a distance of 46 miles, is in the primary stages. It is known at this time that the capital stock will be about $1,000,000, and that the line will be equipped to handle freight. Local parties will be interested to the extent of rights of way, depot grounds, easements, franchises and $100,000 of stock at least.

ANNAPOLIS MD.—A bill has been introduced in the House to incorporate the Stewartstown & Susquehanna Railway & Power Company. The incorporators named in the bill are Thomas Mackenzie, Harry M. Benzinger, Joseph W. Galbraith, Clarence B. Hight, E. E. Mackenzie, Harry E. Karr and Thomas H. Robinson. The capital stock is $10,000, with privilege of increasing it to $500,000. The company is authorized to construct and operate an electric or steam railroad from some point on the west bank of the Susquehanna River, in Harford County, through the northern part of Harford County, for a distance of 12½ miles or more to some point near the said State line not farther westward than the boundary line between Harford and Baltimore Counties, with the power to cross and bridge the Susquehanna River and extend the road eastwardly or northeastwardly to some point at or near the Pennsylvania State line. Power to consolidate with other roads is given.

MANKATO, MINN.—Last fall the construction of an electric railway from Mankato to Albert Lea, a distance o 52 miles, was agitated. Owing to financial difficulties, however, the project was not launched then. Since that time a few of the original projectors, impressed with the Mankato end of the scheme, have had a survey completed from this city to and through Eagle Rock and Mineral Springs to St. Clair, a distance of 13 miles. St. Clair is the center of a very large and rich farming country without any railroad facilities, and while the passenger traffic would be light, there would be an abundance of freight traffic. The line would be very easy to build. The county is level and there is no need for bridges. The promoters are anxious to have the project investigated with a view to constructing the line. J. A. Willard, president and treasurer of the Standard Fiber-Ware Company, of Mankato, Minn., is interested.

JACKSON, MISS.—Chief Engineer Paige, of Terre Haute, Ind., in charge of the surveying party which is to lay out the route for the interurban electric railway from here to Vicksburg, left here April 4. It is said that the straightest line from Jackson to Vicksburg wll be followed, and it is not believed that there are many engineering difficulties in the way. Estimates of cost of construction will be made as soon as the survey is completed.

ST. LOUIS, MO.—D. C. Taylor, president, and Dr. J. M. Berry, secretary of the St. Louis, Kirkwood & Manchester Railroad Company, which was granted a franchise in St. Louis County in 1901, were before the County Court at Clayton last week seeking a renewal of the court granting them permission to cross certain roads. The terms of the original franchise were

INDEXED

Street Railway Journal

VOL. XXIII. NEW YORK, SATURDAY, APRIL 23, 1904 No. 17.

PUBLISHED EVERY SATURDAY BY THE
McGRAW PUBLISHING COMPANY

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.
BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues).............................. $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

The Chicago White Elephant

The municipal authorities in Chicago having at the recent election been presented with a very large and obstreperous "white elephant," in the shape of a demand for municipal ownership of the street railways, are now asking each other what they shall do with it. Mayor Harrison, whose chief aim during his administration has been to obstruct any movements looking to a settlement of the traction question, fails to come forward with any practical plan for realizing municipal ownership, and in his public utterances does not show any great enthusiasm about the municipal ownership scheme. In fact, it is evident that he doubts whether any feasible scheme for municipal ownership can be evolved. The officers of the organization formed for the purpose of municipal ownership agitation, realizing that they must cease to utter glittering generalities and proceed to propose some workable scheme for carrying out their ideas at once, have outlined some plans, which, however, do not seem to be taken very seriously by the Chicago press, as they are manifestly impracticable. The solution of the question toward which events seem to be working now is some kind of a license providing for the purchase by the city upon terms which will be agreeable to the companies.

The Fuse

In the old days of single-truck cars and 25-hp and 15-hp motors, a number 18 copper wire in a wooden box answered all purposes of fuse protection, and gave no trouble, even when it blew on dead short circuit. In these modern times of heavier powered cars, the fuse makes a much more noticeable flash and report. The protection it affords from an engineering standpoint is amply sufficient and the worst that can happen is a burned out fuse contact or a burnt fuse box, and this only occurs when the short circuit is very severe. Unfortunately, however, the legal protection is by no means adequate. Scores of cases are taken into court where the accident is described by the layman witness as a roar and a burst of flame as high as the car. The suit is usually brought to recover injuries which have been sustained in the resulting panic, but which are more often variously ascribed to shock, burn, and the like, the former being the more popular. These suits, while usually won by the company as they should be, are troublesome and expensive to defend, and the money spent upon them would easily hide the inevitable pyrotechnics which accompany the accident, by the simple device of housing the fuse in a strong porcelain enameled steel shell, which, if made long enough and strong enough, will not only hide all the flash from the excitable passengers, but will have sufficient volume to allow the imprisoned gases to escape gradually and muffle the report to a mere puff or hiss. Some forms of gas engine mufflers could be profitably studied in designing such a box, which should be produced, not because of its engineering improvement, but because of its legal importance.

High Tension Trolley Insulation

One of the most important of the new problems now to be worked out in connection with single-phase alternating-current railways is the perfection of trolley wire insulators for potentials of over 1000 volts. Existing over-head material can now be obtained for an operating potential of 1000 volts without difficulty. When we go above that figure we get into a field where there is but little experience to guide us. That trolley potentials of over 1000 volts will and must be used in the heavy railway work of the future, will follow inevitably upon the demonstration of the success of the alternating-current railway motor in commercial work. If there was no other reason, the necessity of reducing the difficulties of the collection of heavy currents will alone require trolley voltages much higher than 1000 volts. The insulation of high-tension transmission lines, however, is such a well-established art that no serious difficulty is to be anticipated in insulating trolley lines at higher voltages than 1000. This does not mean that it is no more difficult to produce a satisfactory insulator for a high-tension transmission line than for a trolley wire. The disastrous effects of the continual hammering of trolley wheels were experienced in the earliest days of the over-head trolley and are well recognized. Mechanical strength to stand this hammering and a cushioning of the hammer blow will be necessary on a 1000-volt line, just as it is on existing over-head construction. The size of high-tension insulators is such as to give them a mechanical strength not possessed by smaller

insulators of glass or porcelain. There is, therefore, good reason to suppose that such large insulators can be used as trolley-wire insulators without the difficulties which would beset any attempt to use smaller insulators of the same material for trolley wire suspension. Whether the trolley wire insulator of the future will be of this type or not is the problem now confronting the manufacturer of this class of appliances.

Preservative Treatment for Ties

Considerable attention is now being given by the railroad companies to the very important problem of timber treatment, and its application to the preservation of ties. Wooden ties are steadily becoming more scarce, and the desirability of obtaining increased life from them is rapidly coming to be felt, especially by the large systems of both steam and electric roads, who use ties in such large quantities. The steel tie has not proven a formidable competitor of the wooden tie either in matter of first cost or in effect upon smoothness of track.

In view of the greatly increasing use of timber and ties by the electric railway systems interest will naturally center in a paper upon "Timber Treatment and Timber Treating Plants," by Walter W. Curtis, before the last meeting of the New York Railroad Club, which is presented in abstract in this issue. Mr. Curtis reviews the state of the art in an interesting manner, and points out the characteristic features of the different processes of treatment, with particular reference to the progress that has been made in the past few years in this line.

He adds important information and data, to that which has previously been published, regarding the actual results that may be expected from treated ties and timber.

A solution is thought by some to have been found for this important problem, in the recent adoption, by some of the larger steam railroad systems, of the method of growing their own ties. An Eastern road is planting large forests of trees of rapid-growing kinds, with the expectation of having timber of sufficient size for tie purposes within twenty or thirty years. Another large system is devoting large tracts of land in waste mountain regions to similar purposes with the expectation of favorable results in somewhat longer periods of time. But, inasmuch as it takes from thirty to sixty years to grow trees of sizes large enough for economical cutting into ties, it may readily be seen that this solution of the problem will not be generally applicable, and it behooves us to give particular attention at present to all possible methods or processes which will increase the life of our present supply of timber. The timber-treating process has proven very efficient and successful, and is, at present, apparently the best solution of this problem. Remarkable results may be obtained in increase of the life of ties by creosoting; the natural length of time in service in the track may, in this way, be more than doubled, although, of course, the saving thereby incurred must not be calculated merely from the resultant increased life—the labor of removing and replacing is by far the more important factor, as it usually amounts to more than the entire cost of the new tie, so that the result of treating may be four-fold, or even more. Furthermore, inferior grades of wood, when properly treated, chemically, may be used for these purposes with as desirable results as can be obtained ordinarily from the best grades of untreated tie timber.

This all applies equally as well to all classes of timber structures, used by our railroad companies, which are subjected to the effects of the weather. The electric railroads are now using timber trestles to a very large extent, and are only too soon confronted with the problem of renewing or strengthening them on account of decay of the lumber. With creosoted timber used for this construction, the life of the structure is not only greatly increased, but the labor required for renewing and strengthening is entirely eliminated—this is a feature that should not be overlooked. The creosoted construction also makes it possible to use the timber deck method of carrying ballasted tracks across trestles, with as little fear of the otherwise inevitable deterioration, as there would be in the best steel construction—this is also a consideration of importance, and should receive careful attention from street railway companies.

One of the most important factors in the problem of timber-treating, which is given considerable attention by Mr. Curtis in this paper, is the method of seasoning the lumber—whether natural or forced. It seems to be very important that timber should receive, for preservative treatment, air seasoning in the usual manner, as in no other way can the sap be removed as effectually; this has an important effect upon the treating process, as it makes possible the same penetration of the chemical into the timber in nearly one-half the time that would be required if green, and it adds greatly to the eventual life of the treated timber.

The Gas Engine Problem

Just now the prime mover most in the public eye is the steam turbine, which in three or four excellent forms is being pushed upon the market with all the energy which great skill and huge resources can muster. Very important it unquestionably is, particularly for certain classes of service, but what its final position in relative economy will be compared with the reciprocating engine it takes a bold man to predict. Even now its inferiority in economy at light load is being questioned, and recent tests have shown that reciprocating engines, when planned with reference to light load service, can give the turbine a run for its money. But the big gas engine, developed in the main abroad, and dismissed almost contemptuously by the extreme conservative wing of the engineering profession, is a power yet to be reckoned with. Bulky it is, and apparently complicated, denounced as costly to maintain and difficult to regulate, but looked at in its larger aspects the great fundamental fact stands out in high relief, that it has double the thermodynamic efficiency of the best steam motors that man has been able to produce. A common little gasoline engine, wheezing and thumping, cheaply built and designed without any of the fine finesse that goes into the planning of a modern steam engine, still utilizes the thermal value of its fuel at double the efficiency of its rivals. This fact there is no dodging, and no amount of argument about high friction losses and difficulties of lubrication will put it out of sight. Setting aside for the present the possibilty of an internal combustion turbine, it is plainly evident that when the reciprocating gas engine has been given anything like the intelligent development that the steam engine has received, it will be a most formidable competitor.

It is difficult just now to say whether this stage has already been reached, but to a certainty by the time the St. Louis Exposition has closed, we shall have new light on the subject. Fuel cost is the court of last resort in power production, and every year sees this item assume a more serious importance. Of course, a great gas engine plant with its gas producers is to-day more costly and complicated than an ordinary steam plant, but what of to-morrow? And gas production is a thing that in virtue of long experience can be reck-

oned with with some degree of certainty. The power of the gas producer to use cheap fuel, and the very low cost of transporting the gas, are matters of serious economic moment. As to the engines, their efficiency is a matter of record, and they require little attention. On the mechanical efficiency and life of very large gas engines we have at present very little light, but it is obviously unfair to judge these qualities by the performance of gas engines of ten or a dozen horse-power, as unfair as it would be to compare a little hoisting engine with the great triple expansion engines of a factory. A thousand kilowatt direct-coupled gas-engine unit is a thing which must be taken seriously, and within the next few years we venture to predict that such machines will be in considerable number in actual commercial service. In railway work, with its traditionally irregular loads and severe service, gas engines will be required to prove their qualities beyond question, and many people are inclined to doubt their usefulness under such conditions. Time changes conditions, however, and it is a fact that on large railway systems the load factors are often good and the irregularities of load are very much less than the traditions of earlier years indicate.

The storage battery too, which is coming into so extensive use as an auxiliary in power stations, and which has proved its usefulness as a load regulator, cannot be denied to gas engine plants. In the case of long lines and systems operating over a large territory, the present practice requires the use of high voltage electrical power transmissions with sub-stations, the latter often equipped with storage batteries to steady the load. How many engineers stop to think seriously of the possibilities of supplying sub-stations driven by gas engines with gas from a central producer. Remembering that the amount of gas to be delivered amounts to, roughly, 20 cu. ft. in horse-power per hour, it is entirely obvious that the supply main, even for a thousand kilowatt sub-station, would be of very moderate dimensions, while if properly laid, the depreciation and liability to interruption of service would also be very small. We are not aware that the details of such a system have ever been thoroughly worked out, and we are not prepared to say the scheme is practicable. But the results of such an investigation would certainly be interesting, and might furnish food for serious thought, particularly in cases where the distances are rather moderate. Within two or three years large gas engines will cease to be curios and will become genuine competitors in power problems. What the outcome will be in the long run we should be rash to predict. However, there is no use in shutting our eyes to the facts and pretending that the steam engine and steam turbine are to fight it out between themselves and divide the spoils. They will have to admit a third party to the melee, one who carries a large club and who is used to hard raps. When the dust of the fray has blown away it may not impossibly be found that the newcomer has escaped the ambulance.

The Flood Year

The past year has been the most disastrous in the way of floods for some time, and interurban railways in Indiana have suffered, especially during the last few months. In cases where interurban roads have followed the river valleys they have this year been confronted with extreme high water conditions, which have demonstrated the desirability of rights of way above high water mark. It is in loss of bridges and their approaches, however, that the most damage has been done, for such emergencies as these it is absolutely necessary for interurban roads in the long run to maintain a reserve and depreciation account. The floods of Indiana have been the greatest since 1875, and will prove a good guide to future interurban railroad construction and financial methods. During the Mississippi and Missouri floods in June last, steam railroads were great sufferers and their reserve accounts were heavily drawn upon for reconstruction at that time. In the June flood, however, the Kansas City street railways were also badly damaged by the temporary flooding of the principal power houses. The lesson of the whole matter is to keep above the highest recorded high water mark wherever possible, and to build bridges and their approaches with a view to floods as well as with a view to carrying the loads that are put upon them.

The Endless Chain of Crooks

The business of systematically swindling street railway companies by a class of men called journeymen railroaders, who secure employment as street railway conductors simply to steal what they can, has long been an established fact. This class of men has a peculiar ability in nearly always keeping employed, and as one caught stealing in one city can usually secure employment in another, another crook taking his place, an endless chain is maintained.

The position of a street car conductor is one that calls for special ability in the man filling the position provided it is to be done correctly, and there are plenty of men to be had to fill all vacancies who will be honest in the work if the proper methods are employed. By this is meant provided that proper care is used to determine their antecedents.

In the case of a resident of the city, the investigator should be able to find out if an applicant ever worked as a street car conductor before by personally seeing the references. In cases where the latter live at a distance, the mail has to be employed and this leaves open several opportunities for misstatements. The writer knows of a case where a man had the record of being discharged twenty-two times in twenty cities, and when a company would write to his references, would secure the letters and personally dictate the reply.

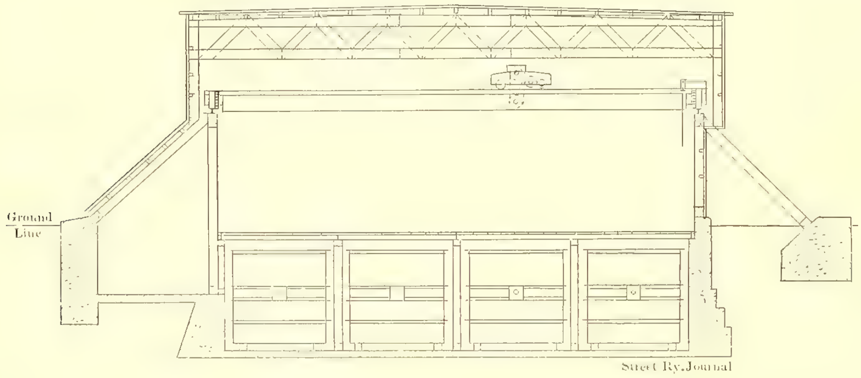
When a road is finding it cannot secure men enough to fill vacancies in its operating department from men that make direct application or feels uncertain of the quality of the men or certain of the poor quality who apply in this way, the method of engaging men should be changed. It might pay in some cases, for instance, to enter into an arrangement with other large employers of labor, such as express companies or large department stores, by which an agent of the railway company could interview their applicants for employment. Such men might often be better fitted for railway service than for that for which they have applied, and they naturally would not include the professional railway grafter. Again, the situation wanted columns of the large dailies often contain advertisements from men desirous of securing employment. These men might be sent an application blank, with a statementment of the class of man desired and the Government statute in regard to the use of mails for fraudulent purposes printed on the blank. In fact, if a reference to this law was printed on all letters of inquiry to references and which makes punishable any attempt to defraud by any use of the mails, it might make some people more careful as to the statements they make about men whom they recommend. It is stated that plan is being used by some jewelry instalment houses with success.

A professional grafter not only appropriates fares, which is bad enough, but holds his car back to pick up passengers and makes it more difficult to detect errors in registration, demoralizes other conductors and motormen and berates the management.

DISPOSAL OF CITY ASHES AS AN ADJUNCT OF STREET RAILWAY BUSINESS IN BROOKLYN

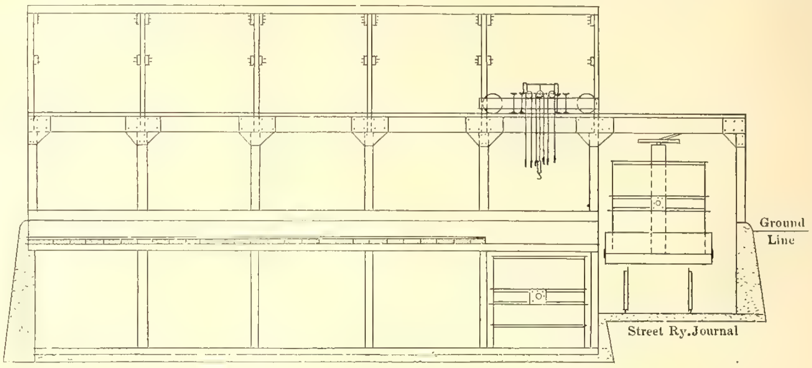
The advisability of the street railway interests of the larger cities contracting with the municipal authorities for the removal of ashes seems to be proved by a very interesting experiment which is now being conducted in Brooklyn. In pursuance to an advertisement published by the Department of Street Cleaning, of New York, for proposals for the disposal of ashes in the Borough of Brooklyn, the American Railway Traffic Company, the operating organization holding license from the Brooklyn Rapid Transit Company, tendered a proposition to the city which was accepted. It provides for the establishment of so-called collecting stations to which the municipal ash wagons deliver ashes, street sweepings, paper and general household rubbish, except garbage, and for the subsequent disposal of the material by the contracting company without further care on the part of the Department of Street Cleaning beyond supervision to see that sanitary methods are maintained.

Besides its aspect as a revenue-producing proposition of satisfactory proportions, as will be discussed later, the project is of interest from the character and equipment of the buildings and rolling stock especially provided, and from the plant and methods adopted for final disposition. The American Railway Traffic Company agreed to build thirteen receiving stations scattered about the borough about 1 mile apart, and to dispose of the material at 35 cents per cubic yard. There was no existing figure under such conditions that would allow the city to make any comparisons, but it was estimated that the average haul by the city wagons would be decreased 50 per cent, so that a less number of carts would suffice, leaving a reserve to take care of the periods of maximum collection, to overcome the delays attendant on bad weather and have an equipment equal to the gradual increase in population for some time to come. From the point of view of cost to date, the Department of Street Cleaning does not expect to show a financial saving, and it would probably not be safe for any street railway company considering such a proposition to estimate on having a proposal accepted at the rate of 35 cents, except possibly where the conditions approach those of Brooklyn. The total quantity of the material to be handled in a given city gives, of course, an index to the figure which a city can afford to pay.



CROSS SECTION OF RECEIVING STATION

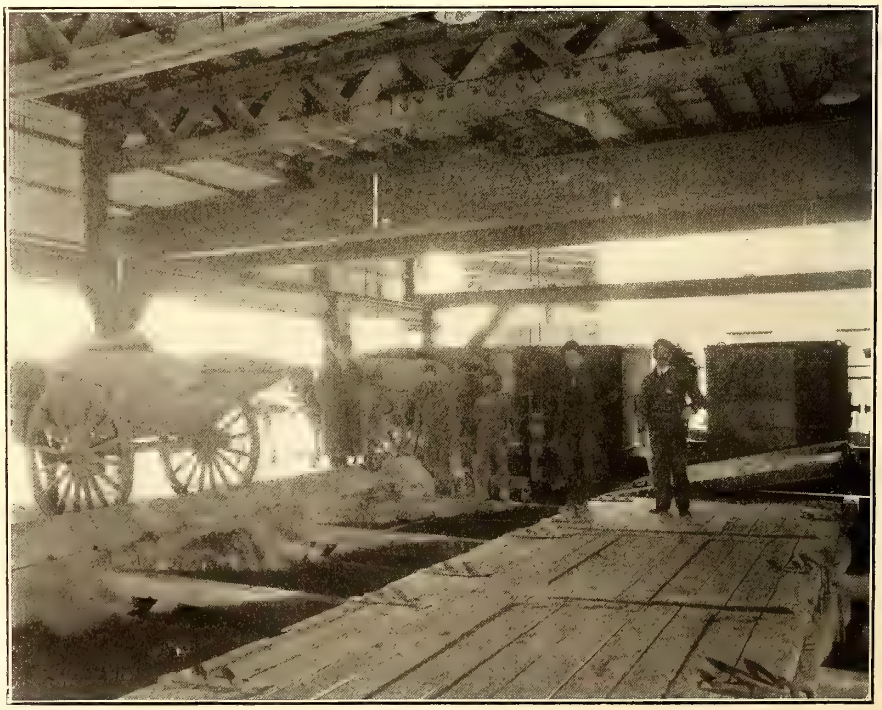
Four of the receiving stations are now in operation and the rest are in process of construction. Each is a timber-frame structure sheathed in corrugated galvanized iron on both walls and roof, but extends below ground in the form of a concrete cellar or pit with a portable flooring at grade. This cellar contains large steel ash bins, into which the Department carts can dump directly, the bins, when loaded, being lifted from the pit by means of an electric traveling crane and placed on a special flat car designed for this service.



LONGITUDINAL SECTION OF RECEIVING STATION

Space for twenty bins is left in each station in five rows of four each, and a timber framework of posts and beams, leaving clear places for the bins, is built in the pit for the support of the portable covers or floor. This is of 6-in. splined planking, built in sections, each large enough to cover one row of bins. Each section is hinged along one side, and when a row of bins is filled and none of the cars is in the station so that they can be carried away, the section of floor is turned over upon them by the electric cranes, uncovering a row of empty bins. On the top of the flooring across the front of the bins to be filled is laid a dumping log. This carries at each end a long, heavy round bar which fits into a hole in the flooring. By this arrangement the dumping log can be lifted by the crane and placed in any section of the floor.

Along one side of the group of bins a concrete constructed depression below ground has been provided for the recep-

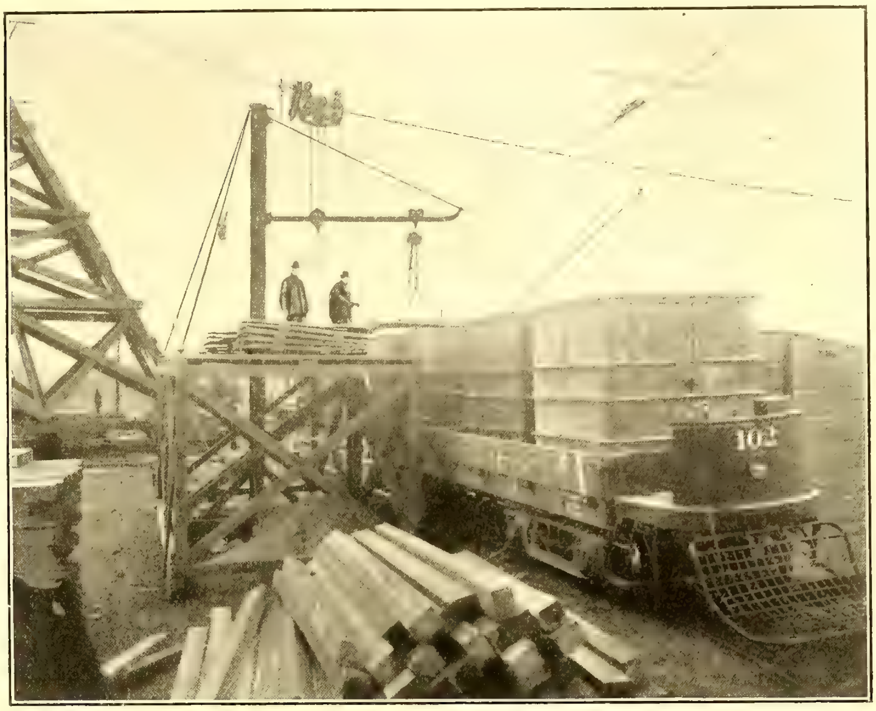

VIEW IN RECEIVING STATION

tion of the paper and rubbish collection, the ashes and street sweepings at present being dumped directly into the bins. The paper and rubbish pit serves for sorting. This work is performed by a sub-contractor to the American Railway Traffic Company, who removes about 80 per cent of this portion of the city collection. In brief, then, each station houses a group of portable bins into which the city carts, that are driven in at grade, are dumped without handling, and also a compartment for the sorting of paper, and a length of track for one of the railway cars for transporting the bins. The use of an electric crane has required two lines of timber columns to carry the crane-rail girders, and these are braced to the building columns and are bolted to the top horizontal beams through triangular steel plates, as indicated in the accompanying illustration. Outside of each receiving station is a separate small building for the employee in charge of the station. Here is done such clerical work as may be necessary.

The dimensions and general construction of the bins, 250 of which were built by the Riter-Conley Manufacturing Company, of Pittsburg, are also indicated in the engravings. Each bin carries two trunnions, by which it is lifted with hooks suspended from the crane trolley. The rings at the bottom are for use in dumping, the apparatus for this purpose at each disposal plant having a third cable with a hook for catching the ring. A sheet steel cover is provided for each bin, to prevent the wind from blowing away any ashes in the passage of the cars through the city. It will be found that each bin holds nearly 10 cubic yards filled, or 200 cubic yards for each station. For the thirteen stations the amount is 2560 cubic yards, or about the average collection made by the Department. The cranes were built by the Shaw Electric Crane Company, of Muskegon, and are of 7½ tons' capacity, with a span of 35 ft. It has two wheels on each rail, with a wheel base of 7 ft. 10 in. The controllers for the three motors of the crane are located at one end of the paper sorting pit.

STANDARD BIN, HAVING A CAPACITY OF 10 CU. YDS.

The type of car used for this service is a modification of the work cars recently purchased by the Brooklyn Rapid Transit Company. They were built by the Middletown Car Works, Inc., of Middletown, Pa., and are of the 18-in. hinge-side gondola pattern, equipped with four Westinghouse motors of 40-hp each, and with the Christensen air brake. The cars are 38 ft. 6 ins. in length over all, and 7 ft. 10 ins. wide. They are equipped with the Peckham standard M. C. B. truck, with 31-in. wheels, and the trucks have the Peckham combination side frames, double-roller side-bearings, flexible motor suspension and the Taylor non-chattering brake hanger. Instead, however, of a timber post in the center of the car for the trolley carrier, a cast-iron post is employed with the fuse blocks fixed underneath the car. This departure was necessary to obviate the care that would otherwise have to be exercised in lifting and lowering the bins close to the post. Four bins are shipped by each car, and the total load is 26 tons, 6 tons in the bins themselves and the remainder in their contents. As each bin holds 10 cubic yards, it will be noted that the weight of the ashes is calculated on the basis of 1000 lbs. per cubic yard, which has been found to be the average weight of household ashes in the more or less moistened condition in which they are received.



RAISING THE COVERS FROM THE BINS JUST BEFORE THEY ARE DUMPED

OUTSIDE VIEW OF A TYPICAL RECEIVING STATION

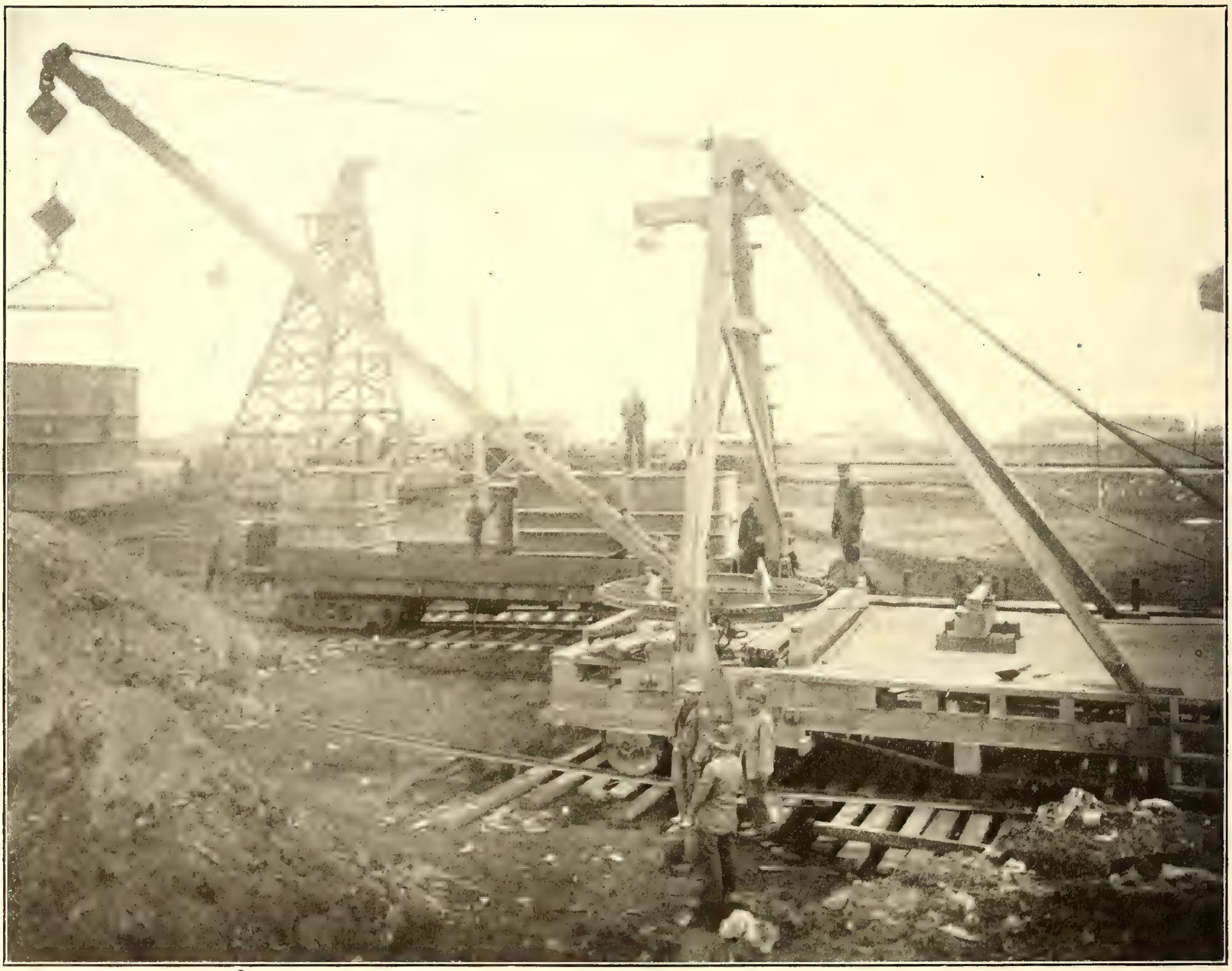
The general scheme for the disposition of ashes is to utilize them for filling or land reclamation. There is a large field for work of this character in the outlying districts of Brooklyn, including, for example, an extensive but shallow body of water known as Jamaica Bay, which is an arm of the Atlantic, protected by sand bars. For fills on a large scale two methods are in operation, one consisting of a large derrick car and the other of a traveling aerial cableway, the latter for specially large fills, as will be outlined.

The derrick car is an 8-ton traveling derrick designed and built by the New Jersey Foundry & Machine Company, of New York. Its general characteristics are shown in accompanying photographs, which are views of a derrick-car at present located at Neptune Avenue, near Brighton Beach. The derrick is of extra heavy wooden construction, reinforced by heavy tie rods and gussets, and designed throughout for severe wear in continuous service. One of the larger sizes of the Lidgerwood electric hoisting engines is mounted on the rear of the derrick, the hoist being operated by a 50-hp General Electric railway motor. The effective radius of action is 30 ft., and the boom swings through 170 degs. The derrick has been working day and night for several weeks, and for a large part of this time has been unloading buckets at the rate of four cars an hour, one bucket every four minutes. The fastest work up to date has been one carload of four buckets in eight minutes. The maximum weight of a loaded bucket would be 8 tons, the average weight, 6½ tons.

An idea of the capital investment and earning capacity of the ash disposal business may be learned from the following figures. In Brooklyn the actual quantities disposed of in 1901 are given in the accompanying table, and according to contract, measurement is based on the standard cart load of 1.55 cubic yards, or truck load of 4 cubic yards or paper cart load of 1.5 cubic yards. To each of the four stations there are allotted four cars, each, it will be remembered, carrying four bins or 40 cubic yards of material. Each car can be counted on to make two round trips daily, so that for the basis of this calculation, it can be assumed that 1200 cubic yards are taken each day from the four receiving stations. As the company receives 35 cents per cubic yard, this means a daily revenue from the city of $420. The company has its own payroll, and for the operation of its cars, that is, for power and trackage, it pays a stipulated sum per car mile, a card being issued for each car, giving its destination and the route, so that the mileage can be calculated in the main office. The total cost for labor, and operating and maintenance charges for each car may be taken at $15 per day, or for the sixteen cars, $240. Each of the receiving stations costs to operate at an outside figure, $8 per day, or $32 for the four stations, and the dump about $50, so that the operating cost is $322 daily. This shows a profit

BROOKLYN STREET CLEANING DEPARTMENT COLLECTIONS IN 1901

	Ashes	Street Sweepings	Paper and Rubbish	Total
Twelve months...	508,280	202,269	330,109	1,040,658
Maximum month..	54,446	18,762	35,762	108,970
Minimum month..	27,760	17,604	21,717	67,081
Maximum day...	2,632	702	1,119	4,453
Minimum day....	876	271	651	1,798



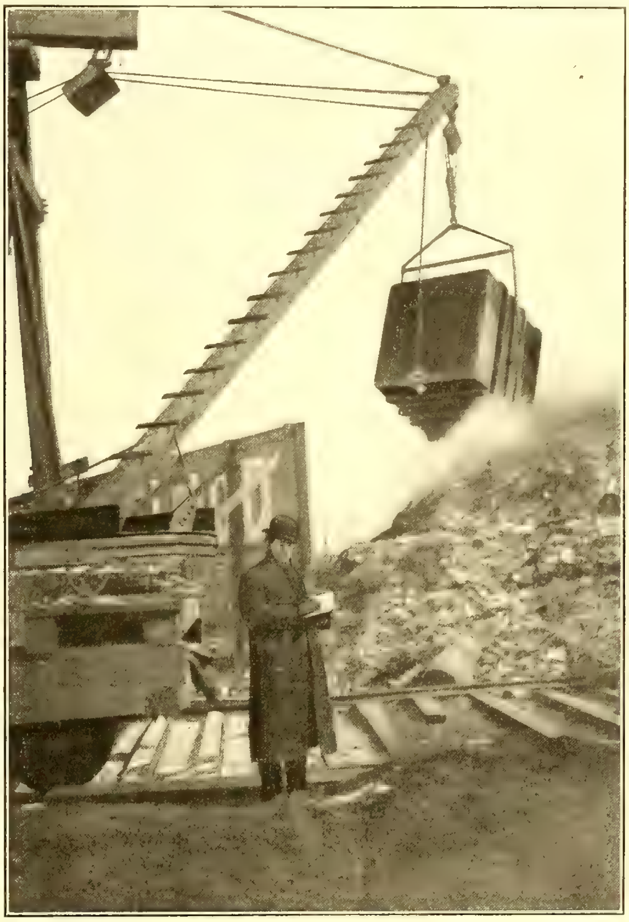
DUMPING THE REFUSE BINS IN THE OUTSKIRTS OF BROOKLYN

of about $100 daily, or $30,000 for the year of 300 working days.

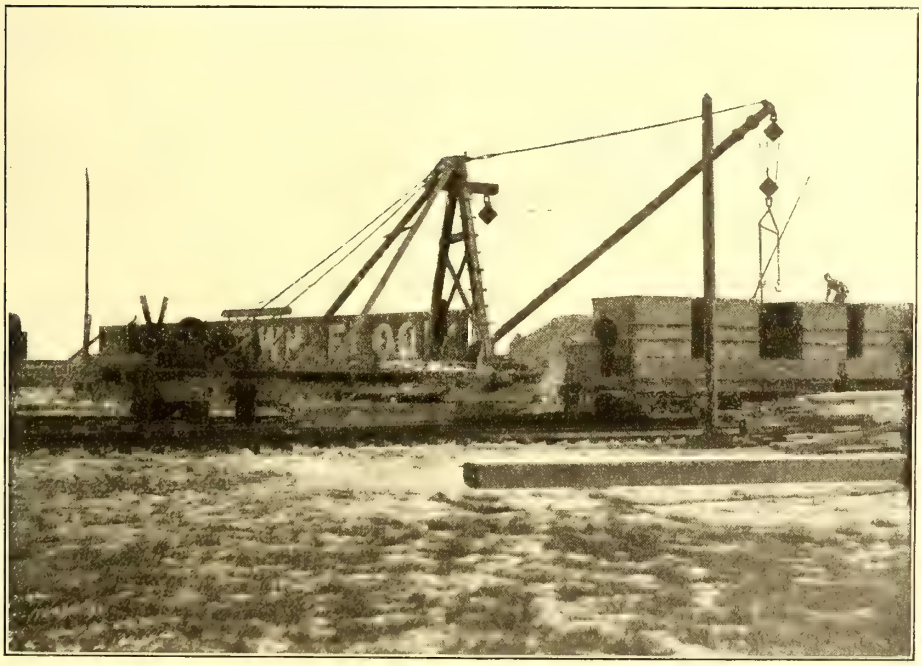
The capital invested in the four stations and equipment is about as follows: Each of the stations completed ready to run, including the ash bins and the real estate, cost about $25,000, or $100,000 for the four. The cars cost $3,700 apiece, or $59,200 for the sixteen. The dump equipment cost $6,000. The total capital invested is thus, in round numbers, $165,000, so that the profit would appear to be at least 18 per cent annually on the investment. If 10 per cent of this is deducted for the maintenance of the plant and machinery, there will be left a net profit of 8 per cent on the investment. At the expiration of the contract, five years hence, the company will then, of course, be better able to compete again, as it may offer the city the economy derived from the short wagon hauls, being the sole possessor, through its relationship with the Brooklyn Rapid Transit Company, of the privilege of using the lines of that company. The ability to take care of the constantly increasing amount of ashes with the steady increase of population is also a point of considerable importance in the consideration of possibilities at the end of the five-year period.

The traveling cableway method of dumping is designed, as stated, for operation on a large scale. Briefly it consists of two timber towers, each mounted on wheels and a traveling cableway connecting the two towers, which are 550 feet apart. The loaded car is brought under one end of the cableway and the bucket is carried from the car to a point along the span of the cableway, where it is dumped. As soon as the lowland immediately each side and below the cableway becomes filled, the two towers are moved along their tracks a short distance further and the filling continued. The plant is particularly well adapted to places where the area to be filled is very great. For example, in the marsh land back of Coney Island, where the cableway is at present in operation, a fill 12 feet deep over the 550 ft. of span for, say, 100 yards, amounts to nearly 75,000 cubic yards, all put in place with a movement of the plant 100 yards.

Each of the towers is 64 ft. high above the rail. They are of a more or less pyramidal form, with one face vertical. This is, of course, on the farther side from the cableway, the more inclined members serving as struts against the pull of the cables. The main timber members of the tower are 12 ins. x 12 ins. in size. Each tower is carried on fourteen pairs of wheels and the base is reinforced with tie rods. The journals are fastened to the underside of 10-in. x 12-in. sills, and the fourteen sets of wheels are disposed of on five lines of rails, one pair at the inner side of the tower and the remaining three vertically under the apex. On one of the towers is mounted the hoisting outfit, which comprises a three-drum Lidgerwood plant driven by General Electric 57-motors. The drums are controlled in the usual way through friction clutches and there is a brake provided in each case. One drum is for the hoisting cable, the second for hauling the trolley and the third for dumping. The two motors drive the same shaft and they are controlled by a General Electric K-11 controller. The cableway outfit was designed by the Lidgerwood Manufacturing Company.



VIEW AT THE DUMP

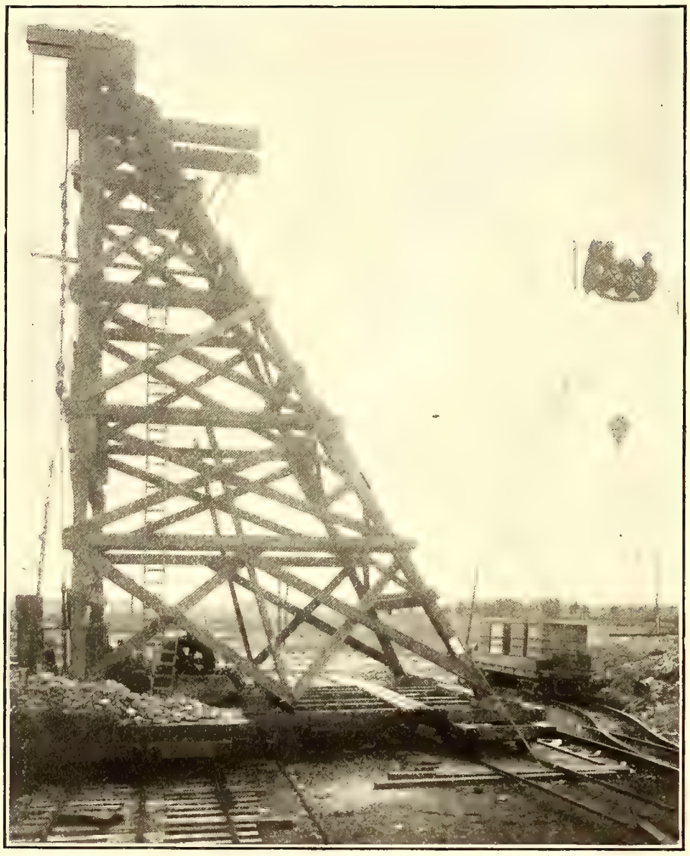


LIFTING THE BINS FROM THE FLAT CARS

The cars approaching the dumping ground pass alongside an elevated platform on which is mounted a jib crane. This is shown in one of the accompanying photographs. It is used for lifting off the covers from the bins, so that the cars are immediately ready for the dumping plant and for placing the covers back on the bins when the unloaded car passes out. The jib is provided with a hand hoist trolley, and one man is stationed on a platform in charge of this work. He is usually assisted by one of the men having charge of the car. Two men are also employed at each dump for fixing the hooks of the lifting mechanism under the trunnions of the bin, and one of them also sees that the dumping cable is carried around underneath the bin and fixed in the eye pro-

vided for that purpose. In emptying, the dumping cable is pulled when the bin has been brought to the point desired, overturning the bin. It comes back to its original position by gravity, as the trunnions are placed somewhat above the center of gravity.

The credit for the conception of this enterprise and for interesting the American Railway Traffic Company in it is largely due to C. R. Van Etten, general freight agent of the Brooklyn Rapid Transit Company. He originated the



TRAVELING CABLE METHOD OF DUMPING

general method of handling the material, and in collaboration with Hon. J. C. Brackenridge, now Commissioner of Public Works, for the Borough of Brooklyn, and with R. C. Taylor, mechanical engineer of the Brooklyn Rapid Transit Company, perfected the mechanical devices necessary to carry out the contract without requiring manual labor for handling the material from the time it is received until disposed of as valuable filling for waste and swamp land. Edwin W. Winter, president of the Brooklyn Rapid Transit Company, is president of the American Railway Traffic Company, and J. F. Calderwood, general manager of the former company, is vice-president. Captain Alexander R. Piper, formerly Deputy Police Commissioner of New York, and prior to that superintendent of final disposition of the Street Cleaning Department of the city, is general superintendent.

The first train drawn by an engine made a trip through the New York subway from the One Hundred and Twenty-Fifth Street Station to City Hall, on Wednesday afternoon, April 14, a pony engine of the Manhattan Company making steam from an improvised oil burner. Mr. E. P. Bryan, general manager of the Interborough Rapid Transit Company, which will operate the tunnel, was in charge of the train and had as his guests August Belmont, John B. McDonald and officials of the Interborough Company. Stops were made quite frequently to give the party a chance to make a careful inspection of the work that has been done.

PLANS OF THE ELECTRIC RAILWAY TEST COMMISSION OF LOUISIANA PURCHASE EXPOSITION

An outline of the plans drawn up by the Electric Railway Test Commission, under whose authority the tests of electric traction apparatus will be conducted at the Louisiana Purchase Exposition this summer, was published in the STREET RAILWAY JOURNAL for March 26, 1904. In the same article the names of the gentlemen comprising the four engineering committees appointed by the Commission to report on the detail tests for different classes of service were given, with the reports recommended by the committee on tests of city and suburban equipments and that on the test of interurban equipments.

Since the publication of that article the Commission has appointed a working committee on tests which will have actual charge of carrying out the tests, and which will carry out the programme recommended by the several committees mentioned and approved by the Commission. The chairman of this working committee is Prof. W. E. Goldsborough, chief of the Department of Electricity at the Louisiana Purchase Exposition, and the services of Prof. H. H. Norris, of Cornell University, have been secured to conduct the tests. Prof. Norris proposes to take up this work as soon as the conditions at the Exposition grounds permit, and will continue the tests until the close of the Exposition at St. Louis, and outside of that city if the Commission should so decide to conduct work of this character elsewhere than in St. Louis. He will have the assistance of two prominent electrical engineers who have not yet been selected, and also several young men from the Cornell University instructing corps and present graduating class and probably a few others from certain other technical institutions. Those in Ithaca have already commenced a special study, preparatory to conducting the tests.

The Commission has also appointed an advisory committee to oversee these tests and represent the manufacturers. This committee consists of A. H. Armstrong, of the General Electric Company, of Schenectady; Clarence Renshaw, of the Westinghouse Electric & Manufacturing Company, of Pittsburg, and Ward S. Arnold, representing the Bullock-Allis-Chalmers interests.

REPORT OF THE COMMITTEE ON TESTS OF HEAVY TRACTION EQUIPMENTS

This committee, which consists of F. J. Sprague, B. J. Arnold, W. J. Wilgus and F. R. Slater, has rendered the following report as to the tests of this class of equipment to be conducted by Professors Goldsborough and Norris.

Complying with your request for the submission of a programme to be followed in the conducting of tests upon heavy traction electric railway equipments at the St. Louis Exposition, your committee begs to suggest as follows:

1. Each party submitting apparatus for test shall furnish a complete written description thereof, setting forth clearly the special features of the design and calling attention to any points that are considered new. The description shall also explain the controlling mechanism, designating its applicability to direct or alternating-current, with proposed working voltage, and if for alternating-current, stating the frequency and phase desired for most successful operation.

2. All tests shall be conducted upon the track designated by the Electric Traction Commission and conducted under actual operating conditions.

3. No tests shall be made upon electric locomotives or other apparatus of less than 500 normal hp, unless specially permitted by the Commission. It is assumed that the term "Heavy Traction" applies to locomotives or motor cars of a total capacity rated on an hourly basis of 500 hp or more.

4. The tests will be conducted with the locomotive or other motor cars running light, and also when pulling trains, with the purpose of studying the following features: (a) motor capacity

in various conditions of operation; (b) acceleration; (c) coasting; (d) braking; (e) heating.

The following curves and diagrams shall be prepared: (f) speed time curves; (g) distance time curves; (h) voltage and ampere time curves; (i) kilowatt input and distance curves; (j) draw-bar pull diagrams made when attached to a fixed anchor, and also with dynamometer coupled between locomotive and trains operated under running conditions.

If alternating-current motors are used the following additional curves shall be prepared; (k) real kilowatt time curves; (l) apparent kilowatt time curves.

5. The tests shall include the determination of heating and the distribution of same in the field, armature and commutator under various loads at different rates of speed. The heating of the bearings shall also receive consideration.

6. The tests of the methods of control and comparison of hand and automatic acceleration shall be made as bearing upon the elements of (a) safety; (b) convenience; (c) economy; (d) smoothness of operation; (e) ability to group into two or more units.

7. The tests of the methods of control shall also be considered as bearing on: (a) smoothness of acceleration; (b) variation of economical speeds; (c) reversibility; (d) action with one or more motors cut out; (e) relation of starting to running current under different rates of acceleration.

8. The equipment will be considered as to: (a) general construction; (b) weight and distribution of same on drivers under static and hauling conditions; (c) relative weights of electrical and mechanical parts; (d) number and size of drivers; (e) acceleration of working parts; (f) influence on track.

9. Tests will be made upon each locomotive or motor car submitted to ascertain (a) watt hours per ton mile with locomotive running light at various speeds; (b) watt hours per train ton mile exclusive of locomotive; (c) watt hours per ton mile with locomotive load and with train under various weights and acceleration.

10. Methods and detail conditions for conducting the tests shall be agreed upon by those who have immediate charge of the tests before the commencement of the trials. These conditions shall be satisfactory to the representatives of those furnishing the apparatus. It is understood that all tests shall be made under similar conditions when possible. When these conditions are necessarily dissimilar, due allowance shall be made in compiling the results, so as to place all apparatus upon the same plane of comparison.

REPORT OF COMMITTEE ON TESTS OF NEW ELECTRIC RAILWAY SYSTEMS

This committee, which consists of B. J. Arnold, P. M. Lincoln, of the Westinghouse Electrical & Manufacturing Company, of Pittsburg, and W. B. Potter, of the General Electric Company, of Schenectady, has made the following report on tests recommended on electric railway systems:

Complying with your request to submit an outline of tests to be conducted upon new electric railway systems at the St. Louis Exposition, your committee begs to submit the following:

Each party furnishing apparatus to be tested shall submit a written or printed description, setting forth clearly and fully the salient points in the system, and the principal advantages claimed for it. He will also completely describe the motors and controlling apparatus, stating whether the system is designed for direct-current or alternating-current or both, and if for alternating-current, whether for single-phase, polyphase, series, repulsion, inductive, synchronous or other type of motor, and state in any case the most desirable voltage to use in the motor, and if alternating the preferred frequency.

In testing any new system we have assumed that the tests should be divided into two principal parts as follows:

1st. Motor, including car equipment.

2d. Line, including all sub-station apparatus and other translating devices interposed between the power house bus-bars and the trolley wheel or contact shoe of the locomotive or car.

Schedule of motor tests to be made with apparatus running stationary upon testing blocks: (a) Test motors to determine efficiency, power factor (if alternating), torque, speed, horse power output under various conditions as to voltage, frequency (if alternating) and current, to be met in the service for which the system tested is intended; (b) the one hour rating of motors to be determined according to the standards outlined by the American Institute of Electrical Engineers; (c) test motors under constant loads to determine rate of heating during continuous operation.

Schedule of tests to be made on equipment when operating upon experimental track: (a) acceleration tests on single cars and multiple-equipped trains; (b) braking tests of single cars and multiple-equipped trains; (c) coasting tests of single cars and multiple-equipped trains; (d) motor heating tests on single cars and multiple-equipped trains.

Prepare the following curves; (e) speed time curves; (f) ampere time curves; (g) volt time curves; (h) real kilowatt time curves; (i) apparent kilowatt time curves (if alternating); (j) distance time curves; (k) tests and curves to determine car and train friction.

Schedule of tests to be made upon line and auxiliaries: determine (a) ohmic resistance; (b) inductive resistance; (c) power factor; (d) efficiency of copper and iron portions of line, separately and jointly, under the following conditions:

1st. When the electrical energy is delivered from the power house bus-bars to the working conductor without translating devices.

2d. When electrical energy is delivered from the power house bus-bars to the working conductor through supplemental transmission lines or translating devices.

If supplementary transmission lines or devices are used in case No. 2, each element shall be tested separately as well as in conjunction with the line as a whole as outlined above.

Tests upon each system shall be made to determine the following: (a) watt hours per ton mile at car; (b) watt hours per ton mile at sub-station bus-bars (in case sub-stations are used); (c) watt hours per ton mile at power house bus-bars.

All tests to be under like conditions, and when conditions are necessarily unlike, due allowance shall be made to reduce the apparatus tested to a fair basis for comparison.

The watt hour per ton mile, as stated above, to be determined from the summation of the specific tests hereinbefore outlined and checked by integrating wattmeters placed on the power house bus-bars, sub-station bus-bars (if sub-stations are used) and the car.

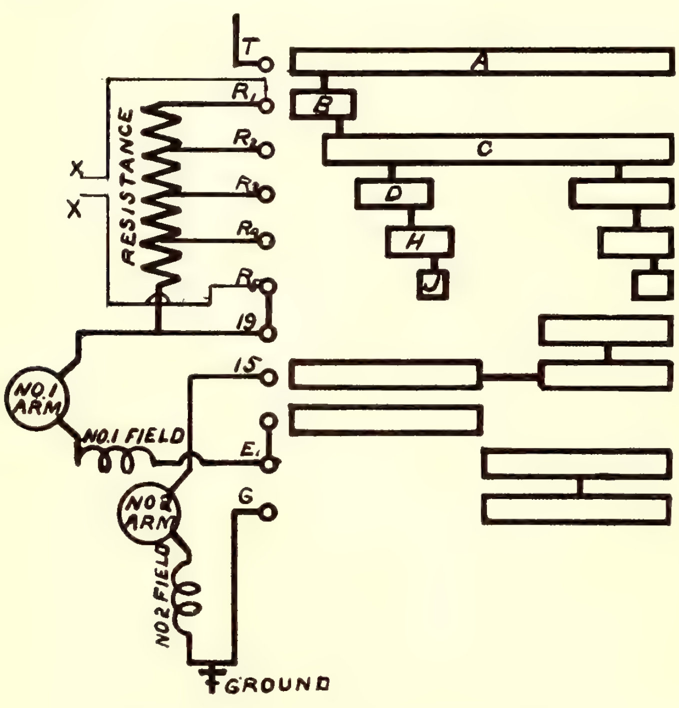
A project for the establishment of a central distributing electric power and light plant in the Reichenberg (Austria) land district has taken definite form. The territory included is about 10 miles square, and twenty-four towns and villages have joined in the movement and subscribed to the capital stock. The population of the district, exclusive of Reichenberg, is about 60,000. Stock is subscribed at present to the amount of $200,000, and this it is proposed to increase to $400,000. The principal purpose of the corporation will be the distribution of electric light and power, with the possibility of installing and operating a system of suburban electric tramways. Tramway and light franchises for the city of Reichenberg are at present owned by private corporations, and at their expiration it has been generally supposed that the city would take over and conduct the enterprises. Negotiations are pending, however, which may change the situation in this respect. Communications regarding equipment, etc., may be addressed to Directors Alfred Ginskey, Maffersdorf and Dr. Richard Pirkl, Reichenberg.

ADJUSTING CAR RESISTANCES

BY CALE GOUGH

To the average car house repair man the most mysterious part of the electrical equipment of a car is the starting resistance. In very few instances will a car shop foreman be found who has a knowledge of the total ohmic resistance required for a car or the ratio that should exist between the different points. His only means of dealing with them is the "cut and try" method and this should certainly be eliminated in car house work wherever possible. In most instances much time and vexation could be saved by the proper use of a measuring instrument along with a knowledge of the required resistance. Several instruments are supplied for this purpose, such as the ohmeter and the well known Wheatstone bridge. Explicit directions for operating are usually attached, so that the workman of average intelligence can learn to use them in a few minutes.

To obtain an idea of the resistance required and the proportioning of the steps, the resistances of an equipment that has by use on the road proven to be well adjusted should first be measured. These resistances can thereafter be taken as a standard for that equipment. The total resistance ordinarily required for a two-motor car with 35-hp or 40-hp motors is



WIRING DIAGRAM OF K-10 CONTROLLER

about 6 ohms. A general rule for proportioning would be that the resistance on each point be half what it is on the preceding one. With a rheostat resistance of 6 ohms this rule would give: first point, 6 ohms; second point, 3 ohms; third point, 1½ ohms, and fourth or last resistance point, ¾ ohm. Measuring the resistances down to a point of laboratory accuracy is not required, as the starting of the car is not affected appreciably for quite a range of variation.

To connect up the most usual form of bridge box it is simply necessary to join to the terminals of the resistance to be measured the terminals on the box usually marked "X." But before connecting the trolley should be removed from the wire to avoid all chance of injury to the instrument. The rheostats should be cool, as a high temperature increases the readings appreciably.

The engraving herewith shows a diagram of a K-10 controller with resistances and motors in their proper position between fingers. The terminals "X" "X" are connected by means of No. 14 wires, shown by the finer line, to the fingers "R_1" and "R_5." All that is necessary now is to throw the controller on successive notches and read the instruments. On the first point it is readily seen that to pass from one terminal "X" to the other, the total resistance of the car must be traversed. On the second and successive points the controller cylinder bridges across part of the resistance and reduces the total resistance between the terminals of the measuring instrument. On the fifth point the finger "R_5" makes contact with the small segment "J." The cylinder then short-circuits all the rheostat resistance. The reading obtained on this point is that of the instrument leads and connections. It should not amount to more than .04 or .05 ohms. To obtain the exact rheostat resistance on the several points this last reading must be subtracted from the previous ones.

A study of the readings so obtained and of the behavior of the car will show that the car jerks on that point between which and the preceeding one an abnormal difference of reading was obtained, and further, that the car shows little change of speed between points with small differences of readings.

If the step variations of the readings are not what they should be, the position of the resistance leads can be changed until the desired differences are obtained.

When newly wound boxes are to be placed under a car they can be readily tested on the floor. If to be connected in series on the car they should be so connected upon the floor. The total resistance should first be obtained. If this is found to be of proper value for the equipment the points for connection of the resistance leads can next be found. To do this leave the instrument lead connected to the last resistance, say R_5 stationary. Detach the other lead and move it by steps towards the stationary one, taking readings all the time until proper points for the attachments for all the resistance leads are found. Now, when the boxes are put up and the leads connected to the points previously marked, it is a certainty that the car will start smoothly.

The trouble saved in changing boxes and "juggling" the resistance leads pays many times over for the time spent in making the tests.

Station buildings of modern appearance and design are to replace the old-fashioned horse-car waiting rooms which have heretofore furnished shelter for patrons of the Pacific Electric Railway Company, of Los Angeles, Cal. The first of these new buildings is nearing completion at the junction of the Pasadena and Monrovia lines. The style of architecture is Mission, and this will be an appropriate feature of all the stations along the company's lines. The building now being erected is a one-story structure, presenting the appearance from a distance of a succession of arches. On the inside is a booth for trainmen, which may also be utilized for ticket selling. The construction is almost entirely of concrete. According to the present plans of the company, similar stations are to be built at all junction points on the various interurban lines. At the junction of the Whittier and Long Beach lines, and at the point where the interurban system follows a private right of way from the East Ninth Street line, new buildings will be erected in the near future, and when the new line to San Pedro has been finished, a station will probably be built at Dominguez Junction, where the two lines from the sea will converge. With the completion of this line, this junction will become a very important point on the system, and, if present plans are carried out, the building to be erected there will be a little more commodious than the others. Facilities are to be provided for handling freight and express, for it is the ultimate intention of Mr. Huntington to make a strong bid for the express business between San Pedro and Los Angeles.

CORRESPONDENCE

MOVING THE PUBLIC FORWARD

Boston, April 18, 1904.

Editors Street Railway Journal:

I note with some amusement a brief note in your last issue regarding moving the public forward in street cars. As a persistent student of tramway conditions and a frequent passenger on crowded cars, I am impelled to remark that the suggestions of the article in question are apparently made from the standpoint of the conductor who would like to move his crowd forward with a hydraulic rammer. In the first place, while there are doubtless many passengers who object on general principles to being compelled to shift their positions at the will of the conductor, there are many more who fully sympathize with his manifold sorrows and would rather oblige him than not if not thereby put to much inconvenience. But I, like most of my fellow beings, object to being put in a position from which I cannot escape at will, and hence decline to move up when, by so doing, I have to force my way the length of a long car in order to avoid being carried by my destination. It is so common an occurrence to see passengers thus carried by or detaining the car for a long stop while worming a way toward the door that it is small wonder that the public often declines to move up. If the tramway companies desire and expect to utilize every square inch of standing room, it is certainly up to them to furnish far better exits than are now available. And it is perfectly safe to say that unless this difficulty is met the case will go from bad to worse with increasing density of traffic and the general use of the otherwise very desirable long cars. It is idle to suggest any means to compel passengers to move up since the immediate result of so foolish a policy would be a no-seat-no-fare agitation, probably successful, and in such case on just grounds of complaint.

The use of the front platform as a regular means of egress is almost equally impracticable, although the front door is undoubtedly a useful adjunct. But until a tramway company is willing squarely to assume full responsibility for the safety of passengers thus using the front platform, it cannot get much help from this source. The motorman has troubles of his own, and it is very doubtful whether more duties could be heaped upon him without injuring his efficiency. Even if an extra conductor were carried to ensure the safety of passengers using the front platform, either one platform or the other would, for half the year, be stopping in mud or snow. Overcrowding is a bad business at best, and it is especially bad in the case of long, closed cars, with vestibules such as are used in many northern cities. Everyone interested in street railway work has racked his brains for a remedy time and again, but no remedy yet appears. I have sometimes thought that the best plan after all is the foreign one of limiting the number of passengers and putting out a "Complet" sign when the number is reached. It would be more or less annoying at first, but in the long run it would save more trouble than it would cause. In particular it would check the present nuisance of a crowd jammed to an amorphous mass in one car and the next car with empty seats, perhaps two minutes behind. Here in Boston cars are announced as full by the conductor, but he is usually good natured enough to let passengers on as long as there is even hypothetical standing room. It would be comparatively easy here to set and enforce a reasonable limit and the public would soon take it without protest. Under such conditions I doubt whether there would have to be any material increase in the number of cars operated, save on some few lines where an increase would be needed in any case. The only other remedy for the difficulty of egress is in some radical departure in car construction, allowing the crowd to move safely and easily in more than one direction. What can be done in this line remains to be seen, but very little of practical value has been yet accomplished.

Boston, April 18. Louis Bell.

ANOTHER IMPOSTOR

General Electric Company.

New York, April 18, 1904.

Editors Street Railway Journal:

A person calling himself George E. McCants, and describing himself on his card as chief electrician of the General Electric Company, Schenectady, N. Y., is traveling in Texas and making representations that he is connected with this company. I should esteem it a favor if you would insert a note to the effect that there is no person of this name on the payroll of the General Electric Company. It is also almost unnecessary to add that there never was any person of this name chief electrician of the company.

E. H. Mullin.

NOTIFYING PASSENGERS AS TO THEIR DESTINATION

Jersey City, April 16, 1904.

Editors Street Railway Journal:

A recent article in your paper spoke of the desirability of furnishing the best accommodations possible to passengers in order to secure and hold their business. This is, of course, desirable, but I think that a company can carry this principle so far that it becomes detrimental to its own interests. For instance, the suggestion was made that the conductors watch out for those passengers who request to be informed when the car reaches a certain point. Now, 99 per cent of a carload of passengers know just where they want to get off and a request of this kind usually causes the conductor considerable worry. In his effort to remember the destination of such passengers his attention is distracted from his main business, which is that of collecting fares. One good way to reduce this annoyance is for the conductor to remind the passenger about five minutes before he reaches his destination that the car will be there soon, and thus throw the final responsibility on the passenger.

It often happens that the conductor has recently gone on the road and is himself unfamiliar with many of the streets. In such cases I believe it would be desirable for the company to supply such conductors with a slip printed on cheap paper, containing the names of all the cross-streets on the line traversed by the cars on that particular division. As on long lines there are usually from 100 to 150 streets, these lists would be of great convenience, while the cost of printing them would be infinitesimal. As matters are now, a strange conductor has to write down the names for reference until he has memorized them.

It would also save a great many disputes and some damage suits if the company had a rule that a conductor who had carried a passenger past the destination point asked for, would be permitted to give him a transfer or otherwise pass him back on the next car going in that direction.

Conductor.

The Cincinnati, Dayton & Toledo Traction Company is adjusting its rates with a view to making them as uniform as possible. The road is a consolidation of several short roads and the old rates have prevailed, making an extremely cumbersome system for auditing accounts. The rates between Cincinnati and Hamilton have been on a basis of 2 cents per mile, and those between Hamilton and Dayton on a basis of 1½ cents. The rates on the northern portion will probably be increased to 1¾ cents. The price on commuters' books will also be increased and equalized.

TIMBER TREATMENT AND TIMBER TREATING PLANTS *

BY WALTER W. CURTIS

One of the important elements affecting the solution of the problem of supplying the demands of the railroads for wood in its various forms is its chemical treatment to prevent decay—and the construction of works to give such treatment as quickly and economically as possible. The old saying that a penny saved is a penny earned is certainly true when applied to the timber question. It takes about sixty years to grow 16-in. diameter pile, of the quickest growing pine; eighty or ninety years may produce an 8-in. x 16-in. stringer of the same quality. If we can secure a twenty to thirty year life for these sticks by treatment at reasonable cost, instead of from two to twelve years if used under like conditions untreated, we can congratulate ourselves as being of some use in the world and as being wealth producers in the truest sense.

Creosoting in this country dates from 1865 and has been principally used for the treatment of piles and timber for marine work, to prevent destruction by worms. While a considerable number of ties have been so treated, the expense has been and still is too great to permit general use for this purpose. Creosoting is by all means the best method of preserving timber known, and wherever the financial conditions are such as to permit the first cost, and where the timber will not be destroyed mechanically regardless of its freedom from decay, there can be no question as to the best treatment to adopt.

Various methods of seasoning wood have been patented. Seely in 1867 was granted a patent on a method of impregnating, consisting of immersing the timber in an iron tank filled with oil, heating it to drive out moisture, replacing the hot oil suddenly with cold oil, whereby it is forced into the wood by condensation. A patent to Hayford in 1872 added to the use of steam for seasoning, the pressure of hot air, to prevent the checking of the timber by the more rapid seasoning of the exterior portions of the wood. S. B. Boulton, in 1881, patented a method of seasoning by boiling the wood in the dead oil of coal tar, keeping the pressure in the cylinder below atmosphere, to permit the water to be removed at a lower temperature than 212 degs. A patent to Messrs. Curtis and Isaacs, of the Southern Pacific Railroad, was granted in 1895, covering a process identical with Boulton's, except that they do not use the vacuum during boiling.

The philosophy of both is that as water is vaporized at 212 degs., while the oil does not vaporize under 300 degs, a temperature maintained between these will drive off all the water, which can then be replaced with oil by pressure. Both of these methods have been used in this country with success.

Preservatives for timber are needed to prevent decay and to prevent destruction by marine worms. As under ordinary conditions, untreated timber will resist decay for a considerably longer period than it will a hungry teredo family, and as the amount of timber used on land and in water differs very materially, the use of treated material for marine work made more rapid and general progress. It was soon recognized that no treatment would avail against the teredo and limnoria, except a large injection of dead oil of coal tar. Treating works naturally sprang up to supply the demand, located along the sea coast and gulf line.

These works doing commerical work principally, orders were placed only at the time the material was needed, which necessitated the use of green timber and, I believe, few if any of these plants have yard room sufficient to store any considerable supply of material. The use of such green stock results in a much longer treatment being required and, in the opinion of some, in inferior work.

* Abstract of a paper read at a meeting of the New York Railroad Club, April 15.

From eighteen to twenty hours are required to secure the same penetration as is possible with ten or twelve hours if air-seasoned material is used, the difference being principally in the length of time spent in steaming the timber. If the English and Continental practice of long-time seasoning is followed, requiring storage for from eight to twelve months, the steaming is eliminated entirely and the time of treatment is cut down to about three hours.

The use of creosoted material is now becoming more general for an important purpose, which promises a large market; this is for decked trestle bridges, where the ballasted track is carried directly over the structure. Two types of such structures are in use; one where the deck is of solid timber, constituting the stringers and floor of the structure; the other, where separate stringers are used, covered with a 3-in. plank floor.

Mr. E. B. Cushing, engineer of Maintenance of Way of the Atlantic system of the Southern Pacific Railroad, states that road began using solid deck creosoted bridges in 1885. "The first one built was examined recently and found to be in perfect condition. It has never had a dollar's worth of bridge work on it since it was driven, the surfacing, aligning, etc., being done by section men in ordinary process of track work."

The other type of bridge, using stringers and a plank floor, has been in use on the Louisville & Nashville Railroad for many years. Mr. R. Montfort, chief engineer, recently wrote me:

I cannot state the length of life of creosoted timber where properly treated. I can, however, say, that during the year 1876 the New Orleans, Mobile & Texas Railroad used a large quantity of creosoted timber as piling for piers of iron bridges over Chef Menteur, Rigolets, Pearl River, West Pascagoula and East Pascagoula Rivers. We are now renewing the superstructures of these bridges; replacing bridges erected by the Phœnix Bridge Company in 1876 with plate girders. At the Great Rigolets we have placed the new superstructure on the piles driven in 1876. Some of these piles are as much as 95 ft. long. At Chef Menteur we used seven piers, each consisting of sixteen piles, or a total of 112 piles, not one of which was found defective, although driven twenty-eight years ago. In this climate an untreated pile could not be counted on to last but about seven years, or at the most eight years. The piles at Chef Menteur vary from 75 ft. to 90 ft. in length.

We have on the Louisville & Nashville Railroad miles and miles of trestles with creosoted stringers that were placed in 1876 and 1878, and are apparently as sound now as they were then. These trestles have, of course, been strengthened by the addition of other stringers so as to carry modern loads.

Mr. Montfort well says, in the face of such results, he can not tell what is the length of life of properly creosoted material.

As between such structures and metal ones, with open floors, the preference would seem to be with the perishable material, wood, provided proper precautions are taken against fire from beneath the structure. To be perfectly safe, however, the combination of steel girders and creosoted wood floor carrying a ballasted track furnishes the best possible structure where masonry is not justified. For elevated tracks over streets, the use of the wood floor is in my judgment decidedly superior to any other construction. This has been used successfully for such locations, the floor being made water-tight by caulking and pitching before the ballast is put on.

The greatest demand of course of the railroads on our forests is for ties. A perfect preservative must be a germicide, which is insoluble in water, non-volatile under usual temperatures, preferably an excluder of air and water, and cheap. In the dead oil of coal tar, we have the first three elements, and the fourth to a considerable degree. By the usual methods of injection, it cannot be called cheap, except in consideration of its ultimate economy through long life.

The life secured from the ties thus treated varies pretty closely with the amount of preservative used.

Creosote in America is worth about 1 cent per pound, delivered at the works. The cost of the ties treated depends upon the amount injected. In Great Britain they use from

8 to 10 lbs. of oil per cubic foot of timber for Baltic red wood; in France and Germany for beech and pine, from 10 to 20 lbs. On the basis of 10 lbs. per cubic ft., a tie containing 3 cubic ft. would cost here for oil alone, 30 cents.

The usual charge made by treating works for labor, fuel, profit, etc., is from $5 to $7 per 1000 ft., board measure. This adds to the cost of oil 20 to 25 cents. The cost of a 12-lb. treatment would be about 15 cents per cubic ft.

The cost of Burnettizing is about 3¾ cents per cu. ft.
The cost of zinc tannin is about 5 cents per cu. ft.
The cost of zinc creosote is about 7-5 cents per cu. ft.

This high cost of creosote accounts for the many efforts to secure the same results with other materials, or with combinations with other materials which will reduce the amount of tar oil required.

One way of doing this is to put in less oil alone, but the trouble is that the injection is then superficial and any checking of the timber or wearing under the rail destroys the protection, permitting access of air to the unprotected center and early decay. The Southern Pacific Railway made a test in 1895, in WestTexas, where 1694 sap pine ties were impregnated with 6 lbs. of tar oil per cubic ft., and laid in track with the same number of untreated ties of the same character. After five and one-third years service, not one of the creosoted ties had been removed, while 16 per cent of the untreated ones had been taken out on account of decay. Unfortunately no later reports have been made on this experiment.

The principal objection to the processes using zinc chloride, sulphate of copper and other mineral salts is that such salts are all more or less soluble in water; some of them indeed hydroscopic. They are effective germicides, and as long as they remain in the wood in sufficient quantity, will prevent decay. It will probably be admitted that the injection of any antiseptic, which at the same time has no directly injurious effect on timber, is beneficial and in proportion to its antiseptic power and its difficulty of removal. The solutions containing metallic salts are more readily injected than oils, and it has consequently been attempted to use them in conjunction and various methods have been patented for this purpose. Mr. J. B. Card, who introduced the Wellhouse treatment, proposed a method of first injecting a small amount of tar oil, then immediately thereafter injecting a solution of zinc chloride. He stated by this means he secured a much better distribution of the oil throughout the wood than was possible with the ordinary injection of the same amount of oil, and at the same time thoroughly protected the interior of the stick with the zinc chloride.

In Germany a method has been used for a number of years in which the solution of zinc chloride is mixed with tar oil and the two injected at one time into the timber. This method requires for its success a very light grade of oil difficult to obtain and of high cost, and there is some discrepancy in the reports of observers as to the uniformity of injection in ties occupying varying positions in the cylinder, the tendency being, of course, in any such mixture for the oil and water to separate on account of their varying specific gravities. This method, however, has given satisfactory results in practice and is undoubtedly an improvement over straight burnettizing.

Mr. Boulton has patented a method of first injecting the zinc chloride, then running out this solution and filling the cylinder with tar oil, boiling the timber in this until the desired amount of water of the first solution has been removed, and then injecting under pressure the desired amount of tar oil.

In April, 1894, the Southern Pacific laid in Western Texas 1824 sap pine ties, which were given an injection of 12 lbs of 2 per cent solution of zinc chloride; then removed, allowed to dry in the air for ten days and replaced in the cylinder and given a second injection of 3 lbs. of creosote, both quantities being in pounds per cubic ft. At the same time, 1694 untreated heart pine ties were placed in the same piece of track. In December, 1903, after nine and two-third years of service, 8 per cent of the treated ties had been removed and 95 per cent of the untreated heart pine ties had been removed.

Another method of doing the same thing has been that of injecting the solution of zinc chloride and immediately following this with a second injection of tar oil, the first injection being stopped at the proper point to permit the injection of about 3 lbs. of tar oil per cubic ft. A number of these ties have been in service for six or eight years with very satisfactory results.

I have given above a statement of the comparative costs of the zinc creosote treatment as compared with others.

There is one other treatment which has been before the public for some years, and which has some very desirable theoretical features about it; namely, the Hasselmann process. This consists in boiling the timber in a solution of several substances, the principal one being sulphate of iron. There have been a number of treatments proposed whose value was based upon the securing of a chemical reaction in the wood itself, but there has been a good deal of skepticism about the securing of such reactions, and the Hasselmann process seems to be the only one in which clear evidence has been given of success in that regard. The process is very cheap and the penetration of the wood thorough and it is to be hoped that the claims of the promoters thereof may be justified by the test of time. The actual value of this process, however, for ties, is still to be demonstrated, as compared with other treatments.

Still another modification of the method of treatment is a zinc-chloride process known as the Wellhouse treatment. This consists of the injection of zinc chloride, followed by injections of solutions of glue and tannin, the object of the latter being to plug up the ducts of the timber.

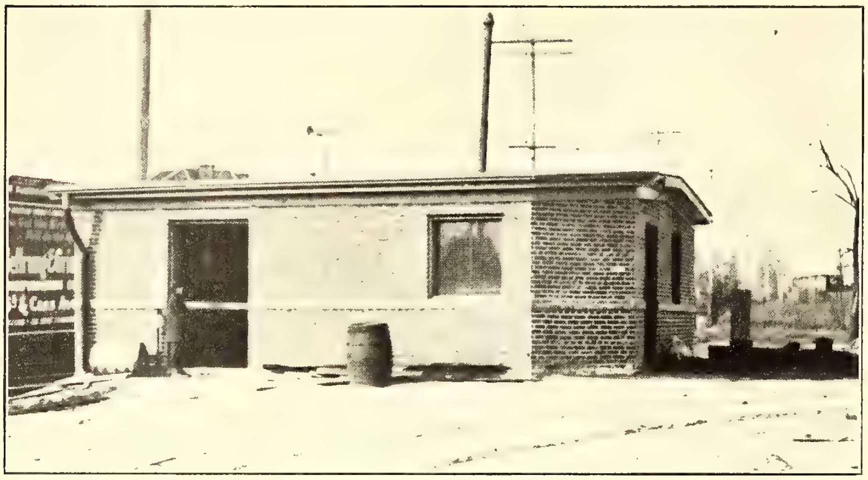
The Atchison, Topeka & Santa Fe Railway, with an experience extending over seventeen years, shows an average life for inferior pines and spruces treated with zinc chloride of eleven years. The Atlantic system of the Southern Pacific Railroad, with the same number of years' experience, shows a life of sap pine ties treated with the same material of nine and one-half years, while the Pacific system of the same road, where treated ties have been used for ten years, report 57 per cent of the ties laid in track in 1895 as being in service after eight years. The Pennsylvania Railroad in a test instituted in Indiana in 1892, where burnettized hemlock and untreated white oak laid in rock ballast, shows an average life to date of 10.58 years for the first and 10.17 years for the second, with 41½ per cent of the hemlock and 33 per cent of the oak still in service. With burnettized tamarack, an average life of 8.84 years, and of untreated white oak, 9.47 years, both laid in gravel ballast and with now all of the ties removed, has been secured.

In a paper read last year before one of our societies, I summarized the situation as follows: "It is safe to say that whenever an inferior tie can be purchased and treated by burnettizing, and then cost no more than a white oak or other first-class tie, the adoption of treatment by that or a better process is justified. It may not be possible to determine which particular treatment is the most profitable, but this should not be considered as justifying the failure to begin treatment. A plant should be designed to treat by either, and if the future necessitates a change, this can be readily made; and in the meanwhile, whichever has been adopted, it is reasonably certain results will be worth the cost."

There are a number of questions in the treatment of timber which are yet unsolved. The subject, however, has been removed beyond the experimental stage and treatment can be adopted with reasonable confidence that benefits commensurate with the expense will be secured, and that further investigations and discoveries will be in shape of developments which will probably enable us with a reasonably increased expense, to secure more permanent and satisfactory results.

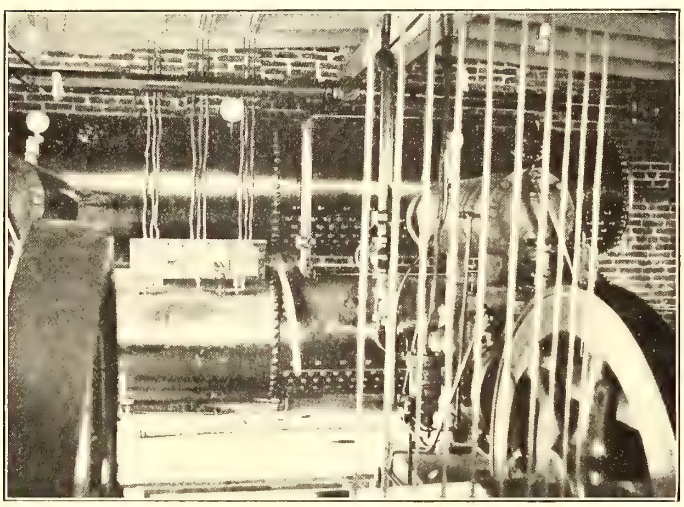
COMPRESSING STATIONS FOR STORAGE AIR BRAKES AT ST. LOUIS

In the Street Railway Journal of Feb. 6, 1904, a full account was given of the car equipment and stationary air



COMPRESSING STATION AT DE HODIAMONT—CAPACITY, THREE COMPRESSORS

compressors of the Westinghouse storage air brake system which the St. Louis Transit Company has adopted for its



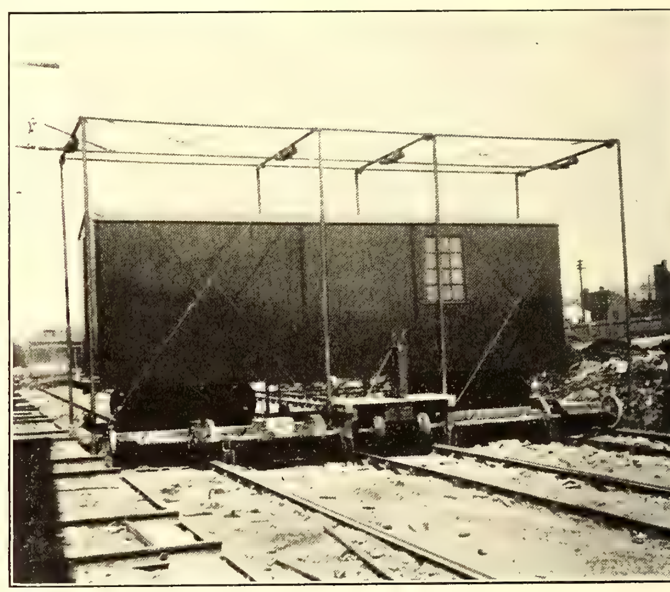
STORAGE TANKS FOR 325 LBS. AND AUTOMATIC PRESSURE-REGULATING SWITCHES IN COMPRESSING STATION

entire equipment of 1500 cars. The present article gives the construction and arrangement of the compressing stations which were not fully decided upon at the time the last article was written.

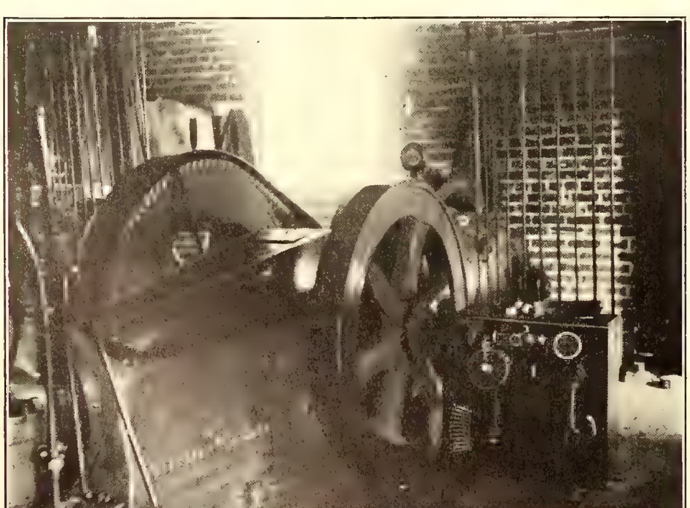
Some compressing stations are located in small brick buildings at the end of the line (one of which is shown), some are in car houses, and in addition some portable stations on box cars are provided for temporary terminals, and as reserves, for use at car houses.

Drawings and photographs both of the standard compression station and standard compressor car are reproduced here, through the courtesy of W. O. Mundy, master mechanic.

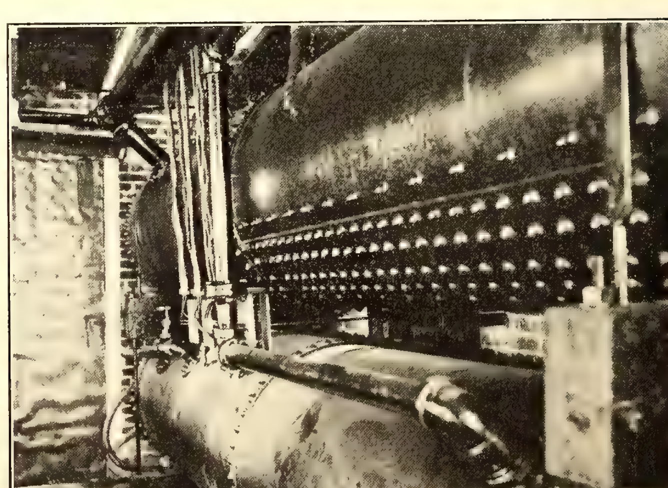
The particular compressor station illustrated happens to have three air compressors. Some others have one or two compressors, but the general arrangement remains the same. This building is 25 ft. square. The storage tanks are located along one wall. A radiator for cooling the jacket water is located along another wall. The water from the cylinder jackets of the air compressors is discharged into a well from which it is raised by an air lift to a small tank above the level of the radiator. From this tank it flows through the coils of the radiator back to the cylinder jackets of the compressors, and so



PORTABLE COMPRESSING PLANT ON CAR



COMPRESSOR AT DE HODIAMONT STATION

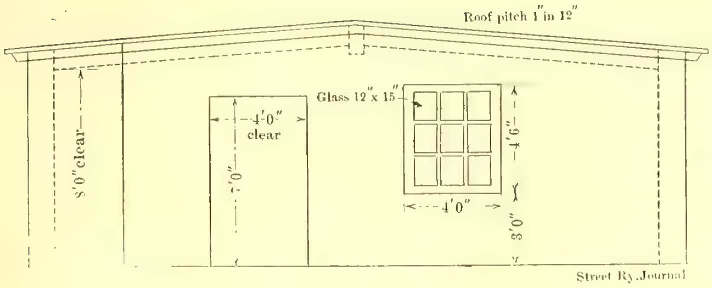


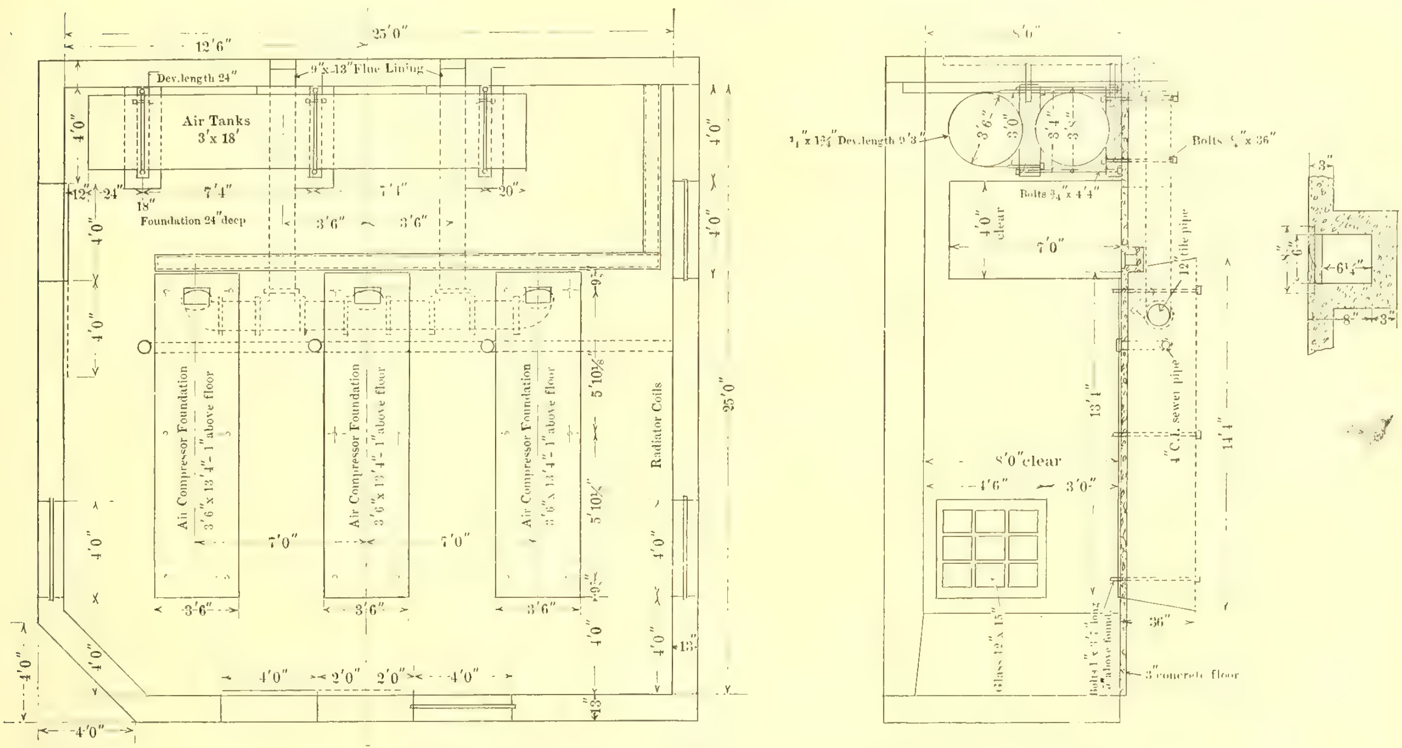
STORAGE TANKS AT DE HODIAMONT STATION

on, being kept in constant circulation. The compressor cars are also all being equipped with air lifts for circulating water, and a radiator, except that as a trial the first car was equipped with a circulating pump. The air lift was finally chosen because it is simpler. It is automatically controlled by an electrically operated air valve which puts the air lift in operation when the compressor starts.

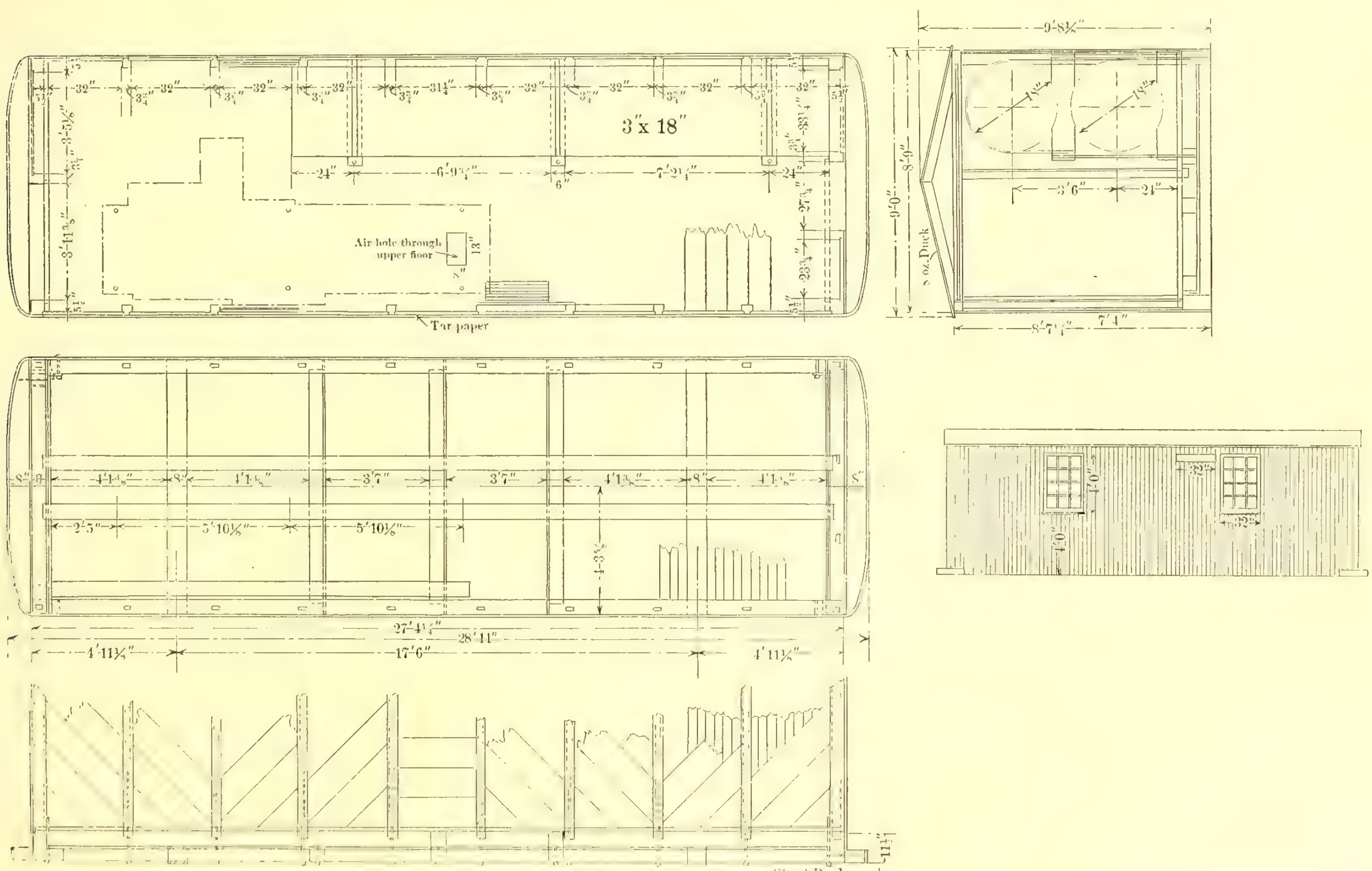
AIR CONSUMPTION PER CAR HOUR

A test made on a car operating on the Olive Street line, which is one of the heaviest traffic lines the company has, showed that the consumption of air per car hour is 100 cubic





END ELEVATION, PLAN AND SECTION OF COMPRESSED-AIR STATION



PLANS AND SECTIONS OF AIR-COMPRESSOR CAR

ft. of free air. Some tests made before the storage air system was decided upon, which were taken as a basis from which to figure the compressor capacity, gave 107 cubic ft. of free air per car hour. The cars are scheduled for over 10 miles per hour.

The consumption of air just given, Mr. Mundy believes, can be materially reduced by the use of an improved brake cylinder which he is designing, which requires considerably less air for a brake application than the ordinary cylinder.

ELECTRIC RAILWAY DEVELOPMENT IN THE FAR EAST

In spite of the large population in the Far East there are now only six electric railway systems in operation outside of those in Japan. A number of other cities have, however, made arrangements for the installation of electric lines and others are proposing to do so, so that within a year or so it is probable that the number of electric roads in operation in the Orient will be considerably increased, if not doubled. From a financial standpoint the electric roads which have been put in operation have been satisfactory, although the track mileage is very much smaller than that for cities of similar population in either Europe or America. This is of course due to the small amount of money per capita, particularly in India and China. In many of the towns of both of these countries an ordinary native can live and keep a whole family on about what the average American pays for car fares during the same period. The native population has, however, to be depended upon largely as patrons of the electric lines and it is found in the Far East, as in other places where electric lines have been built among a poor population, that natives patronize the cars to a greater extent in proportion to their incomes than in more civilized countries. There seems to be a fascination for them in car riding, and while the aggregate amount spent upon electric railway transportation is of course far less than in a town of corresponding population in the West, it is larger than might be anticipated.

As a rule natives are employed as motormen and conductors on the cars and as firemen in the power stations. The managers, power-station engineers and operating staff are usually Europeans or Americans, and as most of the enterprises so far built have been in the English possessions, the operating company is usually an English corporation with headquarters in London. The wages for the native employees are of course quite low, averaging from $3 to $14 per month. On the other hand the white officials have to be paid higher salaries than they would receive in Europe to attract them to the country, and as it is impossible for a European to work continuously in many parts of the Far East, it is necessary to have a larger force than would be required in more temperate countries.

In nearly all cases the cars or trains are arranged for the accommodation of two classes of passengers, as the Europeans and high-class natives will not travel with the coolies. As a rule this is accomplished by having trains of two cars, each consisting of a closed motor car, which is intended for first-class passengers, and an open trailer with cross benches which is for second-class passengers. In some cases combination cars have been run with satisfactory results. The white population does not form a very large proportion of the patrons of the cars, as it is of course numerically insignificant as compared with the native population, and many of the European residents own and prefer to travel in private equipages.

The first city in the Orient, encountered in a trip East, in which electric transportation matters are a live issue at present is Bombay. The street railway system in that city is owned by an American corporation and animal power is employed. The municipality, however, is preparing to introduce an electric road. It has instituted legal proceedings to purchase the existing system, and if this is successful will undoubtedly award contracts before long.

Madras has a short electric conduit system which was installed ten years ago by the Electric Construction Company of London. The road is only a few miles in extent.

Calcutta, which is the principal city in India, has by far the largest electric railway system in the East. The road is some 40 miles in length and 150 cars are in use. It was installed by Dick, Kerr & Company, who took the entire contract for the line, and was put in operation during 1902, so that the first year of electric operation has recently been completed. The road is owned by a company which is capitalized for about £790,000 and last year, which was the first year with complete electric operation, paid a dividend of 7 per cent. The operating expenses during the first period were slightly under 50 per cent of the receipts and the £5 ordinary shares are now selling at about £7 in the London market. The fares are graded according to the English system, the minimum fare being 1 anna, which is equivalent to an English penny. The cars are operated in trains of two each, consisting of a closed motor car, which is used for first-class, and an open trailer, which is used for second-class passengers. These cars are coupled permanently together and operate single ended on loops or Y's.

Directly south of India is the large and populous island of Ceylon, whose capital, Colombo, has an electric railway system owned by the Ceylon Planters' Company and installed by Kincaid, Waller, Manville & Dawson, of London. The electrical apparatus was furnished by the British Thomson-Houston Company and most of the other apparatus came from America. The line is about 8 miles in length and was put in operation in 1898. The capitalization is £130,840 ordinary shares and £120,000 in 5 per cent debentures.

Mandalay, the capital of Burmah, is the next city going east which has or is soon to have an electric railway system. The road, which is being installed by Dick, Kerr & Company, of London, is now being finished and will be in operation in about a couple of months. It is owned by the Burmah Electric Tramways & Lighting Company, Ltd., of London, which is capitalized at £200,000. The track is about 12 miles in length and thirty double-truck cars of the long, open type will be employed. As coal is expensive in Mandalay, costing about $7 per ton, it is proposed to use wood as fuel to a large extent. The engineers for this line are Kincaid, Waller, Manville & Dawson, of London.

Rangoon, the next largest city in Burmah, is the seaport of Mandalay. There is at present a steam tramway system in that city, but the concession for this line has expired, or is near expiration, and the municipality is now arranging for tenders for a new concession.

Siam has the oldest electric railway system in the Orient, the trolley line in Bangkok having been put in operation ten or twelve years ago. The corporation is a Danish one and American apparatus is used. Several articles on this system have appeared in past issues of the STREET RAILWAY JOURNAL.

An extensive electric railway system is now under construction at Singapore. It will consist of 27 miles of track and about seventy cars, open and closed, and is owned by an English corporation which anticipates the opening of the line during the early part of 1905. The contractors for the road are Dick, Kerr & Company. One of the most interesting features of this system is that the rails are laid on concrete and thermit rail joints are used exclusively. The same contractors are building an electric line at Hongkong, which is the next city proposing electric equipment encountered traveling eastward. The Island of Hongkong is quite mountainous, but the tramway runs along the coast connecting the shipping and mercantile districts. It is about 13 miles in length and

about thirty cars will be employed. It is owned by an English company. The engineering for both Singapore and Hong Kong is being carried on by A. Dickinson & Co., of London.

Shanghai awarded a franchise for an electric system to an English company about a year ago, but no construction has been commenced and it is doubtful whether the road will be built. Pekin has a short electric line built by Siemens & Halske, of Berlin.

Seoul, the final city on the Continent of Asia of electric railway importance, has a short electric tramway system owned by an American firm and equipped largely with American apparatus. This road has come into considerable prominence during the past few months on account of the war news from Korea and has been described in this paper.

Franchises for the cities mentioned above vary greatly according to local conditions of the governments under which they are issued, but in the districts and countries under English control are for thirty or forty-two years and usually with the provision that at the end of that time the municipality has the right to purchase the road for a price based upon the capitalization of the earnings during the immediately previous three or five year period. Although there is considerable future for electric railway construction in some of the largest cities in the Orient, the lines will necessarily be small and limited in number for the reasons pointed out in the early part of this article.

CHANGES IN THE ELECTRIC PACKAGE COMPANY OF CLEVELAND

Quite an important change has taken place in the affairs and management of the Electric Package Company, of Cleveland, which handles the express business on the various interurban roads radiating from Cleveland. Heretofore Barney Mahler, formerly president of the Lake Shore Electric Railway, has been president and general manager of the company. With a view to retrenching expenses, the offices of president and general manager have been abolished, and the offices of secretary-treasurer and auditor have been combined. In the future the management will be vested in an executive committee composed of three representatives of the various roads interested who will receive no salary. Each road will appoint a member of this committee. The committee appointed at a recent meeting consists of J. O. Wilson, general passenger and freight agent of the Cleveland & Southwestern Traction Company; Charles Currie, general manager of the Northern Ohio Traction & Light Company, and Charles W. Wason, president of the Cleveland, Painesville & Eastern Railway. Mr. Wilson will serve four months and the Lake Shore Electric Railway Company will then appoint a man who will serve one year. Mr. Currie will serve eight months and the Cleveland Electric Railway Company will appoint a man for a year. In this way there will be an expiration and the appointment of a new member every three months. The general offices of the company have been removed from the Electric Building, Cleveland, to the new express station of the Electric Package Company.

The Electric Package Company is rather a peculiar organization. It is not an incorporated company, being in reality an association; it owns no property by its own right. Each road provides its own express cars and pays its own crews with the exception of the messenger, who is paid by the Package Company. Each road owns its own teams at the towns on its own line, while the teams at Cleveland are owned by the various companies. The union express station, which was described and illustrated in a recent issue of the Street Railway Journal, is owned by the Electric Depot Company, and the stock of this company is owned by the various roads interested; the station is leased at a fixed rental to the Electric Package Company. The Electric Package Company maintains the Cleveland station and the teams used at this station, also the stations and teams at the various towns reached by the system; in some instances the express stations are combined with the passenger stations of the various roads, and in these cases the Electric Package Company pays a portion of the expense.

The division of the receipts from the business of the Electric Package Company necessitates a rather complex system of accounting. There are three expense accounts which are taken care of before the division of receipts. The general expense includes salaries of officers and several other items necessary for the operation of the business as a whole. This is divided pro rata among the various roads as to the money earned. In this connection it might be stated that in Cleveland the Cleveland Electric Railway Company is a party to the arrangement, and receives from the suburban companies a pro rata of their receipts based upon the mileage goods are carried over its tracks.

The Cleveland expense includes the rental for the Cleveland station, salaries of office force and teamsters, rental of teams, and other expenses incident to the operation of the Cleveland station. This expense is divided among the various roads in proportion to earnings on goods shipped in and out of Cleveland.

The suburban expense includes the maintenance of the various stations, rental of stations, salaries of teamsters and clerks, and other station expenses are charged to the company on whose lines they are located. Salaries of messengers come out of this fund.

SUBWAY CONSTRUCTION IN PHILADELPHIA

Construction is now well under way upon section No. 3 of the underground system of the Philadelphia Rapid Transit Company, and is progressing rapidly. This section includes the four-track portion of the system on Market Street between the loop station at the City Hall and the Schuylkill River. The portal end of the tunnel, where the tracks emerge to cross the Schuylkill River and join the elevated structure beyond, is nearly completed and is being roofed over, and also the piers for the special bridge at this point are well under way. The tunnel is being constructed eastward from the portal, by the open trench method, as far as Nineteenth Street, and in many portions the roof covering is now being applied.

The construction of the portal end involves a serious problem in changing the grade of the street. The street level will be raised some 10 ft. or 12 ft., which will, however, be greatly facilitated by the fact of its former low level in the two blocks adjoining the street bridge over the Schuylkill River. This change of grade is now being carried out in sections in order not to interrupt the heavy street traffic at this point, the street car tracks and roadway being nearly ready for use upon the fill in side of the street.

As stated in a previous article in these columns, the plans of the rapid transit improvements in Philadelphia include first of all this four-track subway in Market Street, from a central "loop" station surrounding the City Hall, west to the Twenty-Third Street portal, where connections will be made by a special two-level bridge over the Schuylkill River to the surface and elevated lines beyond. This work is now being pushed rapidly, and will, it is claimed, be completed in 1905. The elevated structure will extend from Twenty-Third Street west upon Market Street to Sixty-Third Street and will have two important branches. Besides this, a double-track subway will extend from the City Hall loop station to the Delaware River, with also an extensive branch loop entirely surrounding the shopping district. Other lines are also contemplated but at present have not been definitely defined.

A NEW SYSTEM OF CURRENT COLLECTING FOR HEAVY ELECTRIC TRACTION LINES

BY HENRI SOMACH

The Oerlikon Machine Works, of Switzerland, have equipped an experimental line with a new system of current collection devised by E. Huber, the technical director of that company.

The following article is intended to comprise a description of the details of this system and to display its characteristic points of merit, which appear to the writer to be a great step

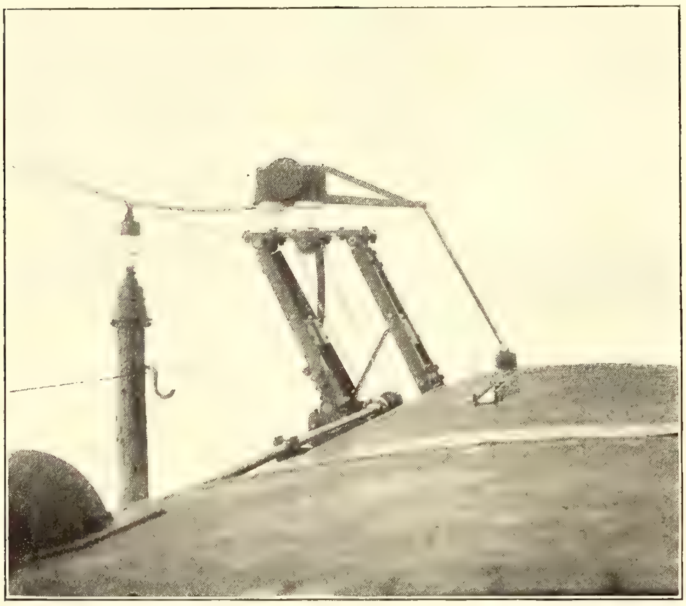


FIG 1.—FLEXIBLE ROD USED FOR COLLECTING CURRENT

toward the solution of the problem of heavy electric traction on long distance lines.

It has been very definitely decided by modern engineers that the solution of the long distance traction problem is to be reached by means of a single overhead conductor supplying alternating single-phase current at high voltage to the car, the return being had through the service rails of the permanent way. There are many objections to the methods already in use when they become applied to long distance service. The third rail must either be raised to prohibitive potentials in order to minimize losses, or an excessive number of substations must be employed, and the third rail, by reason of its proximity to earth, is at any voltage a greater or less source of trouble.

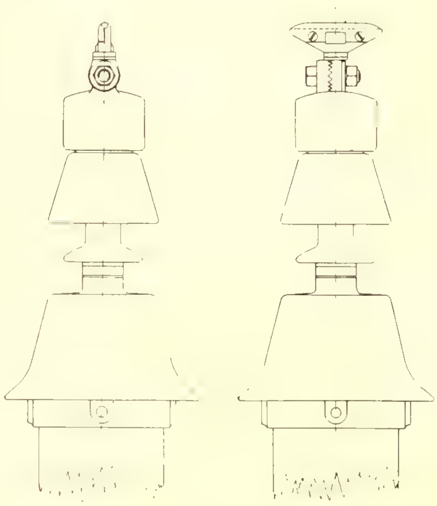


FIG. 4.—INSULATORS USED TO SUPPORT POWER WIRE

Furthermore, in equipping long distance lines the solution of the problem appears to the writer to be that of dealing with the conditions as they now exist, that is to say, we must use the same rolling stock and the same method of train operation and simply replace the steam locomotive by a suitable electric tractor. Many reasons why this system of locomotives versus multiple unit control or individual car equipment could be discussed pro and con and would not be within the scope of this article, which has an intent to discuss simply the means of overhead current collection.

Suffice it to say that the writer, believing fully in a system of locomotive traction for long lines, considers that a successful current-collecting device for such a locomotive is of paramount interest and importance. The efforts of men such as Lamme, of Pittsburg, and of Winter and Eichberg, of the Union of Berlin, and of Dr. Finzi, of Milan, very pointedly show that these prominent engineers believe that the single conductor and rail return is the system of distribution to be

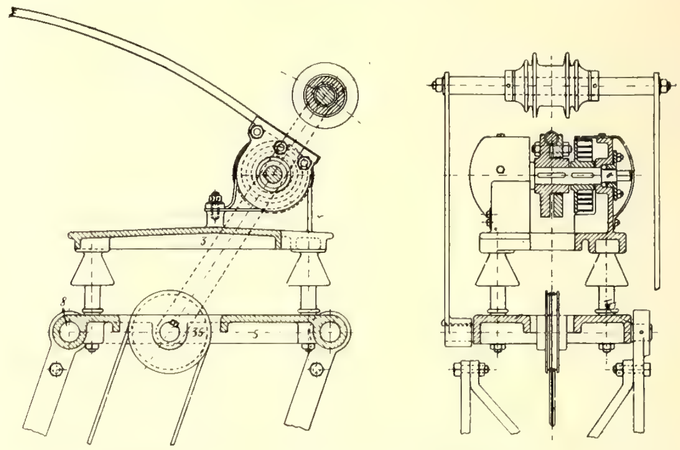


FIG. 2.—CONSTRUCTION DETAILS OF CURRENT COLLECTOR

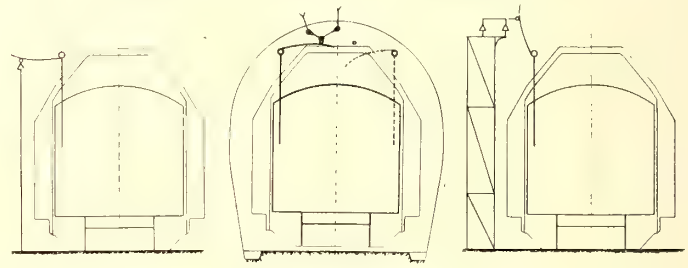
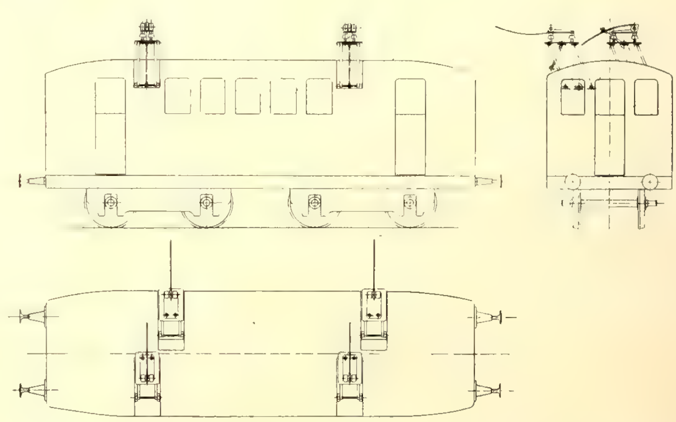


FIG. 3.—SHOWING SOME OF THE POSITIONS POSSIBLE WITH FLEXIBLE-ROD CURRENT COLLECTOR

striven for. Messrs. Mordey and Jenkin arrived at the same conclusion in a discussion occurring on Feb. 18, 1902, before the Institution of Civil Engineers of London. Therefore the writer confines his article to the description of the device for single-phase current collection from a single overhead conductor.



FIGS. 5 AND 6.—TWO SETS OF TWO CONTACTORS MOUNTED ON A PARALLEL LINKAGE FOR CHANGING POSITION OF CONTACT STEMS AT CENTERS OF ROTATION

The Oerlikon Machine Company has devised a new apparatus for this purpose capable of adapting itself to the various conditions to be found on existing trunk lines and numerous cross-sections on existing structures, such as bridges and tunnels.

The conditions to be filled on trunk line service are the following:

1. The current-collecting apparatus should not require manipulation during change in the direction of the motion of the train.

2. It should be very light in order to diminish the violent shocks on the overhead conductor.

3. The contact part should be very readily renewable.

4. The arrangement of the apparatus should be such that it is practically impossible for it to damage the contact line.

5. The apparatus should be so arranged as to have a wide range of motion, thereby permitting it to make proper contact in many different relative positions between the overhead conductor and the train, and the apparatus should not come off the wire.

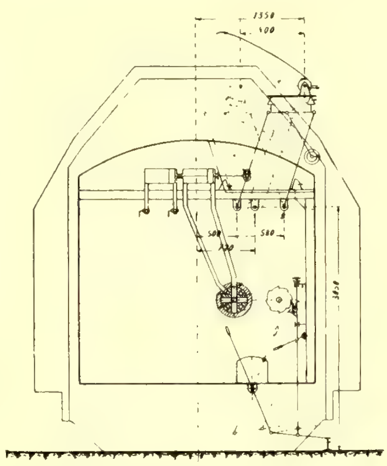


FIG. 7.—COMPRESSED AIR CONTROLLING APPARATUS FOR LATERAL DISPLACEMENT OF PARALLEL LINKAGE MOUNT

6. The overhead line ought to be double, not only for double track but for single track, the two lines being entirely distinct and on separate insulators, the one serving as a reserve in case the other is disabled.

7. The overhead wires ought to be placed at the side of the permanent way so as not to interfere with the rolling stock.

8. The arrangement of the overhead wires and all their insulators and supports ought to be designed in such a manner as to present a minimum surface to the effects of wind and snow.

9. The overhead wires should be capable of being repaired without blocking the service.

10. Branches and crossings on the overhead system should be effective without the use of special apparatus such as commonly employed in the ordinary trolley work.

11. The division of the overhead wires into sections should not require the employment of insulating connectors, which are subject to great deterioration on account of the high tension employed.

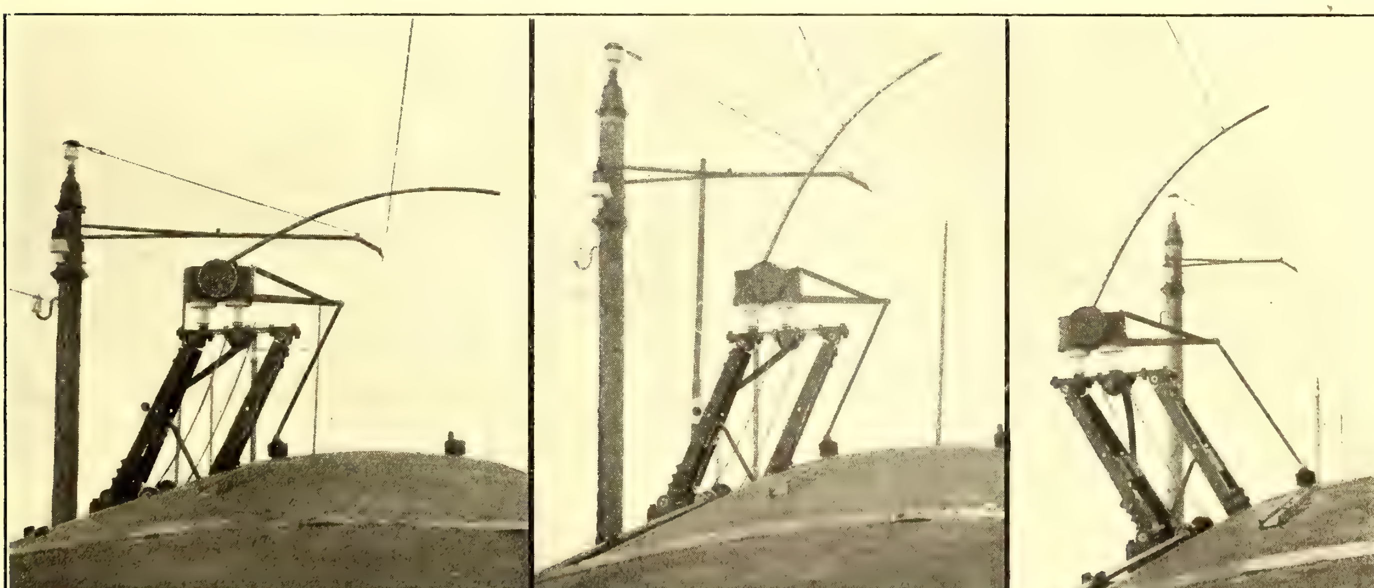
12. The overhead wires and their supports should be capable of safe installation no matter what the section of the permanent way may be, that is, independent of whether there may be tunnels or any other special arrangements along the route.

13. All of the material in the overhead construction should be specially constructed on account of the high tension employed.

It is proposed to show how the current-collecting apparatus referred to and the overhead construction used in connection therewith fits these various conditions.

FIG. 9.—CURRENT COLLECTOR OPERATING AT ITS LOWEST POINT

The new current-collecting apparatus is of the bow type made of a metallic stem, having a slight curvature and rubbing with its convex surface on the single overhead wire. The stem is arranged so that the forces applied will permit its lower extremity to move on an axis parallel with the track, which gives it rotary motion in a plane perpendicular to the track. The mount of the collecting stem is attached in place by bolts which permit its ready renewal in case of need.



FIGS. 10, 11 AND 12.—SOME CHARACTERISTIC CASES, SHOWING FLEXIBILITY OF CURRENT COLLECTING DEVICE

Spiral springs are arranged so as to cause the stem to press firmly against the overhead conductor and insure a good contact thereon in any position in which it may be rotated. The various positions of the stem are practically directed by the

overhead conductor, which conforms in height and lateral arrangement more or less to the requirements of the track. The current-collector is insulated as a whole by means of heavy porcelain insulators. An insulated knob of porcelain mounted on the end of the lever which appears in a pendent position in Fig. 1, swings on an axle which is manipulated by a chain

FIG. 13.—VIEW OF AERIAL CONSTRUCTION OF SINGLE-PHASE RAILWAY

under the control of the motorman. By operating this chain the contact stem can be lifted from the wire and placed out of commission. This apparatus is shown in diagram in Fig. 2, the chain being numbered 35, the lever 3 and the porcelain knob raised.

Fig. 3 shows a number of diagrams which display the various positions that the overhead line may have with reference to the collecting device. The first cut shows the normal position. The contact wire is arranged outside the profile of the car where there is a free space of about 2.3 meters. The contact stem slides underneath the wire contact on its upper surface. The contact wire is supported on porcelain insulators shown in detail in Fig. 4, which are mounted directly on the supporting poles without the use of cross-arms. The middle diagram shows a position of contact which is employed in tunnels or in other engineering arrangements, such as crossings and branching with other lines. In this last position the current-collector operates like the ordinary bow system, where the overhead wire is above the track and the bow rubs beneath the wire. The great laxitude of this apparatus with reference to the position of the contact wire can readily be seen.

It is only necessary in order that a contact shall be made that the line intersects the surface generated by the collecting stem in its rotation from 0 to 180 degs. However, to augment still further the extreme limitations of position in space for the contact wire, the apparatus is mounted on a parallel linkage by means of which the position at the center of rotation of the contact stem can be moved up or down. This is displayed in Fig. 5 and Fig. 6, in which two sets of two contactors are shown, both of which can be placed in service and allow the car to run from one section on to another without an arc on the contact wire. The lateral displacement of the parallel linkage-mount can be effectively controlled by the hand or by means of compressed air, as shown in diagram in Fig. 7.

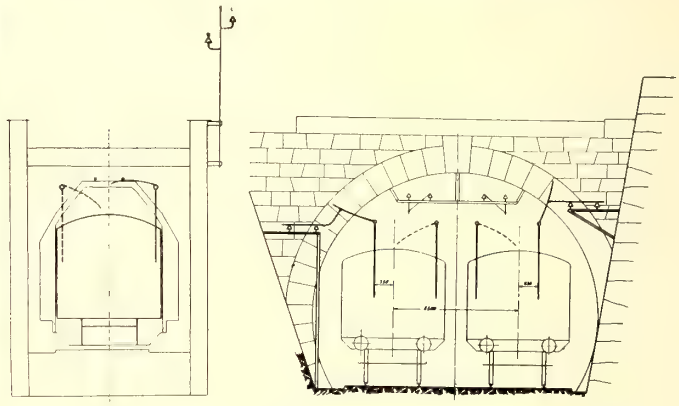


FIG. 8.—ARRANGEMENTS OF CONTACT WIRE IN VARIOUS CASES

This lateral displacement of the current-collecting device is necessary only in traversing tunnels on a double track, and it is possible to effect this automatically on entrance and exit to the tunnel. This can be done most simply by means of a bar suitably placed on the track which engages with a mechanism under the car at different heights and operates the air-controlling apparatus. Fig. 8 shows various arrangements of contact wire in various cases of permanent way construction. Figs. 9 to 15 are photographs representing the various positions of the contact device on the experimental line of the Oerlikon Company. Fig. 13 gives a general view of the aerial construction of this experimental line on which single-phase alternating-current is employed at a pressure of 14,000 volts. It will be noted that the insulation of the line is exclusively of porcelain, even where the contact wire is supported by transverse suspension. This is accomplished simply by a metallic connector and the transverse wire is insulated from the poles, that is to say, the earth, by porcelain insulators. This ar-

FIGS. 14 AND 15.—FLEXIBLE-ROD CURRENT COLLECTOR IN USE ON EXPERIMENTAL LINE

rangement has been selected because of its peculiar fitness to resistance and high pressure.

The line is not doubly insulated, but each porcelain insulator is sufficiently large for the pressure employed. These insulators are individually tested to 30,000 volts after having been thoroughly soaked with water. The entire line has been tested as a whole to 16,000 volts and the insulation has been found to be perfect. This arrangement is to be preferred to several insulators placed in series, each of which is insufficient alone.

Following the description of the line and the current-collectors for high tension which has just been made, a resumé of the advantages which obtain will be in order.

The current-collecting apparatus requires no manipulation when the car is operating.

The contact stem is very light, readily interchangeable and preferably covered with a composition softer ,than copper thereby avoiding undue wear of the contact wire. The weight of this contact stem is only 1.5 kg (3.3) lbs; its length 130 cm (51.2 ins.) and the maximum pressure against the contact wire only 3 kg (6.6 lbs.).

Because of its curved form the stem can not become engaged between contact wires and suspension wires when there are any. As a further consideration the stem is constructed to be the weakest part so that entanglement will not damage the line. The stem can not come off the wire because its length exceeds by 350 mm (13¾ ins.) the furthest position of the contact wire from the center of rotation of the contact system. It will appear from thedescription and the arrangements and from Figs. 1 to 16, that the contact wire and the current-collecting apparatus are well adapted to any constructional sections that are met with on trunk line railroads.

The principal advantage of this system ,appears to the writer to obtain in the possibility of establishing contact in the first diagram of Fig. 3, that is to say, on the side of the track

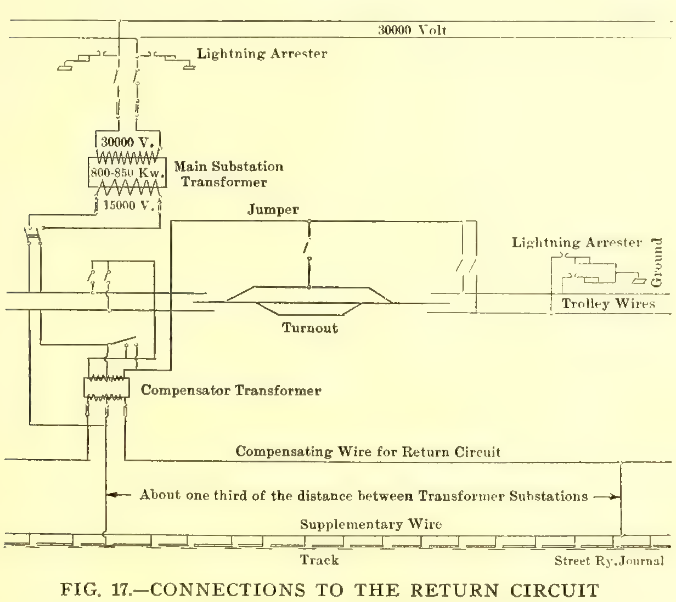


FIG. 17.—CONNECTIONS TO THE RETURN CIRCUIT

at a distance of 725 mm (29 ins.), with the contact wire supported directly on insulators on the extremities of the pole, and the contact stem riding above the wire. It is worthy of remark that on at least 90 per cent of most railroad lines such a system of contact following this section can readily be established. This arrangement of the line is very advantageous from the standpoint of solidity of construction and ease of protection. It is possible when necessity arises to provide massive supports under the contact wires adapted to the high tension without interfering with the current-collector, because the latter makes contact from above. For the same reason the construction is less liable to sleet troubles, the sleet being generally thicker on the underside of the line wire.

Finally it is possible to install two contact lines on a single track, one on each side of the track and to take current from one or the other wire, according to circumstances. One section can be repaired while the other is in operation and the repair work can be carried on without interrupting the service because the line is arranged on the side and does not interfere with the rolling stock. The locomotives ought to have then four contact-collectors, two on each side.

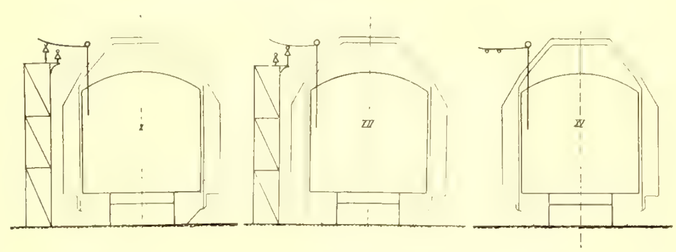


FIG. 16.—PASSING FROM ONE SECTION TO ANOTHER

For double track lines it is not necessary to have two independent lines of contact for each. It suffices to have for each track a single lateral line arranged as shown in Fig. 3 The space between the tracks is not sufficient for the installation of poles for the support of a line of contact and transverse suspension above the tracks is not to be recommended. It is therefore preferable to have two lines of lateral contact, one on either side of the track which form a sufficient reserve upon one another, being mechanically and electrically completely independent. It is not difficult to conceive of arrangements permitting in case of accident on one section of a contact line to continuing operating on the other track, using the current on the other line.

In closing the description and discussion of this new system of current collection, the writer wishes to again call attention to the facilities which this system offers to the separation of the contact line into sections when they can be easily insulated one from the other without necessitating the employment of insulating circuit breakers inserted in the contact wires themselves, which are subject to rapid deterioration. This separation of sections is obtained in this system by an air gap between the contact wire of one section and that of the following section, the wires overlapping each other without touching. The contact stem makes contact for an instant with both wires at once in such a manner that the passage of one section to another makes no interruption even momentarily in the current supply. Passage from one section to another is diagrammatically illustrated in several forms in Fig. 16.

Inasmuch as the use of a track return has been criticised as offering excessive impedance to the alternating-current, it is well, in closing this article on a system of contact which depends upon this principle, to make mention of some practical results which the writer has been fortunate enough to secure. In one case, with a frequency of 42 cycles per second on the Burgdorf-Thun line, the apparent resistance was eight times the ohmic resistance at the rails, and this effect with the smaller currents on the high-tension system of distribution proposed is less. To obviate this inconvenience, it is possible to effect the return of current equally well by a copper wire arranged along the rails and connected at each joint by means of a very simple connection of a clamp of serrated copper and a bolt. Good connection is not necessary in this case, because the greater part of the current is conducted by the copper wire entering the same by the connection of the nearest joint, and the drop which is due to bad contact is but a small percentage of the total. This arrangement for return current is advantageous because the return is independent of the condition of the electrical connections of the rails and a rail can be removed in case of repairing the track without interrupting the return circuit.

Even with a return circuit reinforced by a continuous copper wire such as has been described, the effect of self-induction because of the proximity of the rails is apparent.

In a test made by the Oerlikon Company on a track with two rails of 28 kgs per meter and with a wire 8 mms in diameter laid along the rail and connected in the manner indicated above, the following losses of voltage were obtained with a current of 100 amps.:

50 cycles, 70 volts per kilometer.

16 cycles, 42 volts per kilometer.

With continuous current, 30 volts per kilometer.

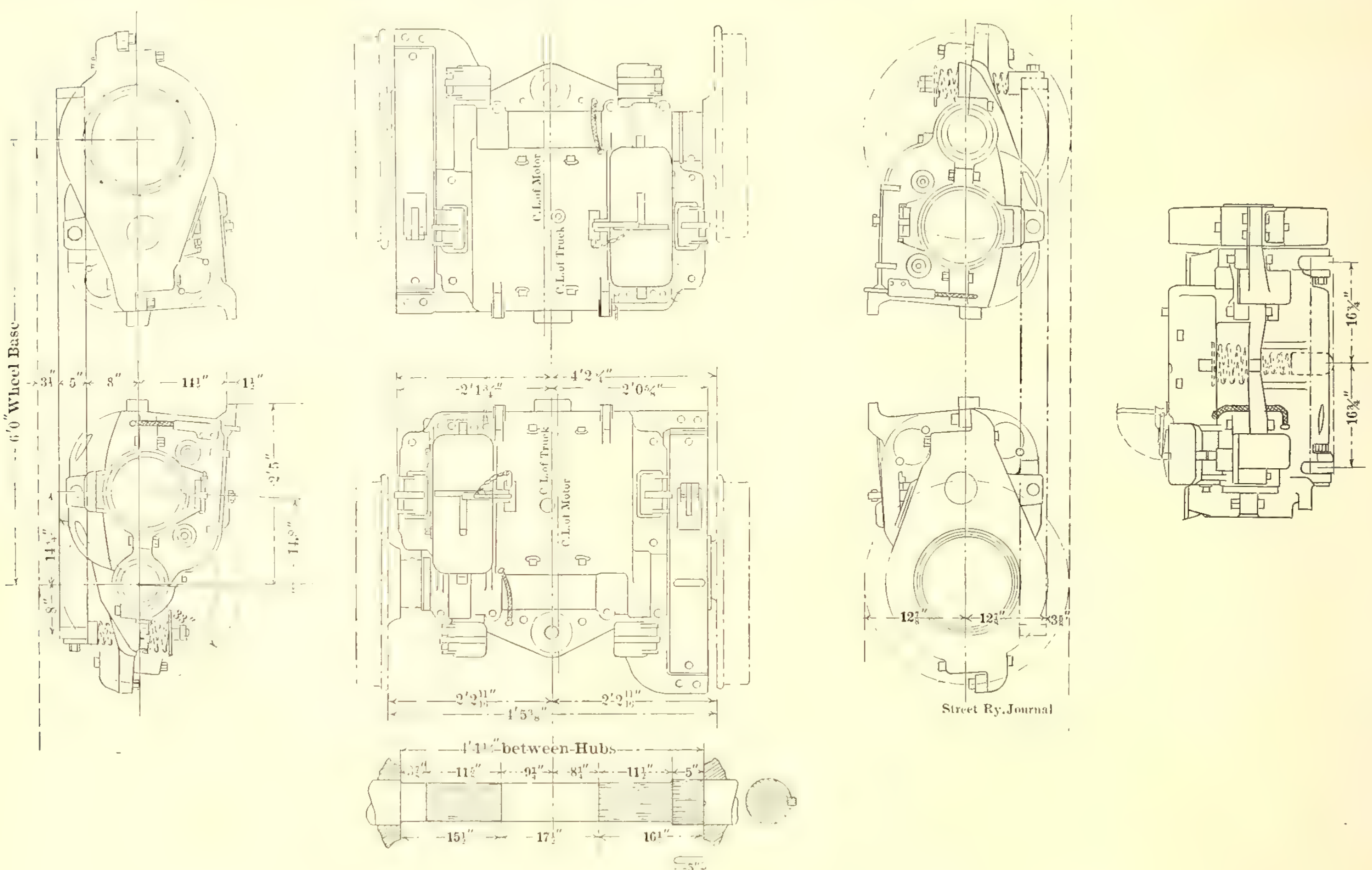
The effect of self-induction in the return can be compensated for, and the loss reduced to a very small amount by a system of compensation based on the employment of booster transformers.

This is accomplished by substituting for the return booster which would be used with a direct-current system a series

WESTINGHOUSE NO. 85 RAILWAY MOTOR

The new Westinghouse railway motor known as No. 85, is of similar capacity and performance to the No. 76 motor of the same company, which has been found particularly adapted to suburban and interurban service. In outline and appearance the new motor follows lines recognized as standard in Westinghouse practice, but mechanical modifications have been introduced, so that the No. 85 motor possesses many features of advanced construction.

The frame is made of cast-steel divided horizontally in two parts, securely bolted together and forming a field which is wholly iron-clad, and approximately cylindrical in shape. The design is such that when mounted on the truck the holding bolts may be withdrawn and the upper field lifted off. To this end the suspension lugs and projection for the support of the gear case are cast with the lower field. A large open-



DIAGRAMS SHOWING ELEVATIONS AND PLAN OF NO. 85 RAILWAY MOTOR

transformer in which the primary is in series with the trolley wire and the secondary therefore has a compensating action proportional to the primary current, as shown in Fig. 17. This line can be supported on the same poles as the high-tension contact line, but the current which it conducts is at much lower voltage.

It has been found in the experiments with this system of compensation by the Oerlikon works to reduce the losses in the rails to 10 per cent of that which would have obtained without such compensation.

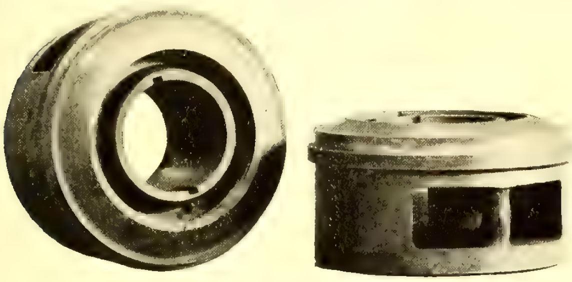
F. T. Chandler and P. M. Chandler, of Chandler & Company, bankers and brokers, of Philadelphia, in company with President George F. McCulloch, of the Indiana Union Traction Company, in the latter's private car recently spent a week inspecting the various lines of the company, and by courtesy passed over other traction lines of Indiana. Chandler & Company are heavy handlers of the stock of the above company and the Fort Wayne Traction Company and other traction companies of Indiana.

ing with a spring locked cover is provided in the upper casting, which permits access to the commutator and brushes. Hand-holes are provided in convenient locations about the motor frame. The four pole pieces are built up of soft steel punchings riveted together between end plates of wrought iron and are held to the motor frame by bolts. The poles project radially inward at angles of 45 degs. with the horizontal. Two bolts, secured by lock washers, hold each pole piece in place. They do not penetrate the pole face, but terminate in heavy rivets inside the pole made for this purpose. A smooth and unbroken pole face is thus presented to the armature. The poles are made with projecting tips, which properly distribute the magnetic field, and also serve to retain the field coils, which are held firmly in place by steel spring washers. The coils are wound with asbestos-covered wire. They are heavily taped and are treated with specially prepared insulating compounds, which render them practically moisture proof. Leatheroid washers provide adequate protection against mechanical injury.

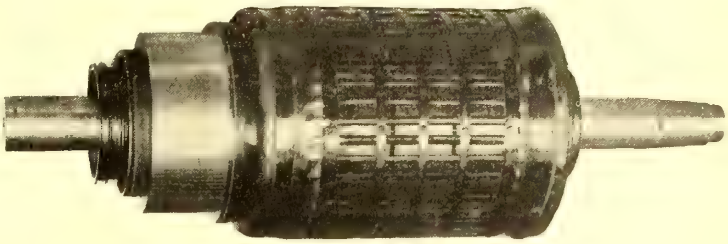
The armature core is formed of circular punchings of soft

steel, built up upon a cast-iron spider. Ventilating spaces are provided in the core at right angles to and parallel with the shaft. The spider is pressed on and keyed to the shaft. The commutator also is mounted on the same spider, and the shaft can thus be taken out and renewed, should this be necessary, without disturbing any other part.

The armature is wound with machine formed coils imbedded in rectangular open slots and held in place by band wires sunk in grooves. It is, therefore, wholly iron-clad, and the winding protected against mechanical injury. Canvas caps protect the winding at both ends, completely covering the parts of the windings outside of the armature core. The end plate at the pinion end is provided with a bell-shaped flange upon which the windings rest. This flange also holds the ends of the coils rigidly in place. The ends of the coils and the back of the commutator are thoroughly protected from carbon and copper dust. The complete armature is 15¾ ins. in diameter. Wiper rings, of approved design, pressed upon the shaft outside the armature revolve in spaces in the motor frame inside the bearing boxes and prevent oil working its way along the shaft to commutator or winding. Oil thrown off by these rings is drained off through suitable openings.



ARMATURE BEARINGS



COMPLETE ARMATURE AND COMMUTATOR

The commutator consists of 117 hard drawn copper segments with short necks, separated by prepared mica sheets, built up upon a cast-iron bushing and clamped between two V-shaped surfaces, from which they are insulated by similarly shaped rings of moulded mica. The complete commutator measures 12 ins. in diameter x 4¾ ins. in width, and has a wearing depth of approximately 1 in. It is pressed on and keyed to the armature spider.

Brush-holders of the sliding shunt type are mounted on cast brass arms, which are secured to the motor frame by vulcabeston headed bolts. These arms admit of radial adjustment to compensate for wear of the commutator. The tension springs may be thrown back and fastened out of the way, facilitating the inspection of the brushes. Each arm carries two carbon brushes ½ in. x 2 ins. section. The tension springs for each brush are independently adjusted. Flexible leads of rubber-insulated cable are brought out through bushings of semi-hard rubber set in the motor frame.

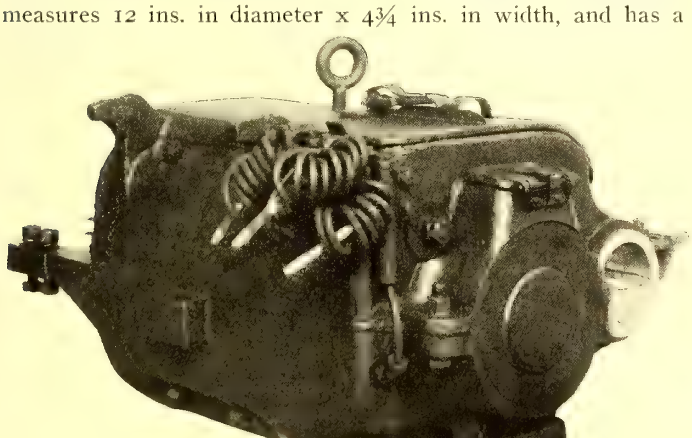
The armature bearings consist of solid bushings of cast-iron, lined with babbit metal, and keyed in place within heavy housings. The bearing at the commutator end of the motor is 7¾ ins. long, and that of the pinion end, 9 ins. long. Both are bored for a 3⅝-in. shaft. The axle bearing shells are made of cast-iron divided horizontally and held between projections cast solid with the upper and lower halves of the motor frame. The bearings are 11 ins. long, and lined with babbit metal. They will accommodate a shaft 6½ ins. or less in diameter. The bearing boxes are packed with wool waste and are lubricated by means of oil, similar to the journals of a railway car.

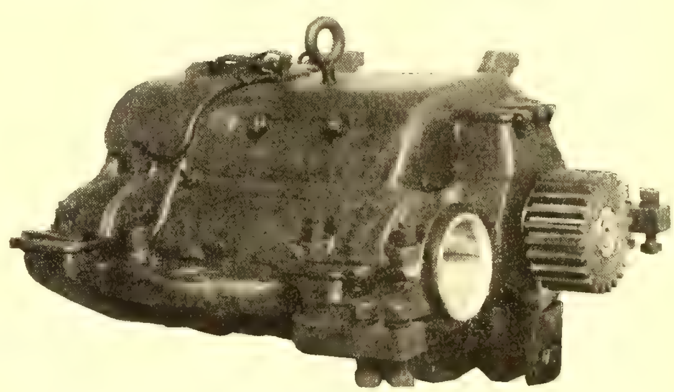
The pinion is made of forged steel with machine cut teeth. It is keyed in place and held on a tapered seat by a special nut and lock washer. The gear is made of steel, in one piece, and is pressed on the car axle. The gear and pinion have a diametral pitch of 2½ per inch and faces 5 ins. wide. Standard pinions are made with from fifteen to twenty-nine teeth, and corresponding gears with from fifty-nine to forty-five teeth.

The gear case is of malleable iron, cast in two parts, which are bolted together. It is mounted on lugs projecting from the lower half of the motor frame, and is therefore not disturbed when the upper field is lifted off.

The No. 85 motor is designed for either nose or Baldwin-Westinghouse suspension, as indicated by the outline drawing on the opposite page.

Before leaving the works each motor is run under load and the insulation is submitted to an alternating potential of 3000 volts. This final running test supplements a long series of tests and inspections of each and every part during construction.





SIDE AND END VIEWS OF NO. 85 RAILWAY MOTOR

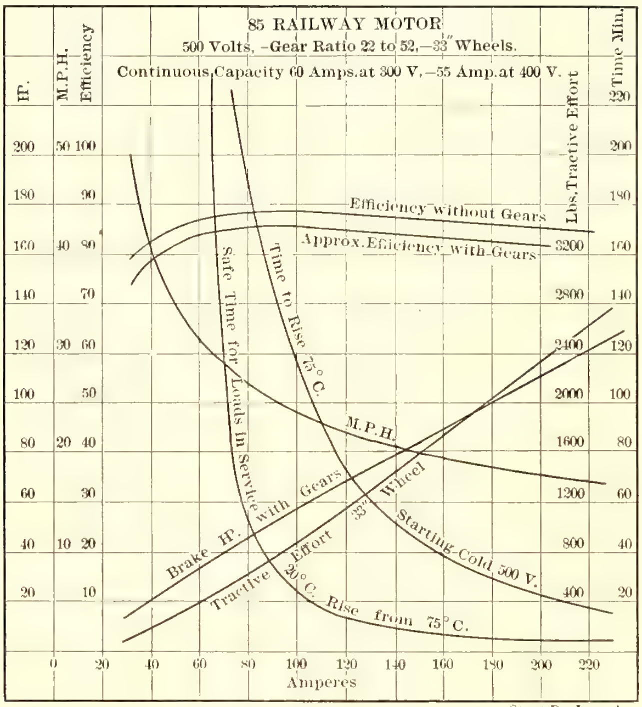
The Westinghouse No. 85 motor, complete with gear and gear case, weighs approximately 4500 lbs. The motor alone, without gears and gear case, weighs approximately 4000 lbs. The complete armature, with commutator and shaft, weighs approximately 995 lbs. The weight of a complete double equipment, including motor, controllers and the usual details, is approximately 10,780 lbs., and that of the corresponding four-motor equipment approximately 21,640 lbs.

When mounted on 36-in. wheels, the clearance between bot-

tom of motor and top of rail is 4⅝ ins.; between bottom of gear case and top of rail, 3⅝ ins. The diagram shows the general outline and principal dimensions of this motor.

The operating characteristics of this motor are clearly indicated by the performance curves, one of which, for a gear ratio of 22 : 52 is published herewith. A quadruple equipment is well adapted to the operation of a car of from 20 to 25 tons (without equipment or load) at a schedule speed of approximately 25 miles per hour, with stops at intervals of 1½ to 2 miles. With 36-in. wheels, and gears of standard ratio, a maximum speed of 45 miles per hour may be maintained.

The Westinghouse No. 85 motor is nominally rated at 75-hp. It is, however, now recognized in well informed railway circles that nominal rating is not the proper basis for motor selection. Conditions of service differ so largely and so many elements enter into the problem that it is necessary to predetermine



PERFORMANCE CURVES OF NO. 85 RAILWAY MOTOR

actual working requirements as closely as possible, and study performance characteristics of the motors considered with special reference to these requirements in order to properly determine the size and type best suited for any particular service. Fortunately, these problems are rapidly becoming more generally understood, though many a road is still paying heavy repair charges, due in no sense to the design and construction of the motors, but solely to the fact that a good motor is being abused by conditions it was never intended to meet. With the curves such as are now supplied with motors, it is possible to determine accurately whether or not a motor is suited to a service whose main characteristics are known. The Westinghouse No. 85 motor has a continuous service capacity of 60 amps. at 300 volts, or 55 amps. at 400 volts, these voltages being selected as representing a fair average of the voltage at the motor terminal under usual conditions. In ordinary railway service the manufacturers recommend it as being able to carry safely any load within the range shown on the performance curves, provided the integrated heating effect does not exceed that caused by the continuous application of either of these currents at the corresponding potential.

With a load of 60 amps. at 300 volts, or 55 amps. at 400 volts carried continuously during a shop test, the rise in temperature of the motor windings, as measured by thermometer, after ten or twelve hours, or after a constant temperature has been reached, will not exceed 75 degs. C. With equivalent load under a moving car the temperature rise should not exceed 55 degs. C. Heavier loads may be carried for shorter periods, as indicated by the time temperature curve. If, for example, the motor has been working at a load of 60 amps. at 300 volts, and has reached a temperature of 75 degs. C., it may then carry a load of 72 amps. at 300 volts for one and one-half hours, with additional rise in temperature not exceeding 20 degs. C. Speed, tractive effort, efficiency and power developed are also indicated for different gear ratios and under conditions ranging from currents of 30 to 240 amps. at the normal potential of 500 volts.

MULTI-CURRENT FEED-WATER HEATER

The multi-current feed-water heater shown in the accompanying illustration is the latest design of the Blake-Knowles type for horizontal or vertical setting made by the International Steam Pump Company. In the horizontal form the steam enters the upper opening and travels through a passage whose area is equal to one-half of the cross-section of the whole heater.

HORIZONTAL MULTI-CURRENT FEED-WATER HEATER

This passage is formed by a diametrical baffle plate extending from the end where the steam enters nearly to the opposite end. At the opposite end the steam turns downward and traverses two segmental passages at either side, each having one-sixth of the total cross section. Each of the latter passages is formed by a radial baffle plate placed below the large diametrical baffle plate. On arriving again at the end where it entered, the steam remaining uncondensed passes back through a passage having one-sixth of the total area of the heater and at the exhaust end the remaining steam and air escape through the discharge opening to the condenser or the atmosphere, as the case may be. The water traverses six radial nests or tubes, each forming a segmental group. The cold water entering the heater passes through the tubes occupying the discharge steam compartment. Arriving at the other end it passes back through the next segmental group, and so on, backward and forward, until it reaches the outlet. This gives the rapid circulation and thorough mixing of the feed-water by which is obtained the maximum heating effect possible in an apparatus of this character.

Access to the heater is had by removing the heads. The tubes of the vertical heaters can be cleaned from the top and the horizontal heaters from either end. Feet or saddles are provided as the case requires. Mud blows are employed to keep the heater clean and free from sediment. Entrained water is removed by drip-pipes. Every heater is tested under 250 lbs. pressure per square inch, giving a safe working pressure of 175 lbs. The heaters are made in sizes of 5000-hp in both the horizontal and vertical styles.

The Railway Commissioners of New South Wales, who operate the tramways in Sydney, Australia, are planning to change all of the existing cable lines in that city to electricity. The Sydney tramway system now consists of 206 miles of track employing 33 grip cars, 576 electric motor cars, 96 steam locomotives, 123 steam passenger cars, 53 electric trail cars and 37 electric freight and work cars.

CARS FOR THE NORTHERN TEXAS TRACTION COMPANY

The Northern Texas Traction Company through the Roberts & Abbott Company, of Cleveland, has recently purchased from the Northern Texas Traction Company, of St. Louis, a number of large closed and open cars for service between Dallas and Fort Worth. The railway company operates all the lines at Fort Worth and one of the systems in Dallas. The interurban system consists of 58 miles of track with an equipment of over fifty cars. An amusement park situated at Handley, about 5 miles from Fort Worth, is reached by this division. Dallas is the second largest city in the State, having a population of nearly 45,000. Fort Worth is one of the chief live stock centers and has a population of nearly 30,000.

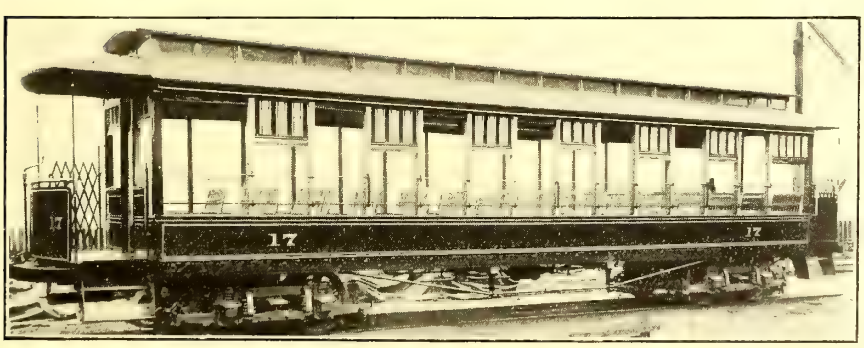
EXTERIOR OF CLOSED CAR FOR THE NORTHERN TEXAS TRACTION COMPANY

As will be seen from the illustrations, the cars have steam car roofs, twin windows and vestibules at the forward ends. The lower sashes of the windows are arranged to be raised their full height and may be held at any point by the locks being released against serrated bronze bars set into the posts. The seats are 35 ins. long and have fixed backs; width of aisles, 20 ins. The total seating capacity is fifty-six. The smoking compartment is located in the forward end and seats sixteen passengers. A toilet room of standard steam car character is placed in the corner at the rear end. The interiors are finished in cherry rubbed to a smooth dead finish and paneling inlaid with white holly and ebony. The ceilings are of three-ply poplar veneer with rafters in semi-Empire style.

INTERIOR OF OPEN CAR USED BY THE NORTHERN TEXAS TRACTION COMPANY

INTERIOR OF CLOSED CAR USED BY THE NORTHERN TEXAS TRACTION COMPANY

The length of the cars over end panels is 40 ft. 9 ins.; over vestibules, 50 ft. 1 in., and over bumpers, 51 ft. 9 ins.; from panels over vestibules, 4 ft. 8 ins.; width over sills, 8 ft. 5 ins.; centers of posts, 2 ft. 10 1-16 ins.; size of side sills, 5¾ ins. x 7¾ ins., plated on the outside with 7 in. x ⅝ in. steel; thickness of corner posts, 4 ins. x 4½ ins., and side posts, 2¼ ins. x 4 ins. The cars are mounted on Brill No. 27-E-2 trucks, with 33-in. wheels, 3-in. tread and ⅞-in. flange. The trucks have solid forged side frames bracketed to the transoms with 1 in. double and single corner brackets. The motor equipment consists of four 50-hp motors per car.



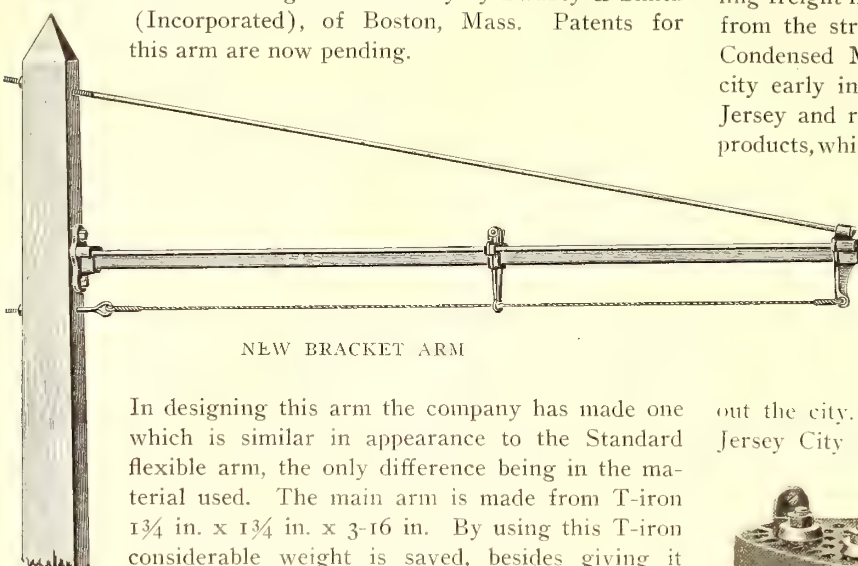
OPEN CAR FOR THE NORTHERN TEXAS TRACTION COMPANY

The open cars are of quite an interesting type, as will be seen by the illustration. They are intended for use as trailers for the cars just received. As the speed will be too high to permit the sides to be entirely open, they are paneled to 20 ins. above the floor and heavy net guards 15 ins. wide prevent the passengers from leaning out. The curtains reach to the paneled portion and the edges extend into deep grooves in the posts so that when down the passengers are completely protected from rain. The seats have reversible backs and are 33 ins. long, leaving the aisle 21¼ ins. wide. The total seating capacity is sixty. The inside finish is cherry and white ash, with ceilings of decorated birch.

The length of the cars over the end panels is 37 ft. 4 ins.; over crown pieces, 44 ft. 4 ins.; from end panels over crown pieces, 3 ft. 6 ins.; width over sills and sill plates, 7 ft. 8 ins.; over posts at belt, 8 ft.; centers of posts, 2 ft. 6 ins.; thickness of corner posts, 3⅝ ins., and of side posts, 2¾ ins.; size of side sills, 4½ ins. x 6¾ ins., with 7 in. x ⅝ in. sill plates; end sills, 4¾ ins. x 6¾ ins. The cars are mounted on No. 27-F trucks, with 33 in. wheels.

BRACKET ARM

The new type of bracket arm shown in the accompanying illustration has been brought out recently by Swazey & Smith (Incorporated), of Boston, Mass. Patents for this arm are now pending.



NEW BRACKET ARM

In designing this arm the company has made one which is similar in appearance to the Standard flexible arm, the only difference being in the material used. The main arm is made from T-iron $1\frac{3}{4}$ in. x $1\frac{3}{4}$ in. x 3-16 in. By using this T-iron considerable weight is saved, besides giving it greater strength and neatness than the ordinary arm made from pipe.

OPEN CARS FOR THE CONEY ISLAND & BROOKLYN RAILROAD

The Coney Island & Brooklyn Railroad Company has lately received from the J. G. Brill Company, fifty thirteen-bench open cars of the type illustrated in the accompanying cut. The cars measure 37 ft. $6\frac{7}{8}$ ins. over the crown pieces and are 6 ft. 10 ins. wide over sills and sill plates. The width over the posts at belt is 7 ft. $7\frac{1}{2}$ ins.; from center of corner posts over crown pieces, 4 ft. $5\frac{1}{4}$ ins.; centers of side posts, 2 ft. 8 ins., and distance between centers of corners of posts and side posts, 3 ft. 5 ins. The side sills are $4\frac{3}{4}$ ins. x 7 ins., with 7 in. x $\frac{3}{4}$ in. sill plates on the outside. The crown pieces are $2\frac{3}{4}$ ins. x 11 ins.; thickness of corner posts, $3\frac{5}{8}$ in., and side posts, $2\frac{3}{4}$ ins. The truss rods are brought up over the body bolsters and extend the entire length of the car along the inside of the side sills, being anchored outside the crown pieces. The running boards are 19 ins. from the rail and from running boards to car floor is 17 ins.

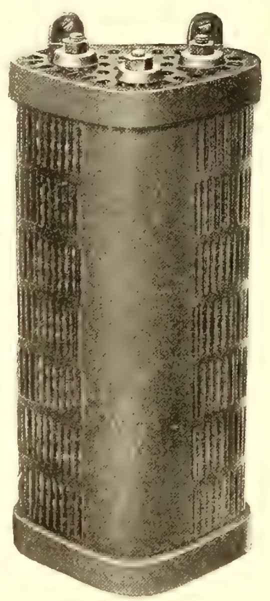
The cars are finished in cherry and ash. The curtains may be drawn to the floor, as seats are provided with Brill round-corner seat end panels. Pockets are provided for the bulkhead sashes. Among other specialties of the builder's make with which the cars are equipped are angle-iron bumpers, ratchet brake handles, radial draw-bars, folding gates, "Dedenda" gongs and signal bells. Ash entrance guards extend the entire length of the car in one piece. The cars are mounted on "Eureka" maximum traction trucks, with 4-ft. wheel base, 33-in. driving wheels, 20-in. pony wheels and $3\frac{3}{4}$-in. axles. The motors are 35-hp each.

The J. G. Brill Company recently has furnished twenty-five fourteen-bench open cars mounted on "Eureka" maximum traction trucks to the Union Railway Company, of New York City, which is controlled by the New York City Railway Company. The Union Railway Company operates principally through the rapidly growing Borough of the Bronx, New York, and Westchester County, its lines extending to the Long Island Sound on one side and the Hudson River on the other.

TROLLEY FREIGHT IN BROOKLYN

The plan of the Brooklyn Rapid Transit Company for handling freight includes a contract that will almost entirely remove from the streets the large double-team trucks of the Borden Condensed Milk Company, which now thunder through the city early in the evening on their way to the milk depot in Jersey and return in the early morning hours with the dairy products, which are then loaded on single-horse wagons and distributed to householders. Hereafter the cars which bring the milk into Jersey City will be floated by the Bush Terminal Company to South Seventh Street, Brooklyn, where the cans will be transferred to the cars of the Brooklyn Rapid Transit Company and transported by the latter to the several distributing stations of the Borden Company throughout the city. At present, the wagons in making the trip to Jersey City have to cross the Brooklyn Bridge or the East River Ferries, drive across New York City and then across by ferry to New Jersey. The economy of the new move is thus readily apparent.

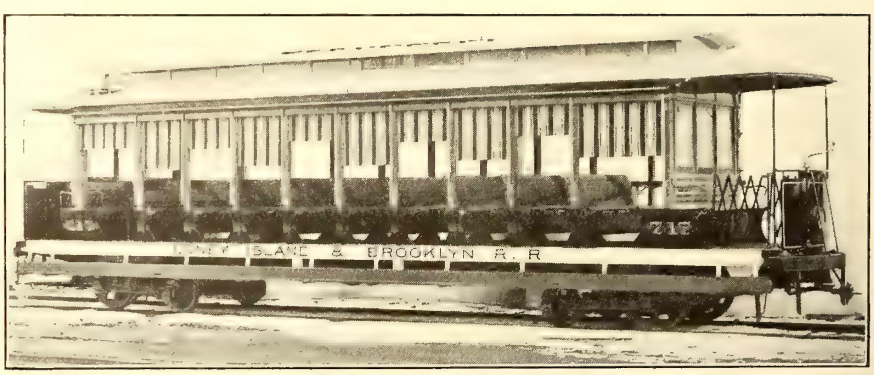
CAB HEATER FOR NEW YORK SUBWAY CARS



ELECTRIC CAB HEATER USED IN NEW YORK SUBWAY CARS

The accompanying illustration shows the heater designed by the Consolidated Car-Heating Company for motormen's cabs in the cars of the Interborough Rapid Transit Company, of New York. This heater is placed in a vertical position close to the controller. It has three coils, with all of the lead wires coming out of the heater case at one end. The heater case is of heavy steel, perforated, except in front, as shown in the cut. These cab heaters are wired in series with the car heaters and arranged for three intensities of heat.

The Consolidated Car-Heating Company is now filling an order from the Brooklyn Heights Railroad for 165 heater equipments for elevated cars; 610 heaters (450 being of special size of panel type) for motormen's cabs and 149 switchboards, and for the International Railway, of Buffalo, for heater equipments for thirty-five interurban cars. The compact construction of the heater makes it very suitable for cab service.



OPEN CAR FOR CONEY ISLAND & BROOKLYN RAILROAD

FINANCIAL INTELLIGENCE

Wall Street, April 20, 1904.

The Money Market

A further accumulation of bank reserves is the principal development to be noted in the week's money market. Last Saturday's bank statement showed an increase in surplus of over $4,000,000, due entirely to an addition of over $7,000,000 to specie and legal tender holdings. The enlargement of cash resources has come about through the same causes which have been observed for the last several weeks. On the one hand the banks are gaining both in their routine transactions with the Treasury, and with their interior correspondents; on the other hand, they continue to receive large consignments of gold from Japan, which are transferred via San Francisco. This latter movement is to be accounted for partly by the large purchases of war supplies which Japan is making in this country and partly by the transfer of deposits by capitalists in the Orient, who evidently prefer to have their funds in a safer market. It is a question, however, whether this migratory capital can be considered as more than a temporary addition to our bank reserves. In the present state of the exchanges the result is likely to be a much larger exportation of gold to Europe than would otherwise have occurred. Sterling has now risen considerably above the price at which the first exports were arranged a fortnight ago. At this writing, although no definite engagements have been made, it is expected that more announcements will be heard of before the end of the week. The Bank of England has reduced its rate of discount, and the price of gold has fallen in London. Notwithstanding these changes, however, the situation continues to be wholly favorable to further large transfers of gold to France in the immediate future. Our market, of course, can afford to view these probabilities complacently. However heavy gold shipments may be, they will not bear very severely upon our surplus supply. It is even doubtful whether they will lead to any appreciable hardening of money rates. It is well to anticipate, none the less, a considerable reduction in local bank reserves during the next month or six weeks. It is also well to look forward to a further increase in the loan account, as the natural consequence of the recent railway borrowing. Call money on the Stock Exchange is abundant at 1½ per cent and under. For time loans rates are unchanged at 2½ per cent for sixty days, 3 per cent for three months, and 3½ to 3¾ per cent for six months.

The Stock Market

This week's market has had none of the exciting incidents which abounded in its predecessors. Generally, it has been a dull professional trading, with the tendency of prices downward. The decline has occurred more through the market's own inertia than for any other cause. Yet various outside reasons appear which have played their part in the downward movement. More has been heard of the Harriman intervention suit before the St. Paul court than anything else. But it now seems probable that this matter has been overrated as an immediate speculative influence. Decision was rendered yesterday against the Harriman petition to prevent the dissolution of the Northern Securities Company, on the terms proposed last month by the Hill-Morgan party. It was announced at once, however, that the suit would be renewed, probably in the New Jersey court; consequently, the whole affair seems likely to remain in statu quo for an indefinite time. Whatever else may be in doubt, it is clear that the controversy over the disposition of rival interests in the Western railroad territory is not going to lead to any immediate results which the stock market need seriously dread. The most effective reason against a sustained bull campaign in stock lies now, as it has all along, in the indifference of investment capital toward ordinary market ventures. The demand is active enough for the high-grade investments or for high-class securities promising a large return. But toward the great mass of what may be termed speculative issues, the public temper is still as cautious as it has been at any time during the last eighteen months. Speculators for a rise have found that after a certain point their operations arouse no response. This seems to be the real explanation for the termination of the recent advance, and for the reaction which has ensued during the last two weeks. Uncertainty over the approaching presidential nominations, and over the outlook which is at present unsatisfactory for the wheat crop, are minor causes working toward the same end. On the other hand, there are no strong incentives for holders of stock to sell. What with easy money and better business prospects, the situation at bottom is undoubtedly sounder than it was six months ago. A dull market fluctuating within comparatively narrow limits is what most good judges now foresee.

A sharp break in Metropolitan Street Railway stock was one of the episodes of yesterday's dealings. The price was driven down nearly seven points from the high level of two weeks ago. In the absence of any explanation bearing upon the value of the property itself, the decline is attributed to sudden liquidation of some large holdings, based entirely on purely personal grounds. The rest of the traction group suffered sympathetically. Brooklyn Rapid Transit, in which there has been recently some very lively speculation, reflected the hurried overthrow of a number of weak accounts. Manhattan dropped less than the rest, no doubt because it had shared to a less extent than the others in previous operations for the rise.

Philadelphia

No very important changes have occurred among the Philadelphia stocks during the week. Such fractional variations as there have been, have been about equally divided between advances and declines. Phildelphia Electric, which a week ago went as high as 6 3-16, fell to 5½. Philadelphia Company common sold down from 38¾ to 38⅛, and rallied to 38⅜. On the other hand, Union Traction rose from 49½ to 49¾. Philadelphia Traction, after dipping to 95⅝, returned to 96. American Railways gained a fraction to 44. Dealings in all these stocks were only moderately active. The heaviness of Philadelphia Company issues was explained by the quarterly report of the company made public yesterday. Although gross earnings were $175,000 larger than in the period a year ago, working expenses increased sufficiently to leave a decrease of $26,000 in net earnings. On top of this a heavy cut was announced in other income, and a considerable addition to fixed charges, in consequence of which this year's surplus reached the paltry sum of $1,067, against $1,421,000 in the first three months of 1903. Other sales for the week comprised 100 Philadelphia Rapid Transit at 13¾, 200 Rochester Passenger at 96¾, and 58 shares of Thirteenth & Fifteenth Streets Passenger at 299 to 298.

Chicago

Now that the first excitement has subsided over the vote in favor of municipal ownership, the financial community in Chicago is disposed to regard it as a good thing for the values of street railway shares. In the case of Union Traction more particularly, the shares selling as low as they are, it is felt that if the city were to purchase the terms could hardly be below, and might very possibly be above prevailing quotations. On this comforting theory, the Union Traction stocks have advanced this week, the common selling in New York as high as 6¼ against 5⅝ a week ago, while the preferred rose in the Chicago dealings from 30½ to 30¾. The improvement has not extended, however, to the securities of the affiliated properties. Heavy selling, on the contrary, has been resumed in West Chicago, a thousand shares changing hands at declining prices between 42 and 41. In the elevated group, Metropolitan preferred has again been the feature, rising from 46 to 47½ and quickly relapsing to 46. Odd lots of Metropolitan common sold at 15¼ and 15. One hundred South Side sold at 91¾, and later a fractional lot at 91½. Lake Street Elevated receipts were heavy, declining from 3¾ to 3½.

Other Traction Securities

On the Boston Exchange Massachusettts Electric common showed the effect of some rather large speculative realizing, the stock declining from 21⅛ to 19½. The preferred fell a half-point in sympathy from 75 to 74½. On the other hand, Boston Elevated maintained its recent advance, selling at 140 and 140¼, while the West End shares were exceptionally strong, the common going up from 92 to 93, and the preferred from 111½ to 112¼. Some further liquidation appeared in the United Railways issues on the Baltimore Exchange, and all of them sold at the lowest prices since the day when business was resumed after the fire. The income bonds dropped from 52¾ to 51, and the general mortgage 4s from 90¼ to 89¾. The stock, after touching 7⅛ rallied to 7½. Other sales for the week comprised City & Suburban (Washington) 5s at 98, Anacostia & Potomacc 5s at 96, Lexington Street

Railway 5s at 99 and 99¼, City & Subruban (Baltimore) 5s at 113⅞ and Charleston Consolidated 5s at 84.

Cincinnati Traction resumed its old-time activity at Cincinnati last week. It opened at 136½ and advanced to 139 on sales of nearly 1000 shares. Miami & Erie Canal weakened, about 200 shares changing hands at 1½, with more offered at that figure. Detroit United lost a point, closing at 64 for a few small sales. Cincinnati, Newport & Covington was comparatively inactive, a small lot of the preferred sold at the old price, 85½, and a small lot of the common at 30½. The first consolidated 5s of this company sold at 109½ for $50,000 worth, and the second 5s at 106½ for $6,000 worth, Cincinnati, Dayton & Toledo 5s sold at the old figure 81½.

At Cleveland, Cleveland Electric held at 75 and then declined to 74½, with bidders indifferent at this figure. A small lot of Northern Texas Traction sold at 35, and sellers are asking 37 for more, the stock being in good demand. Miami & Erie Canal stockholders seemed panic stricken, and the stock sold down to 75 cents for small lots. Northern Ohio Traction & Light sold down as low as 13½, due to an assessment of $36,000 imposed upon the company by the City Council of Akron.

Sales of traction issues on the New York curb were very few during the week. Interborough Rapid Transit was the active stock, about 800 shares selling on a declining scale, from 109½ to 107¼. Washington Electric 4s sold at 75, Nassau Electric 4s between 78½ and 79¼ and New Orleans 4½s at 76.

Security Quotation

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid April 12	Closing Bid April 19
American Railways	43	44
Aurora, Elgin & Chicago	—	a15
Boston Elevated	140	140
Brooklyn Rapid Transit	46⅝	44¾
Chicago City	160	a162½
Chicago Union Traction (common)	5½	5¾
Chicago Union Traction (preferred)	30½	30¼
Cleveland Electric	74⅞	73½
Consolidated Traction of New Jersey	63	64
Consolidated Traction of New Jersey 5s	105	105¾
Detroit United	64	62
Interborough Rapid Transit	108	107½
Lake Shore Electric (preferred)	—	a40
Lake Street Elevated	3½	3
Manhattan Railway	142¾	141¾
Massachusetts Electric Cos. (common)	20¼	19
Massachusetts Electric Cos. (preferred)	75	74¼
Metropolitan Elevated, Chicago (common)	15	15
Metropolitan Elevated, Chicago (preferred)	45	46½
Metropolitan Street	115½	111¼
Metropolitan Securities	80	77¼
New Orleans Railways (common)	9½	9½
New Orleans Railways (preferred)	28	28½
New Orleans Railways 4½s	74	75
North American	85	81
Northern Ohio Traction & Light	13	13
Philadelphia Company (common)	38⅝	38⅜
Philadelphia Rapid Transit	13¾	13⅜
Philadelphia Traction	95¾	95¾
St. Louis (common)	11½	11¾
South Side Elevated (Chicago)	91½	91
Third Avenue	120½	120
Twin City, Minneapolis (common)	93¼	91
Union Traction (Philadelphia)	49½	49⅝
United Railways, St. Louis (preferred)	53	53
West End (common)	92	92
West End (preferred)	111½	111

a Asked. * Ex-dividend.

Iron and Steel

A further remarkable recovery in pig iron production has been reported for last month. On April 1, according to the compilation of the "Iron Age," the weekly blast furnace capacity had risen to 337,257 tons, as against 308,751 tons on March 1. This brings production back to about the normal overage of a year ago. Notwithstanding this very rapid enlargement, the stocks of pig iron have gone on decreasing, so that they amounted altogether to 455,673 tons on April 1, as compared with 597,904 tons on January 1. The inference is, of course, that great as are the forward strides which the iron output has taken, the increase of consumption has been even faster—a fact which is especially striking, because of the very slight expansion of exports. The improving position of the whole iron and steel trade could not be more strongly confirmed than by these figures. Quotations are as follows: Bessemer pig iron $13.85, Bessemer steel $23, steel rails $28.

Metals

Quotations for the leading metals are as follows: Copper 13⅜ cents, tin 28 cents, lead 4⅝ cents, and spelter 5¼ cents.

ANNUAL REPORT OF THE LIVERPOOL TRAMWAYS

The annual report of the Liverpool Corporation Tramways for the year ending Dec. 31, 1903, was presented March 24 to the tramways committee by General Manager C. R. Bellamy. The report shows: Capital expenditure, £1,863,485; total receipts, £531,483; operating expenses, £341,463; interest and sinking fund, £107,014. The balance, £96,242, was divided as follows: Reserve, renewals and depreciation, £64,161; transferred to general rate account, £32,080. The report refers to the increase in speed of cars which was secured by application to the board of trade, and which now amounts to 14 miles per hour for 10 per cent of the length of line, 12 miles per hour for 54 per cent, 10 miles per hour for 26 per cent and 8 miles per hour for 10 per cent. The experimental top covered car which was introduced in September, 1902, has proved very satisfactory and 150 cars of this type have been ordered. The sides can be removed in summer. Experiments are also being conducted with steel-tired wheels, but the results so far obtained do not warrant their general adoption at present. The net cost of the chilled-iron wheels now in use is 20s. each, and they had an average life during 1903 of 33,500 miles. The wheel guard, which is used in place of a fender, and which has been illustrated in these columns, has proved very satisfactory. Of the 111 persons who were knocked down and caught under the platform during the year, only thirty required medical attendance and only three were killed. Some interesting diagrams of traffic, seating capacity, etc., are contained in the report, as well as a large map of the system. The management during the year has published an official handbook of sixty-eight pages, which is sold for one penny. It contains two or three maps showing the routes of the cars and principal places of interest in the center of the city, and also reading matter giving particulars of different routes, hints to travelers, etc.

PROGRESS IN PREPARATION OF INTERCHANGEABLE FARE COUPON BOOK FOR OHIO INTERURBANS

The transportation committee of the Ohio Interurban Railway Association, composed of F. W. Coen, of Cleveland, J. H. Merrill, of Lima, and J. A. Adams, of Fostoria, met at Fostoria last week and perfected a plan under which the interchangeable coupon book already adopted by a number of roads, is to be handled. The original plan provided that the books be issued by the association, but it was found that the association was not authorized under its charter to sell transportation and become responsible for same, so it was decided that each road should issue its own interchangeable book and that the contract be made between the purchaser and the individual road from whom he purchased the book; but for the sake of convenience and uniformity, the secretary of the association will purchase the books in bulk, the name of the road issuing the book to be left blank. A road desiring a supply of books will make requisition on the secretary for a certain number of books and the numbers on these books will be charged to the company. The company will then have its name printed on the face of the book and on the coupons. It was decided that it would not be necessary to establish a clearing house to balance accounts. At the end of each month each auditor will make a draft against each company whose coupons have been collected during the month, the basis being the face value of the coupons less 16½ per cent, which is the discount given in the sale of the book. In the contracts signed by the companies it will be agreed that these settlements be made in cash upon receipt of draft. The question has arisen as to what would be the status of such an agreement and the money due another company, in case a certain company became financially embarrassed or went into the hands of a receiver. Legal talent retained by the transportation committee has expressed the opinion that such a claim would be a first lien upon an embarrassed road and would even come ahead of labor claims. It is stated that a claim of this kind would not be regarded as a debt, but would be considered as money belonging to the claimant and held in trust by the company selling transportation.

Secretary Merrill states that the roads throughout the Central West are evincing decided interest in the interchangeable coupon book plan, and he feels satisfied that at the Cleveland meeting a number of additional roads will become parties to the agreement.

THE DEMANDS OF THE UNION AT SAN FRANCISCO

At this time there is no telling what the outcome will be of the demands of the employees of the United Railroads of San Francisco for a new working agreement with the company to date from May 1. The men presented their ultimatum early in the present month, and since then negotiations have several times been discontinued with an abruptness that seemed to preclude all possibility of a resumption of the conferences with any hope whatever of a peaceable adjustment. The feeling with which the company comes to this conference may readily be judged when it is remembered that only a year ago it was in the throes of just such a state of suspension, and that now the union, more arrogant than ever before, proposes an agreement with conditions that almost to a unit are impossible of adoption.

The demands of the union are in ten sections, and will be given here only in abstract. The first and second propose arbitration in regard to grievances or complaints. The third does away with the wage schedule recently fixed by Messrs. Mahon and Straus, and also relates to badges, suspensions and uniforms. The fourth, fifth, sixth, seventh and ninth propose different runs, time-tables, hours and wages from those fixed by the awards referred to. The eighth makes it obligatory upon all employees eligible to the union to join the organization within sixty days, and also makes it obligatory upon the company to discharge all non-union men who are eligible to the union. The tenth provides that no employee of the company shall suffer a reduction in his wages because of or through the operation of this proposed conditional agreement.

Of special interest are the demands for increased wages and for the complete unionization of the system. The increase in wages asked is for an advance of from 1 to 2½ cents an hour for platform men not included in the terms of arbitration of last year. Last year thirty-seven days were consumed in taking testimony in the arbitration of wages and three days were spent in argument in New York. On Nov. 3 a decision was rendered in favor of the men, although it was shown that the wages then being paid in San Francisco were from 10 to 15 per cent higher than those paid elsewhere, except in a few small towns in the mining district of Montana.

The company has replied to the demands cautiously, and while rejecting practically all of them, has made an alternate proposition. The company is willing to leave to the arbitration at present provided the interpretation of any clause of the contract to be entered into, but refuses to treat with complaints that involve the abdication of the management. Of course, the clause to compel membership in the union of all men in the company's employ is flatly rejected. Clause ten is agreed to, but clauses four, five, six, seven and nine, all relating to wages, hours, runs, etc., are rejected. The agreement proposed by the company follows:

This agreement, made and entered into this —— day of ———, one thousand nine hundred and four (1904), by and between the United Railroads of San Francisco, a corporation duly organized and existing under the laws of the State of California, hereinafter designated "the company," and the Carmen's Union of San Francisco, known as the Amalgamated Association of Street and Electric Railway Employees of America, Division No. 205, and hereinafter designated "the union."

Witnesseth, That the agreement heretofore entered into between "the company" and "the union," and which by its terms is to continue in force until the first (1st) day of May, 1904, is hereby expressly renewed and agreed to by the parties thereto, and said agreement and all the terms thereof are hereby expressly continued in force until the first (1st) day of May, nineteen hundred and five (1905), with the following exceptions, additions and changes, namely:

1. Platform men shall receive the following wages:

(a) For the first year, twenty-five cents (25c.) per hour; overtime, thirty cents (30c.) per hour.

(b) For the second year, twenty-six and a quarter cents (26¼c.) per hour; overtime, thirty-one and a half cents (31½c.) per hour.

(c) For the third year, and thereafter, twenty-seven and one-half cents (27½c.) per hour; overtime, thirty-three cents (33c.) per hour.

2. All members of "the union" other than platform men shall receive the wages awarded by the recent board of arbitration, readjusted as to length of service, in the manner above set forth in respect to platform men.

3. Nothing in this agreement shall be so construed as to lower any rate of wages now being paid by "the company" to any member or members of "the union."

4. Section twenty-eight (28) of the agreement above referred to and continued in force by this agreement is hereby stricken out of said agreement, and shall no longer continue a part thereof. Said section twenty-eight (28) relates to interest on deposits made by car men, which deposits are no longer required by "the company."

5. This agreement shall continue in effect until May first (1st) one thousand nine hundred and five (1905), and the wage rate herein agreed upon shall be deemed to be in effect as of May first (1st) one thousand nine hundred and four (1904).

The reply of the union to the propositions of the company was a flat refusal to consider the overtures. Several conferences have been held since then, but they all ended without results. The company says that its position is clearly set forth in its reply and proposition to the men. The union seems to be determined to hold out for its demands. There the matter now stands.

One feature of the negotiations that has attracted especial attention is the refusal of the regular employees, pending the signing of a new agreement, to instruct new men in performing their duties. The ridiculous contention is made by the employees that an unusually large number of new men are being broken in for the sole purpose of utilizing them in case a strike is declared.

ARRANGEMENTS FOR THE ST. LOUIS CONVENTION

The secretary of the American Street Railway Association is mailing this week to the members of the association three pamphlets which will be of great convenience to all who expect to attend the convention this year at St. Louis. One gives a list, description and rates of the different hotels, boarding-houses and rooming houses in St. Louis during the convention period; the second is a circular relating to the "Inside Inn," which has 2257 rooms, while the third gives various facts about the Louisiana Purchase Exposition and a map of the grounds. In addition, there is a copy of a report of the Electric Railway Test Commission, signed by J. G. White, chairman, describing the tests proposed, and a circular issued by the association on the convention. The latter is reprinted below.

ANNOUNCEMENT

Dear Sir: The twenty-third annual convention of the American Street Railway Association will be held in Recital Hall, Festival Hall Building, World's Fair Grounds, St. Louis, Mo., Wednesday and Thursday, Oct. 12 and 13, 1904. One session each day, 10 a. m. to 1 p. m. The Mechanical and Accountants' associations will meet the same week at the same place, so all members will have an opportunity of attending all the conventions and visit the exposition at the same time. No exhibits will be displayed by this association this year. The headquarters of the association will be at the Southern Hotel. A limited number of rooms will be reserved for us at the downtown hotels, if applied for before June 1, 1904. The rates are as follows:

Southern Hotel, $10 to $15 per day per room with bath, American plan.

Planter's Hotel, $10 per day per room with bath, European plan.

Jefferson Hotel, $10 to $15 per day per room with bath, European plan.

St. Nicholas Hotel, $7 to $10 per day per room with bath, European plan.

Lindell Hotel, $5 per day per room with bath, European plan.

Rooms can be occupied by three persons if desired at same price, the charge being for the room whether occupied by one, two or three persons. It must be understood to reserve rooms in these hotels, that they must be paid for from Oct. 8 to end of the convention, two days in advance of convention week, and whatever revenue is received by the hotels for these rooms during the 8th and 9th will be rebated to you. Make your reservation early in order to secure suitable rooms. Enclosed please find pamphlets regarding hotels in St. Louis, one of which is issued by the exposition authorities and gives the location and prices of all hotels, boarding and lodging houses in St. Louis.

Wednesday, Oct. 12, has been set apart as "Street Railway Day," and special attractions of some kind will be furnished by the exposition authorities. The banquet will be held Thursday evening, Oct. 13.

The following resolution was unanimously passed by the executive committee:

Whereas, The experience of the association has demonstrated that the custom of issuing gratuitously to each company two banquet tickets has proven unsatisfactory at former conventions,

Resolved, That hereafter all banquet tickets be sold to delegates and others at actual cost

Papers will be presented that will interest all members.

The following resolution was directed to be sent to all members, viz.:

The secretary is directed to request the chief officers of the different companies to notify delegates and heads of departments attending the convention for the companies they represent that they will be expected to attend each session and take part in the discussion; that hereafter at each session of the convention the roll of delegates will be called at the time meeting is called to order, and that the roll call will be published in the minutes of the meeting.

Make a special effort to be present at this convention, as you will have an opportunity to attend the sessions of the association and also visit the greatest exposition the world has ever seen. Reduced rates will be given by all railroads during the exposition.

THE COUNCIL BLUFFS, TABOR & SOUTHERN RAILWAY

President Dobbs, of the Council Bluffs, Tabor & Southern Electric Railway, is preparing a detailed statement of the cost of construction and equipment and an estimate of the earning power of the proposed road from Council Bluffs, Ia., to Rockport, Mo. As soon as these figures are prepared it is the intention to go East and close up the bond negotiations, preliminary arrangements for which have already been made. It is the hope of the officials to have the line completed from Council Bluffs to Tabor, Ia., next fall. The construction work will commence at Council Bluffs and will extend southward. The central power house will be erected at Tabor. The preliminary plans for this building and plant, if carried out, will mean the expenditure of $250,000. Brick sub-stations will be erected at the School for the Deaf, southeast of Council Bluffs, at Glenwood, Sidney, at some point between Riverton and Rockport and at Rockport. The line potential will be 30,000 volts. At the sub-stations the voltage will be stepped down to 3000, and then converted and fed to the line at 600 volts. Depots are to be constructed at Council Bluffs, Manawa, Island Park, Henton's Station, Pacific City, Glenwood, Hillsdale, Tabor, Sidney and Riverton, in Iowa, and Rockport and Langdon, in Missouri. A branch line will be constructed later from Rockport to Tarkio. The contracts will call for 130 miles of trackage, of which 88 miles will constitute the main line. The balance will be made up of branch lines and side tracks. Seventy-pound rails will be laid and 2640 ties used to the mile. At least 1,800,000 cubic yards of dirt will have to be moved to reduce the grades to the maximum of 1 per cent. On one stretch from Hillsdale to Glenwood, a distance of 4½ miles, the maximum grade will be 1½ per cent. On some parts of the road there will be cuts 37 ft. deep and fills 20 ft. and 25 ft. high.

The most expensive part of the construction work will be the erection of the steel overhead crossing by which the line will enter Council Bluffs over the Rock Island & Milwaukee tracks. The crossing will be fully 360 ft. long and 30 ft. high. It is planned for the fast mail trains to consist of three cars and the local passenger trains of two cars. Motor cars and two electric locomotives will be used to haul these trains.

UNITED ENGINEERING BUILDNG

The conference committee on the United Engineering Building has selected Professor W. R. Ware to act as its professional adviser in the matter of the architectural competition. His preliminary report on the subject is to be made to the committee during the present week. Four equal prizes will be awarded to the best four designs.

LESSONS FROM THE INDIANA FLOOD

The recent floods in Indiana have demonstrated the necessity of properly protecting interurban and city railway tracks against the flood tide. The engineers of the interurban lines operating in the White River and the Wabash River Valleys have been carefully going over the districts in which their lines were submerged and report that much has been learned from the ravages of the recent flood. Of the eight lines operating out of Indianapolis, all were more or less damaged and put out of business from two to five days. At Indianapolis, Anderson, Philadelphia and Morgantown the flood entered the power houses, put the fires out and left the systems without power.

Earth fills with small culverts to permit the water to escape are not regarded adequate, and steel trestleing will be deemed far more advisable for future construction, because it affords ample escape for the rushing torrents. What is true regarding the companies operating in the White River Valley was found to be true of the companies operating in the Wabash Valley. The lines between Fort Wayne and Logansport were submerged and more or less damage done to the companies' properties. The Union Traction Company lost a costly steel bridge between Logansport and Peru. The water rose 7 ft. above the bridge and swept the four spans into the bottom of the river, twisting the beams so that the entire structure will have to be rebuilt.

A warning has been afforded the Murdock syndicate, which is to build a line from Logansport to Lafayette along the old Wabash & Erie Canal towpath. The flood established a danger line, as the towpath route was under water nearly the entire length of the proposed line.

The interurban lines, however, did not suffer materially greater damages than the steam lines. Both systems were compelled to weight down their bridges with iron and engines and employ thousands of bags of sand to strengthen levees and fills and to keep water out of the power houses.

A DIFFICULT PIECE OF ENGINEERING IN CALIFORNIA

The Pacific Electric Railway Company, of Los Angeles, is building a branch line to Newport Beach by a coast line route quite as full of engineering difficulties as the Ogden-Lucin cut-off across the Great Salt Lake. The time over this line is to be fifty minutes for the 39 miles between Los Angeles and Newport Beach. That schedule includes stops. A speed of 100 miles an hour, it is calculated, may be maintained for considerable distances along certain sections of the road with the utmost safety to passengers. It is hoped to have this new line in operation by June 1. The portion of the line now incomplete is from Ocean Beach to Newport Beach, a distance of 15 miles. From Ocean Beach to Los Angeles the Long Beach line will be used. Leaving Ocean Beach the new line has a matchless ocean view its entire distance, with a pleasing background of rising hills and broken fields. The unique construction feature of this line is a fill of a marsh of more than 2 miles, south of Alamitos Bay, which must be crossed to maintain a coast line. Across this marsh now is a trestle, serving as a temporary roadbed for the work trains. On either side of this trestle is now being built a fill of dirt, stones and gravel. Three dirt trains, each with a capacity of 850 yards daily, are now busy filling in a permanent roadbed along the trestle. The track is to be standard gage, laid with 60-lb. rails. The poles used are 45 ft. in height, set 9 ft. in the ground and fifty poles to the mile.

PUBLIC SERVICE EMPLOYEES GAMES

During the last few weeks the employees of the street railway department of the Public Service Corporation, of New Jersey, have been engaged in a pool tournament at their clubrooms in Montclair and Paterson to decide for club teams to meet in contest for a handsome silver cup offered by President McCarter, of the company. On Monday evening, April 11, the competing teams met at the Paterson clubrooms, and, after a hotly contested game, the Montclair men won by a score of 137 to 128. General Superintendent Stanley, of the company, was referee. District Superintendent T. W. McAndrews made the presentation speech when the cup was delivered into the keeping of the winning team. The Montclair representatives were taken to Paterson in a special car, and were entertained by the Patersonians with music and refreshments. The members of the winning team were: J. L. Barde, J. H. St. Clair, J. J. Sanders, G. M. Gould, all of whom are conductors, and F. H. Merkle, who is a motorman. The cup is to be contested for every six months.

ANNUAL REPORT OF THE LODZ, POLAND, ELECTRIC RAILWAY

The Lodzer Elektrischen Strassenbahn has published recently its report for 1903, containing some interesting data which may be taken as indicative of electric street railway development in Russian Poland. Lodz is about 75 miles distant from Poland's ancient capital, Warsaw, and is an important linen and woolen center. The electric railway has been in service about four years. Its traffic has increased quite rapidly, this increase amounting to nearly 10 per cent in 1903.

The aggregate length of the line is 9 miles, of which one-third is single track. Overhead construction is used throughout the city. The rolling stock comprises ten double-truck cars, each seating thirty passengers, and forty-two trailers, each seating twenty passengers. Each motor car carries two 25-hp motors. The power house contains three Lancashire boilers, two Worthington pumps and three 340-kw, 550-volt steam-electric sets.

The gross earnings for 1903 were approximately $296,250, and the net earnings, including balance carried over from 1902, $132,218.

MORE ELECTRIC TRACTION FOR BUENOS AIRES

The Buenos Aires Grand National Tramways Company, Limited, a British capitalized concern, whose head offices are at 6 Eastcheap, London, E. C., and whose consulting engineers are Sir George Bruce & White, London, is about to convert its extensive horse car system in the Argentine Republic capital into electric traction. The company operates about 50 miles of line. The estimated cost of conversion is put at $4,000,000 gold. The managing director—C. Dawney—resides at Buenos Aires, as does J. H. Wale, the general manager.

NEW YORK MEN VOTE AGAINST PENSION PLAN

The employees of the Interborough Rapid Transit Company have all voted against a pension plan proposed by the company some time ago. The first organization to vote was the Relief Association of the employees, which is not a labor union, and which voted against it. The motormen, who are still a local of the Brotherhood of Locomotive Engineers, also voted against the plan, and the remainder of the employees on the elevated roads who are organized as Local 332 of the Amalgamated Association of Street Railway Employees, afterward met and voted against it. The principal objection to the plan was that the employees themselves paid all the money into the fund from which the pensions and benefits were to be drawn. The plan was a graded one, based on monthly dues ranging from 50 cents to $2.50. The death benefits ranged from $100 to $1,000, and the sick or accident benefits ranged from $4 a week to $1 a day. The employees said that in case of their discharge or resignation they would have lost the money they had put into the fund.

SNOW PLOWS DO SERVICE IN WESTERN NEW YORK

A heavy snowstorm swept Western and Northern New York April 15. In North Tonawanda the snow was 14 inches deep. Up to midnight 5 inches of snow had fallen in Buffalo, and street car lines were kept in operation by the constant use of snow plows. In Syracuse the snow was 3 inches deep, and Oswego County reported good sleighing. Street railway travel there was maintained under difficulty. Rochester reported several inches of snow. At 11 o'clock April 15, the Rochester Railway Company there had fourteen snow plows out in order to keep traffic open. Railroad trains ran about an hour behind time.

STILWELL-BIERCE & SMITH-VAILE COMPANY

The Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, has taken a lease of the commodious ground floor and basement premises at 93 Liberty Street, now being vacated by Stanley & Patterson, and will take possession next week.

An extensive stock of pumping machinery—power, steam and marine—will be carried, also Victor turbines, air compressors, feed-water heaters and other specialties of the company. A full line of spare parts will also be on hand. Each department will be under separate supervision. The local sales organization of the company will be considerably enlarged. Six new men will be engaged immediately and machinists will be on the spot so as to erect and overhaul machinery.

The present New York offices in the Washington Life Building will be moved to 93 Liberty Street. The management of the local end of the company's business will be as heretofore in charge of G. W. Neff, the Eastern manager.

FOR THE EXTENSION OF THE SANDUSKY SOUTHWESTERN RAILWAY

F. O. Olsen, vice-president and general manager of the Sandusky Southwestern Railway Company, of Lima, Ohio, announces that he has completed a deal with the United States Investors' Security Company, of Wall Street, New York, for an issue of $1,500,000 first mortgage twenty-year gold bonds which are to be subscribed by English capitalists. It is stated that the first payment in the sum of $150,000 will be made through the Cleveland Trust Company, as trustee, on July 15 of this year. It is claimed that this transaction insures the building of the section of the road between Lima and Bellefontaine, with another line crossing the same and extending from Wapakoneta to Kenton. It is stated that the contract provides that 40 miles of the road shall be completed by December, 1904, and that work shall be pushed immediately. It is claimed that 24 miles of roadbed have already been graded. The officers of the company are: John VanFleet, president; F. O. Olson, vice-president; G. A. Smith, treasurer; L. N. Means, secretary. The headquarters of the company are in Lima.

The Birmingham Railway, Light & Power Company has inaugurated a package delivery system in several of the suburbs. For 10 cents packages weighing twenty-five pounds or less are delivered to East Lake, Woodlawn, Avondale, East Birmingham, Kingston or North Birmingham.

SPECIAL POLICEMEN ON THE ELEVATED IN NEW YORK

Special policemen have been placed at a number of the most important stations on the Third and Sixth Avenue Elevated lines of the Interborough Rapid Transit Company, of New York. The special officers wear uniforms that may be easily distinguished from the familiar police blue. The company hires the men, though as a matter of form each must report once a month at Police Headquarters. The introduction of the three-platoon system lessened by nearly one-third the number of policemen on active duty at one time, and the recent death of a woman caused by being dragged along the Sixth Avenue elevated structure by a train, made it imperative that police should be assigned to duty at congested elevated traffic points.

TROLLEY AND STEAM STATISTICS COMPARED

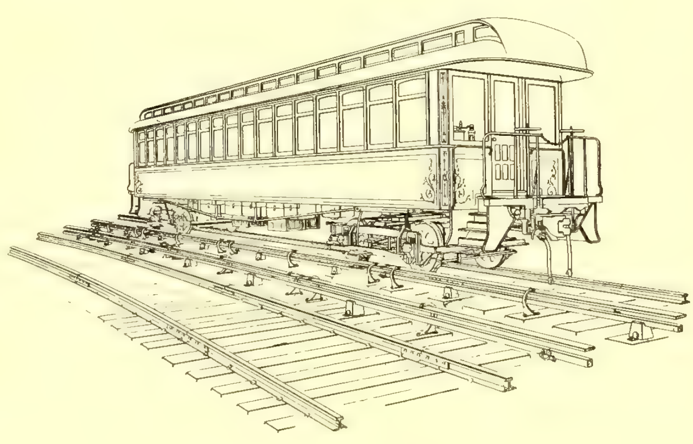
The statistics of street railways are compared by the "Wall Street Journal" with the statistics of the steam roads in the United States for the same year. Already the mileage of the electric street railways amounts to 11 per cent of the steam mileage. The capital stock amounts to 21 per cent; the funded debt to 13 per cent; the dividends to 18, and the interest on bonds to 14 per cent. When one remembers that electric street railways are a development of a very few years, and the steam railroads of the United States are a development of three-quarters of a century, this showing seems little less than marvellous. It appears, however, that the total capitalization of stocks and bonds of the street railways amounts to $96,287 per mile, while the total stock, bonds and unfunded debt of the steam railroads amounts to $64,371 per mile. The dividends paid by the electric street railways amounted to 2.5 per cent of the total outstanding stock, while the dividends paid by the steam railroads amounted to 2.9 per cent, the comparison being for 1902. From this it would appear that the steam railroads are on a better basis as regards earning power than the street railways. The latter, however, are essentially passenger traffic lines. In 1902 they carried nine times as many passengers as all the steam railroads of the United States. These, while carrying over 655,000,000 of passengers, nevertheless obtained the bulk of their revenue from the carriage of freight.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED APRIL 12, 1904

756,820. Automatic Switch-Shifter; Leon Blower, New York, N. Y. App. filed Aug. 7, 1903. Tread-plates arranged near the track rail are operated by pressure-rolls sustained upon the car



PATENT NO. 756,980

platform and depressed to engage them, whereby the switch is actuated at the pleasure of the motorman.

756,859. Trolley Catcher; Montgomery H. Johnson, Utica, N. Y. App. filed July 15, 1903. Details of a cord-controlling device consisting of a spring drum and ratchet.

756,870. Electric Railway Switch; Melbourne A. Marks, Jr., Brookline, Mass. App. filed Feb. 4, 1903. Details of a switch-

throwing mechanism wherein a circuit-closer applied to the wire directs the current into solenoids that actuate the switch point.

756,980. Electric Railway; William B. Potter, Schenectady, N. Y. App. filed July 5, 1902. A metallic cover for third rails, made in insulated sections so as to localize the escape of the current into the cover.

757,006. Brake; Michael A. Wodal, Camden, N. J. App. filed Oct. 29, 1903. Details of a track-brake for emergency purposes.

757,070. Rail Bonding Construction; Edward G. Thomas, Waltham, Mass. App. filed March 19, 1903. The ends of the bond are secured to the respective rails at points extremely diagonal with respect to the joint of the rails, so that the amplitude of the expansion and contraction is lessened.

757,138. Third Rail for Electric Railways; Patrick T. McGowan, Avoca, Pa. App. filed Dec. 22, 1903. The rail has a brush-engaging side surface that inclines downward and inward.

757,195. Rod Grasping Arm or Handle; Henry H. Huff, Boston, Mass. App. filed Dec. 5, 1903. Details of a handle for operating the rod or rock-shaft used to actuate a fare-register.

757,264. Electric Railway; Davis J. Cable, Lima, Ohio. App. filed March 11, 1903. Relates to the mounting and covering of a third rail.

PERSONAL MENTION

MR. DANIEL M. BRADY, of New York, president of the Brady Brass Company, manufacturers of motor and car journal bearings, has been elected vice-president of the National Car Wheel Company.

MR. JOHN N. ACKERMAN has been appointed traffic manager of the Public Service Corporation of New Jersey. Mr. Ackerman formerly was in charge of the real estate department of the company.

MR. G. R. PIERCE, who was general manager of the Mexican Traction Company prior to the merging of that concern with the Federal District Railway Company, of Mexico City, is now on a visit to New York.

MR. F. R. PHILLIPS has been appointed master mechanic of the South Covington & Cincinnati Street Railway Company, of Covington, Ky. Mr. Phillips formerly was connected with the Cleveland Electric Railway Company.

MR. HENRY GUTZWILER, of Mansfield, Ohio, has been appointed general superintendent of the Cincinnati, Milford & Loveland Traction Company, of Cincinnati. Mr. Gutzwiler started in the business some years ago as a conductor in the employ of the Cincinnati Traction Company.

MANAGING DIRECTOR TAYLOR, of the New Zealand Electrical Construction Company, the concern which has secured the contract for the construction of the Christchurch electric traction system, is now on his way to the United States in connection with the placing of contracts for material, equipment, etc.

MR. BARNEY MAHLER, formerly president of the Lake Shore Electric Railway and the Electric Package Company, of Cleveland, has opened an office in the Electric Building, that city, where he will conduct a general brokerage and bond business, making a specialty of handling traction securities.

MM. DESPREX, BARREL and GRAND, engineering experts of the Underground Railway system of Paris, France, are now on a visit to this country for the purpose of studying American electric traction methods. They inspected the Boston subway last week, having been conducted over the system by Chief Engineer Carson.

MR. F. HUBERT CHAMBERLAIN will have charge of the construction of the Christchurch, New Zealand, municipal electric traction system, reference as to which was made in the STREET RAILWAY JOURNAL April 9. Mr. Chamberlain is an old General Electric man. Prior to his present position he acted as construction engineer of the Sydney City & Suburban Tramways, which are operated by the New South Wales Government.

MR. CHARLES HARRISON SMITH, superintendent of overhead construction of the Eastern Ohio Traction Company, of Cleveland, died last week as the result of injuries received while on a trip of inspection. He was on a regular car and was leaning out from the door looking at the overhead work, when he was struck by a telephone pole that stood close to the track. His skull was crushed, and he died in a special car that was hurrying him to Cleveland.

MR. HENRY E. HUNTINGTON, president of the Los Angeles Railway Company, Los Angeles Interurban Company and Pacific Electric Railway Company, of Los Angeles, Cal., has returned to New York and may not get back to California until fall. When he went to the Pacific Coast last September, he expected to remain about two weeks, but business prolonged his stay through seven months. During the last few months his systems have been greatly extended in Southern California.

MR. E. W. CLARK, head of the banking house of E. W. Clark & Company, of Philadelphia, Pa., is dead. Mr. Clark was seventy-seven years of age, and had been prominent in financial circles for many years. The company with which he was connected made a specialty of street railway securities, and as a result Mr. Clark became known to many street railway men. The Columbus Railway & Light Company, Scranton Railway Company and East St. Louis & Suburban Railway Company are prominent among the companies in which the Clark Company is interested.

MR. R. G. ARNOLD, secretary and treasurer of the Arnold Electric Power Station Company, of Chicago, was married on April 5 to Miss Hazel McLane, daughter of Mr. George A. McLane, of New York City. After a short trip East, Mr. and Mrs. Arnold are to return to Chicago, and for the summer will take up their residence in Lake Bluff. Mr. Arnold has for several years been connected with the Arnold Company, of which his brother Mr. Bion J. Arnold is president, and has formed a very wide acquaintance among the electrical and mechanical interests of the East and Middle West, who extend to him their hearty congratulations.

MR. WALTER T. COOK, superintendent of motive power of the St. Louis Transit Company, of St. Louis, Mo., who resigned his position some time ago to take effect April 15, was visited on the evening of April 12 by many employees of the company, who gathered at his home to express regret at his leaving the company. As a token of esteem a chest of silverware containing 152 pieces was presented to Mr. Cook by his co-workers. Mrs. Cook was not forgotten either. She received an ivory-handled silk parasol. Mr. William Mundy made the presentation speeches. Mr. Cook has under consideration two offers from Eastern companies and a local proposal, but thus far has not decided as to the future.

MR. SAMUEL ANDREWS, a very prominent citizen of Cleveland, died at Atlantic City a few days ago. Mr. Andrews was one of the founders of the street railway system in Cleveland and was the father of Mr. Horace E. Andrews, who is president of the Cleveland Electric Railway and is interested in a number of projects in New York State. Mr. Andrews was one of the pioneer oil men of the country, and in the early 60's, in company with John D. Rockefeller, organized the firm of Rockefeller & Andrews, which in 1870 was merged into the Standard Oil Company. He was prominently identified with that company for a number of years. With Joseph Stanley he organized the Broadway & Newburg Street Railway, which in 1892 was consolidated with the East Cleveland Street Railroad, forming the Cleveland Electric Railway. Mr. Joseph Stanley, who died a few years ago, was father of Mr. J. J. Stanley, the present general manager of the Cleveland system. It is interesting to note that the sons of these two pioneers are in control of the property their fathers founded.

MR. FRANK T. C. BRYDGES, master mechanic of the Chicago Union Traction Company, died of spinal meningitis at his home in Chicago, April 14, at the age of forty-four. Mr. Brydges had been in the service of the Chicago Union Traction Company and its preceding underlying West Side companies in Chicago for eighteen years. He was an architect by training, and practiced this profession in his native city, Detroit, for some time. Later he was connected with a car building company at Buffalo. He came to Chicago to practice his profession and, through work done for the Chicago West Division Railway Company, became favorably known to the management of the company. In 1886 he was put in charge of the company's shops. In 1889 he designed and built the company's car repairing plant at Fortieth Avenue, Madison and Lake Streets, which, when built, was far in advance of its time. Besides this shop, he designed a number of the company's car houses. At the time of the consolidation of the North and the West Side lines under the Chicago Union Traction Company, he was made master mechanic of the entire property. He was a most conservative man, extremely modest and unassuming, and for that reason was probably not as widely known as many others in his profession. That his worth was appreciated by the interests with which he was connected is shown by his long term of office during the various changes in the company's organization. He was a man of the strictest integrity and utmost loyalty, and one beloved by all who had close relations with him. A widow, a daughter and four sons survive him. The eldest child, a son, is twenty-one years old.

Street Railway Journal

VOL. XXIII. NEW YORK, SATURDAY, APRIL 30, 1904 No. 18

PUBLISHED EVERY SATURDAY BY THE

McGRAW PUBLISHING COMPANY

MAIN OFFICE:

NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.

BRANCH OFFICES:

Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues) .... $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) .... $6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid .... $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Heating Car Houses and Shops

The heating of large buildings, such as car houses and shops, is now generally done by what is known as indirect steam-heating. A fan blower at some central point forces the air through a bank of steam-heating coils. The hot air is then led in galvanized iron pipes to various parts of the building and discharged at outlets, the opening of which can be regulated by dampers. This system, when properly planned, gives excellent results, but certain mistakes are sometimes made in its application, which cause unkind remarks to be made about the installing engineer by the superintendent and workmen who use the shops daily. The theory that "hot air will rise anyway," and that therefore it might as well be discharged near the roof as near the floor from a heating system of this kind, looks plausible and attractive at first, but it does not work out well in practice. This is especially true after the temperature in a building has been lowered during the night and the attempt is made to warm the building quickly in the morning. The hot air discharge pipes from a heating system of this kind should be located near the floor. By near the floor we do not necessarily mean at the floor line, but they should be somewhere within 14 ft. of the floor, and if above the floor line should discharge downward. This creates a circulation and mixing of hot and cold air, which is much more satisfactory to the occupants of the building than a gradual warming of the air in the building by the discharge of hot air near the roof and the gradual withdrawal of cold air from the floor. The temptation is strong in an electric railway shop to place the hot air piping system very high and to discharge directly into the air from the main pipes, as this construction gives a clear head-room for the movement of cranes and travelers and avoids the expense of branches. Sometimes the most feasible place to locate heating pipes is below the floor level. We have in mind one well-heated shop of one story in which all the hot-air pipes and ducts are below the floor level. In this case the discharge pipes are taken up along side pillars, and are curved so as to discharge the hot air downward above the level of a man's head. In this way the headroom is left practically clear and the amount of floor space taken up is insignificant. In arranging these discharge pipes, however, care should be taken to have them high enough so as not to discharge directly upon the workmen. It is also the best practice to use a large quantity of air heated to a moderate temperature rather than a small volume at a high temperature.

The hot-air blast from such a heating system can be used with pleasant effect in the winter, when the cars are brought in for quick repairs, and motors and trucks are covered with snow and frozen mud. By letting such cars stand for a few minutes over a pit from which a hot-air blast is issuing, the snow is soon thawed off and the trucks and motors are dried at the same time.

Much Ado About Nothing

We confess to a feeling of amusement over the solemn reports in the daily papers of the speed tests of steam locomotives on the Zossen-Marienfelde line. We have heard from time to time of extraordinary engines there to be tested, and of the firm conviction of steam engineers that the supremacy of their honored client was about to be vindicated, as against the noisy pretense of upstart electric motors. Until recently there seems to have been a conspiracy of silence against the publication of reports from these epoch-making achievements, but at last the cat is out of the bag—and a very badly singed feline she proves to be. The trials of regular German express engines on the Zossen line appear to have led to nothing of particular interest, for the best speed they are reported as making even with a three-car train was less than 80 m. p. h., and with longer trains of six cars less than 70 m. p. h. This is good, comfortable speed, but nothing to awake the slightest interest when made on an experimental line in a speed trial. More recently an 85-ton special engine, using superheated steam, was put through a series of tests, and succeeded in touching 84½ m. p. h. with a three-car train and a little less than 80 with a six-car train.

Its economy is, perhaps wisely, not stated, but the fact that it consumed 22 per cent more lubricating oil than an ordinary engine does not encourage one in hoping for sensational efficiency. Another engine, weighing with its tender about 115 tons, is about to be tried, and we read with pleasure that there are great hopes of it. We cannot quite see what these trials prove, but we are glad the experimenters seem to be satisfied and are cheerful about the outlook.

Surely, even in Germany, a speed of 84½ m. p. h. on a short trial run cannot be considered extraordinary, and it is not for a moment comparable with the 130 m. p. h. made on the same line by the electric cars. For a locomotive to make the former speed no special efforts are required, and there is not the least reason for anybody to doubt so modest capabilities. We have known for a long time that a first-class steam locomotive could make much higher speed than this for short distances, even with a regular train of Pullmans. There are, if we remember correctly, no less than six American records for short runs of one to half a dozen miles at rates in excess of 100 m. p. h. There is one on the Burlington route of about 15 miles at a small fraction under 99 m. p. h. The trains between New York and Philadelphia almost daily run off miles at 80 m. p. h. to 85 m. p. h., and in 1897 the Lehigh Valley line scored a run of 44 miles between Alpine and Geneva Junction, N. Y., at a full 80 m. p. h. There is not the least doubt that locomotives are capable of short runs at these high speeds, but it is the ability to keep up the pace that locomotives lack. After a bit the fire gets out of condition, and steam and speed fall off together, or the train has to slow up a bit to scoop up water, or the fuel does not handle well, or some trifling thing goes wrong with the lubrication. The very fast runs common here are usually rather short, and are made on regular trains when a little behind time and trying to catch up with the schedule. There has been no flourish of trumpets about it, and the passengers generally have not realized the feat before the end of the trip. On a good track the difference between 60 m. p. h. and 80 m. p. h. is hardly noticeable, save to experienced railway men.

On the other hand, when it comes to the question of long runs, extremely fast running is very rare, so far as the total distance is concerned. We believe that the fastest recorded run for a distance greater than 100 miles was one made on the Atlantic Coast Line about a year ago. The distance covered was 172 miles, between Jacksonville, Fla., and Savannah, Ga., at the average speed of 70.7 m. p. h. In still longer runs the speed limit is lower, and the locomotive shows its limitations very plainly. It is a severe task to generate the power necessary for high speed and to keep steam steadily up in all kinds of weather. There are serious difficulties in the way of reliable work when the power station is on wheels, reduced as far as may be in weight, and constantly under the necessity of forcing the output to the highest possible point. It is in just these matters that the electric locomotive has a tremendous advantage. Its power station cannot only be worked at a fairly economical load but it can be kept up to its work all the time. There are enough boilers to ensure the working battery being in good condition, and there is grate surface enough to keep the fires burning at their best. On the locomotive itself there are relatively few moving parts, the motors are working at a known and definite efficiency, and if they must be overloaded a little the station has capacity enough to back them up. It will prove, therefore, much easier to secure maintained high speed with electric than with steam locomotives. The latter can, on a spurt, do better than a hundred miles an hour, but there is good reason for expecting the electric locomotive to maintain that speed for hours at a time, to say nothing of spurting at far higher speed, as was shown in the Zossen tests. What is most needed now is the actual application of high-speed electric traction on a line 500 miles or more in length, when there is space for a real saving in time. It is too late in the world's history to waste much time or effort on fruitless demonstrations of what nobody is disposed to deny.

Side Entrance Cars for Rapid Transit

The side entrance steel cars adopted for the Illinois Central Railroad's suburban service in Chicago, which are described elsewhere in this issue, cannot fail to be of great interest to all connected with elevated and underground electric railways, and any other rapid transit lines where quick loading and unloading is important, and where passengers can be delivered to platforms at the level of the car floor. Although the suburban service of the Illinois Central Railroad is at present operated with steam, it is of the same general character as rapid transit lines now so generally employing electricity, and the same principles of car construction apply.

Side entrance cars have been used in rapid transit service in other countries, but they are so different from the Illinois Central design as to belong to an entirely different class. The Illinois Central car has a side entrance opposite each section of seats; the aisle, instead of being down the middle of the car, according to the almost universal American practice, is along each side of the car; and the seats, which have a capacity of four persons, are located in the middle. That such an arrangement has advantages as regards quick loading and unloading of passengers is self-evident.

It is gratifying to learn that the experience of the Illinois Central with these cars in actual service, has not revealed certain objectionable features which were to be feared. For example, probably the first theoretical objection that would naturally be raised against this type of car would be the difficulty of heating, especially with such cold lake winds as sweep the Illinois Central's right-of-way along the lake front in Chicago. It would be thought that certainly the opening of so many side doors so close to the seated passengers at all important stations would make the cars very difficult to heat, and give rise to many objections from the passengers. Strange as it may seem, experience does not indicate that these objections exist. The cars are more easily heated than the regular center aisle cars which the company has heretofore used in this service. As to their comfort in this respect, we have taken pains to inquire among disinterested laymen who patronize these cars, and the verdict has invariably been that they are comfortably warm in winter. Of course, there is a certain inrush of air when a door is opened, but the circulation of air around the steam heating pipes under the seats is so free that this cold air is soon warmed. The explanation of the ease with which these cars are heated is undoubtedly in the free access of the air to the steam pipes. To make a side entrance car with numerous side entrances which would be at all feasible for rapid transit service, it was necessary to design an arrangement for closing all the doors simultaneously by an employee at one end of the car. As it was anticipated that this would take considerable power, compressed air apparatus for closing the doors was provided, but the actual results showed that the doors worked so easily that this was not necessary, although the feature has been retained on the new cars.

The car is practically a combination of the original American idea of an aisle car, with the original European idea of a side entrance car, and is somewhat similar to a type of car which is in quite extended use on the continent for limited trains, that is, it has side doors and a side aisle, but is longer; there are two

aisles instead of one, and the interior is not divided into compartments. The details of the Illinois Central car have been worked out with most commendable thoroughness. The control of the side doors was naturally a matter to which much attention was given, because as any experienced railroad man could see, the side doors would be practically the one danger point at which accidents to passengers would occur. To provide against any serious trouble from catching of fingers or clothing in the sliding doors, as they are closed by the employee at one end of the car, flexible connection between the door and the operating rod is employed, which will allow the door to yield sufficiently when it strikes such an obstruction, so that no damage is likely to be done. The electric signalling circuit in connection with the doors would appear to be an important time-saving feature, and one which might well be adopted on other rapid transit lines. Each door, when closed, makes an electric contact. All the door contacts on the train are in series, and the engineer's signal is in series with the contacts, so that he does not receive a signal until every door is closed.

As to carrying capacity, the car also makes an excellent showing as compared with the center-aisle type. The common objection to side entrance cars has been that passengers must find a vacant seat before they can enter the car from the platform, and will therefore delay the train by that much time. On the Illinois Central car they can enter the train at once at any side door and hunt for a seat after the train is in motion. The car is readily adaptable to service over portions of the route where there are no elevated platforms, since by raising the vestibule trap-door the ordinary steps are available. When the cars are used in this way there are no disadvantages connected with their use other than those found with the regular center-aisle car.

The Illinois Central has made a bold departure from established lines of car design for rapid transit service and deserves much credit for the progressive step it has taken. As everyone knows who has studied rapid transit schedules, the station stops take no small portion of schedule time for train terminals, and if this schedule time can be reduced by improvements in car design, it is certainly a matter of as much practical importance as loudly heralded advances in motive power and braking equipment, which permit a faster schedule.

Retribution for Chicago

The bill ordering the tunnels under the Chicago River removed as obstructions to navigation has passed Congress. This further complicates the traction situation in Chicago. Mayor Harrison opposed the bill, hoping to delay its passage until some bargain could be made with the Chicago Union Traction Company for franchise renewals and so throw the expense of lowering the tunnels on the company. As it is, the city will either have to bear the expense or close the tunnels. Chicago is paying the price of the delay of its officers in settling the traction question in more ways than one. By pursuing a procrastinating policy in regard to settling the franchise question it has subjected its citizens to an inferior street railway service, which is unworthy of the city, and which is monthly costing the people of Chicago a large amount of money in lost time. It has become hopelessly muddled in its municipal ownership proposition, and the authorities have become committed in a way to a plan in which few of them believe, and which is impossible of fulfillment. The tunnel problem is simply the latest straw added to the already heavy burden of the city authorities and citizens.

Steam Railroads as Electric Railway Managers

We have often discussed in these columns the effect of the acquisition and operation by steam railroad companies of interurban and other electric railway properties. A new phase of the matter appears in occasional complaints that such appurtenances have been found not to pay, at least in certain instances. Undoubtedly a certain proportion of electric railways are now being worked in a territory where the traffic is too light to furnish sufficient gross receipts at present. As a rule the electric roads worked by the trunk line railroads are very well constructed and equipped. They involve a very substantial investment, and are, perhaps, likely to carry larger charges for construction and depreciation than other electric roads. On the other hand, their fixed charges for capital invested are likely to be moderate, they are managed by men of large experience in the general handling of traffic, and they are not forced into cut-throat competition. In case they do not pay, the cause of failure should certainly prove worthy of study. The fundamental question is the relation of the electric line to steam lines of the same system. If the former is merely a feeder of the latter, the difficulty is due either to actual lack of possible traffic or to unskillful management. An interurban line requires careful handling to bring out all its possibilities of traffic, and if the feeder idea is too much in the manager's mind he may quite innocently fail in bringing the purely local traffic up to its reasonable possibilities.

A still more complicated situation arises in the cases where the electric system has been acquired because it paralleled the railroad proper. In this case it is pertinent to inquire whether the line is operated to supplement the steam service or in part to replace it. If the latter, then an independent estimate of the earnings of the electric system is misleading. For expense on the steam section may have been lessened, while that on the electric section increased. A pair of parallel lines with whatever motive power may be so operated as to show gain or loss on either of them, and the net result is merely that money has been changed from pocket to pocket. The test of success is the joint result upon the two parallel sections. Even so, the question must naturally arise as to whether the electric section being used in part to relieve traffic on the steam section is being employed to the best advantage in building up traffic. It is very likely not to be used as effectively as it would be if worked by an independent corporation in competition with the railway which it parallels, not through inefficiency, but through the lack of the stimulus which comes from an active fight. If the electric line is used to supplement traffic, rather than to replace it, there is till more likely to be lack of determined effort, not from lack of interest, but from fear of interfering with the steam branch of the business. It is very difficult to determine the merits of the situation, for once a line is in the possession of a steam road, it stays there, and it is rather unusual for a steam road to buy out a line in active competition and fully developed, so that comparative results are difficult to reach. It seems to be pretty well established that an interurban line coming into direct competition with a steam line generally gets a very large share of the total traffic. In how far this is obtained by unsound processes of competition is quite another question. The railroad side of the story indicates that part of the traffic so obtained may be unprofitable. Meanwhile, the electric lines controlled by railroads will bear watching with an eye to the facts involved in this discussion, and we hope that more data will soon become available.

THE LOS ANGELES & REDONDO RAILWAY

An article descriptive of the interurban system of the Los Angeles & Redondo Railway Company must present several points of particular interest. Among them are: The fact that it was formerly a steam road, but has now been completely changed for electric traction, with resultant economy and efficiency; the large freight business it handles in connection with its electrically-equipped wharves, and the building of all its own cars in its own shops.

The company was organized fourteen years ago, at which time a narrow-gage steam road was built between Los Angeles

FIG. 2.—SCENE IN INGLEWOOD

and Redondo, a distance of 18 miles. Valuable water-right privileges were acquired at the seaboard and a terminal was secured in the southern part of Los Angeles about 3 miles from the center of the city. For about thirteen years the road was operated as a steam line in friendly competition with the Santa Fé, which owns a standard gage steam road between the cities named.

The Los Angeles & Redondo Railway passes through a fertile and attractive territory that has steadily been built up and improved in keeping with the general growth of all southern California. The local passenger and freight traffic has steadily increased, while a large tonnage is received from coast and foreign vessels. Some two years ago the owners of the road concluded that the conditions warranted and the times demanded up-to-date electric railway facilities. Accordingly, the old line which runs through Sunnyside, Summit, Gardena and Moneta was completely rebuilt, the grades being lessened

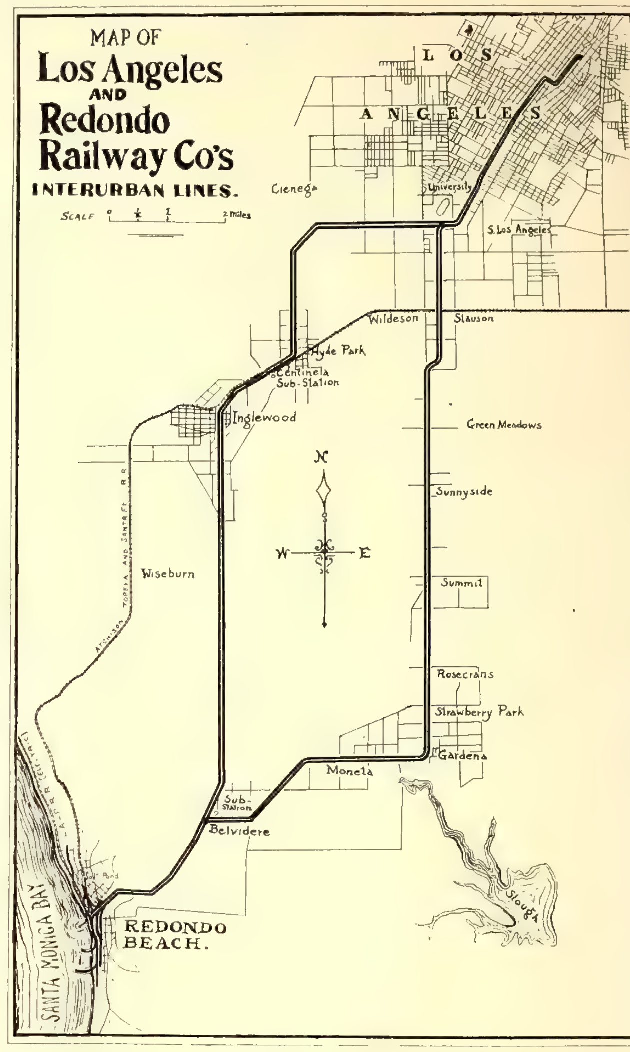


FIG. 1.—MAP OF LOS ANGELES & REDONDO RAILWAY

and curves eliminated wherever possible. In addition, another line was built about 3½ miles west of the old one through the town of Inglewood. This new line branches off from the older one just outside of the Los Angeles city limits and meets it again at Belvidere, a short distance from Redondo. It covers an equally attractive territory and reduces the distance be-

FIG. 3.—PASSENGER STATION AND OFFICE BUILDING AT REDONDO. HOTEL IN BACKGROUND

tween terminals by half a mile, as well as cutting down the maximum grade from 2¼ to 1½ per cent. Both routes are shown on the accompanying map, Fig. 1.

The choice of two routes to the sea has proved a popular feature with the public, and aside from serving two very productive districts, there are several advantages from an operating standpoint which will be mentioned later. The change to electric traction also enabled the company to abandon the passenger terminal in the southern part of the city and to operate its cars from Second and Spring Streets, in the center of the business district, over the Grand Avenue tracks of the Los Angeles Railway Company until its own private right of way is reached. This increased the passenger facilities to such an extent that, although one steam and another electric road reach Redondo, the Los Angeles & Redondo Railway Company gets practically all the passenger business. Fig. 4 is a view of the principal street in Redondo and Fig. 3 illustrates the passenger station and office building of the company, with the Hotel Redondo in the background. A scene in Inglewood on the new route is shown in Fig. 2.

TRACK AND OVERHEAD CONSTRUCTION

New 60-lb. A. S. C. E. section steel T-rails have been installed over both routes. These are laid with even suspended joints on 6 in. x 8 in. x 6 ft. ties. Fifteen ties are required for a 30-ft. rail length and at the joints the ties are spread 10 ins. apart. Standard 24-in. four-bolt angle-irons protect the Edison-Brown plastic bonds that are used throughout the system. The tracks are all of the 3-ft. 6-in. gage that is used on the local Los Angeles street systems.

Center pole overhead construction has been used throughout, with 15-ft. track centers. Thirty-five ft. round cedar poles with 8-in. minimum tops carry the bracket trolley supports and the high-tension, feed and telephone wires, the arrangement being as indicated in the accompanying sketch, Fig. 5.

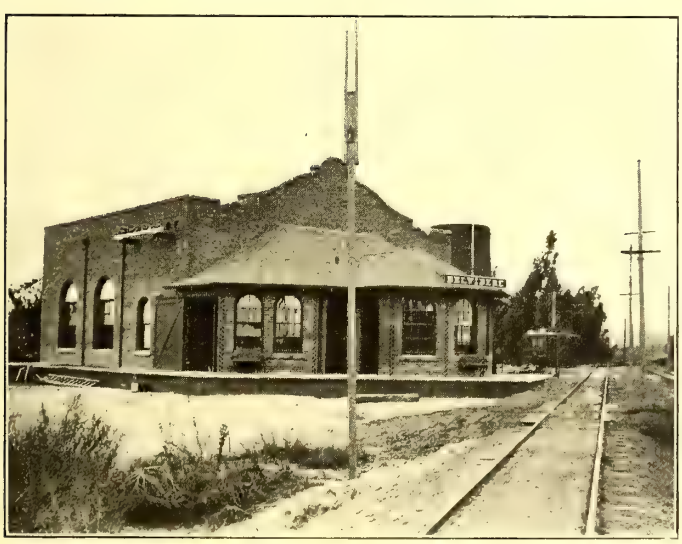


FIG. 6.—BELVIDERE SUB-STATION

The company receives its power under contract from the Pacific Electric Railway Company, of Los Angeles, in the form of three-phase, 50-cycle, 15,000-volt alternating-current, at which potential it is distributed to the two sub-stations at Belvidere and Centinela. The high-tension wires are carried on No. 1 Provo glass insulators mounted on special pins 1¾ in. x 12 ins. The wires are arranged in the form of an equilateral triangle, with 36-in. sides. The top pin is inserted in the top of the pole and two lower ones are carried by a special 4 ft. x 5½ in. x 3¾ in. Oregon pine cross-arm secured to the pole in a 2¼-in gain by a ⅝ in. x 10 in. machine bolt. The insulator pins are fastened by ¼-in. maple dowel pins. The

FIG. 4.—PRINCIPAL STREET IN REDONDO

cross-arm carrying the 600,000 circ. mil feeder cable and the telephone wires is also of Oregon pine. It is 6 ft. x 5½ in. x 3¾ in., and in addition to a ⅝ in. x 12 in. machine bolt is supported by two 24 in. x 1¼ in. x ¼ in. iron braces. The details of the trolley wire bracket are self-explanatory.

As mentioned above there are several advantages from an operating standpoint in having two routes. The wiring system is so arranged that either one or both sub-stations can supply current over either route, thus enabling linemen to cut out either station or either high-tension line while the system is in operation for the purpose of making line repairs, and without interfering with traffic. In case of washouts or other local obstructions on one line, the reliability of service between terminals is assured by the other route. The same advantage applies to telephone service between terminals, as an independent return copper circuit follows each route. Telephones are used in despatching trains.

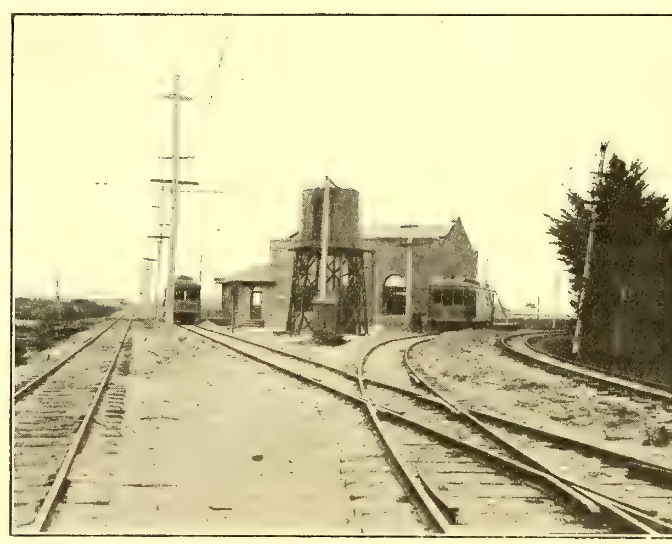


FIG. 7.—BELVIDERE SUB-STATION, SHOWING THE JUNCTION OF THE TWO ROUTES

SUB-STATION EQUIPMENT

As mentioned above there are two sub-stations for distributing direct-current to the system, one at Belvidere, about 3½ miles from Rodondo, the other at Centinela, about 6 miles from Los Angeles. The buildings are both of brick, with concrete floors, and were designed with the idea of being orna-

mental as well as useful. Figs. 6 and 7 are views of the Belvidere sub-station. Figs. 8 and 9 are respectively plan and cross-section of the building and Fig. 10 is an interior view of the station. On account of its cleanliness and fireproof qualities

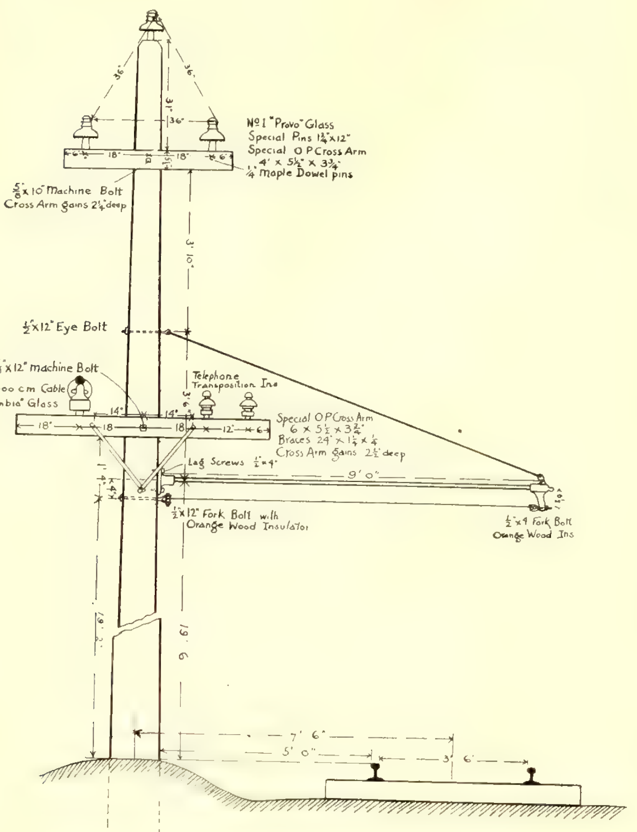


FIG. 5.—ARRANGEMENT OF OVERHEAD CONSTRUCTION

a concrete floor was decided upon. A 2-in. tongued and grooved wooden floor was first laid and this was covered with tar paper to prevent the moisture of the concrete from affecting the wood. A 3½ in. layer of concrete was then added with a ¾ in. wearing surface on the top. Owing to the disastrous results in case of fire, to stations having transformers located on wooden foundations, a brick wall on a concrete base was built to the floor line and the transformers were located on this pier in a row 6 ft. back on the switchboard.

The 15,000-volt transmission wires enter the sub-station building through 12-in. terra cotta tubes, near the outer ends of which are fastened circular glass windows, each containing a 1-in. hole at the center for the wire to pass through. The wires are covered with heavy rubber insulation for about a foot outside the building.

The transformers, seven in number, are of the oil-insulated, water-cooled, 50-cycle type, with 15,000-volt primaries. Each has a capacity of 100 kw and they are connected in delta in two banks, with one for emergency. Each transformer is provided with a 10-point switch in the secondary winding to vary the voltage from 2150 to 2350 volts.

The sub-station contains three motor-generator sets as follows: One 200-kw set, consisting of a 12-pole 215 kw (290 hp) 2250-volt synchronous motor direct-connected to a 6-pole 200-kw, 525 to 575-volt direct-current generator; one 150-kw set, consisting of a 12-pole, 165-kw (220 hp) 2250-volt synchronous motor, direct-connected to a 6-pole 150-hp direct-current generator; one 100-kw set, consisting of a 10-pole 150-kw (200 hp) 2250-volt induction motor, direct-connected to a 6-pole 100-kw direct-current generator. These sets are all of the four-bearing type. The synchronous motors have their exciters attached to extensions of the armature shafts and operate at 500 r. p. m.

Each machine is capable of being started from either the direct-current or alternating-current end, the synchronous motors being supplied with a partial squirrel-cage winding and the transformers with half-taps of 1075 volts for starting purposes. Despite the fact that synchronous motors are not in favor with a number of engineers, absolutely no trouble has been experienced by this company, their operation having been satisfactory in every respect. No synchronizing devices are used. In starting up, the motor is thrown directly on the half-taps and allowed to come up inductively. It is then thrown on full voltage, after which the field switch is closed. This requires but a few seconds and is perfectly safe, there being no danger of shutting down the power station by throwing on a

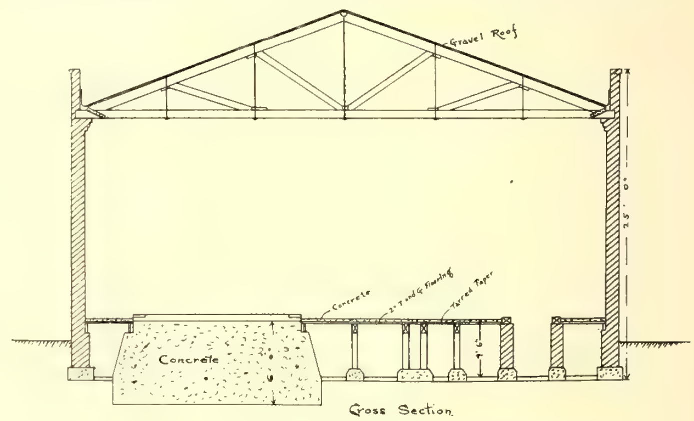


FIG. 9.—CROSS SECTION OF BELVIDERE SUB-STATION

machine out of synchronism as happens sometimes when synchronizing devices are used.

The switchboard is made up of eleven panels of blue Vermont marble as follows: Two high-tension panels, each con-

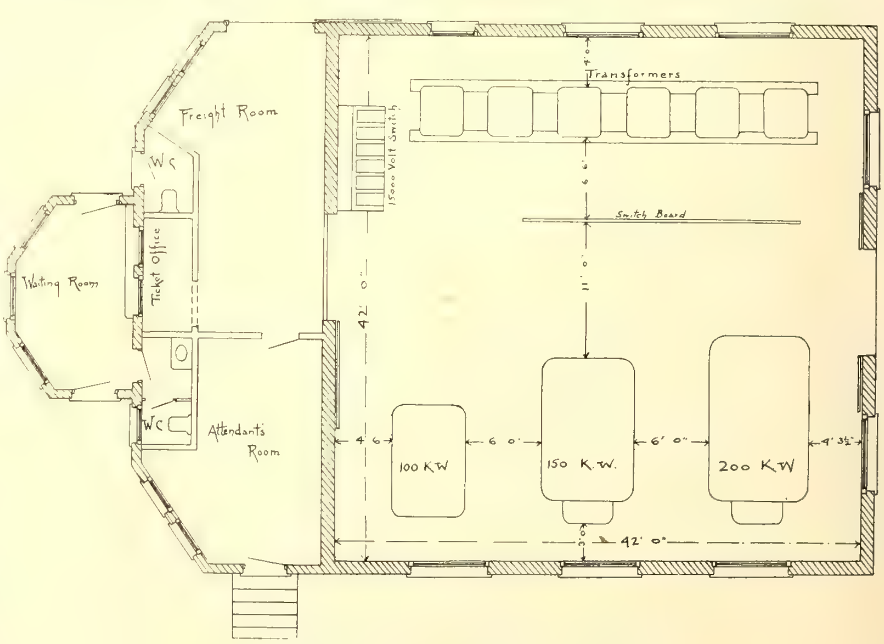


FIG. 8.—PLAN OF BELVIDERE SUB-STATION

taining three single-pole, single-throw 15,000-volt 300-amp. automatic oil switches operated by one handle and mounted in separate brick cells back of the switchboard; also a relay with current transformer for automatically tripping the switch in case of a heavy overload.

One induction motor panel with ammeter and two 2500-volt

oil switches, one with overload relay, the other non-automatic and provided with an interlocking device to prevent both switches being thrown on the line at the same time. The non-automatic switch is connected to the half-taps of the transformers and is used only in starting up.

Two synchronous motor panels containing oil switches as above, alternating-current and direct-current ammeters and voltmeters, power-factor indicator, etc.

Three direct-current generator panels, with circuit breaker, switches, ammeter, rheostat and one four-point 200-amp. starting switch for starting machines from the direct-current end when desired.

Three 600-amp. feeder panels, with circuit breaker, ammeter and single-pole, quick-break switch. Two Weston voltmeters are hung on a swinging bracket at the end of the board and one 1200-amp. Thomson recording wattmeter is attached to a special panel back of the switchboard. The current and potential transformers are also placed on an iron rack 2 ft. back of the switchboard.

All wiring inside the station is rubber-covered; the 15,000 volt wires having an insulation 6-32 in. thick; the 2250 and 600-volt cables having an insulation 3-32 in. thick.

The high-tension wires are placed on No. 1 Provo glass insulators on locust pins, the whole being supported by seasoned wooden frame-work. The cables under the concrete floor are carried on Columbia glass insulators fastened to short cross-arms suspended from the floor joints.

The Centinela sub-station, Fig. 11, is practically the same as the one just described in so far as the generator room and the general arrangement are concerned. All the sub-station apparatus, including switchboards and high-tension switches were furnished by the General Electric Company.

CAR SERVICE

From a public standpoint the advantage of a comfortable and otherwise attractive trip to the sea and return, "where no scene is twice seen," coupled with a reliable and frequent car service, have brought a naturally attractive resort into special favor. The frequency of car service is governed by the season of the year. Last summer a twenty minute service was maintained daily from 6 a. m. to 7 p. m., then a forty minute service up to midnight. During the balance of the year a half-hour service is given from 6 a. m. to 6:30 p. m., then hourly to 11:30 p. m. Extra cars are run on Sundays and holidays both summer and winter to accommodate the additional travel.

FIG. 10.—INTERIOR OF BELVIDERE SUB-STATION

PASSENGER CARS

It is interesting to note that the Los Angeles & Redondo Railway Company builds all its own rolling stock, including passenger and freight cars, in its own shops at Redondo. Its passenger cars, which are of the type illustrated in Fig. 12, are substantially built and are characterized by a well-proportioned and extremely pleasing design. They are 42 ft. long over all and weigh about 34,550 lbs. each, including brakes, motors and electrical equipment. They are finished in cherry and cedar, with the exception of the ceilings, which are either of plain or embossed sheet steel. The outside seats are of the Wheeler pattern, while those inside are of the Hale & Kilburn 98-A type, with oval pedestals and automatic foot rests. The inside seats are finished either in crimson plush or rattan, the latter giving better results in this section. Plain glass is used exclusively for windows and this adds materially to the richness of the car, aside from being stronger than ordinary glass. An unusual feature to be noticed in this connection is that the windows in the passenger compartment are stationary, the management having found that the doors and ventilators give sufficient ventilation, while it is freed from accidents occasioned by persons leaning far out of the windows and being struck by a trolley pole.

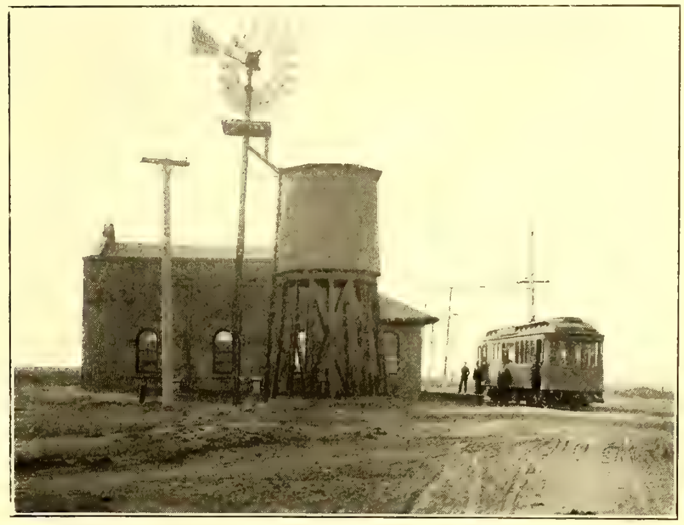


FIG. 11.—CENTINELA SUB-STATION

The trucks are of the 37-A McGuire type, with 6 ft. wheel base and are equipped with two 38-B Westinghouse motors and K-11 controllers. For the air brakes Christensen AA-1 independent motor compressors are used, the air controller being set at 50 lbs. pressure. Vertical ratchet wheel, hand emergency brakes are also provided. Mosher arc headlights, supplied by the Dayton Manufacturing Company, are operated in series with the incandescent lights used inside the car. These lights are wired in multiple series, so that the burning out of one lamp does not throw out the others. Round-dial New Haven fare registers are used to record all five-cent fares and each car is equipped with New Haven trolley catchers.

The strength of one of these cars was well demonstrated in a recent collision on the road, caused by a freight car on

another line which crossed the Redondo road hitting the passenger car at right angles, the cause of the accident being the failure of the brakes on the freight car. Both cars were running at about 10 miles an hour and the Redondo car was lurched off the track, but was only slightly damaged and only part of the glass was broken.

POWER CONSUMPTION OF CARS

The company has equipped each of its cars with a permanent Thomson recording wattmeter, the instrument being mounted over one door as shown in Fig. 13. By means of these meters a careful record is kept of the power consumed by each car on every trip. Once a month the chief electrician of the company posts a report which shows the standing of each motorman, the man who shows the smallest kilowatt consumption per car mile ranking first. As a result the motormen soon learn how to handle their cars with the minimum expenditure of current and the posting of the record is an incentive for them to make the best showing possible with a consequent saving to the company. The result is a valuable check on the power consumption, an item of no small importance, especially where the power is rented, but one which seems to have been more or less disregarded by the average electric railway. From these records it has been found that the average consumption of passenger cars per car mile with the regular gear ratio of 18:64 is 1.25 kw. On a higher geared car with 14:58 ratio there was about one-third more power consumption per car mile.

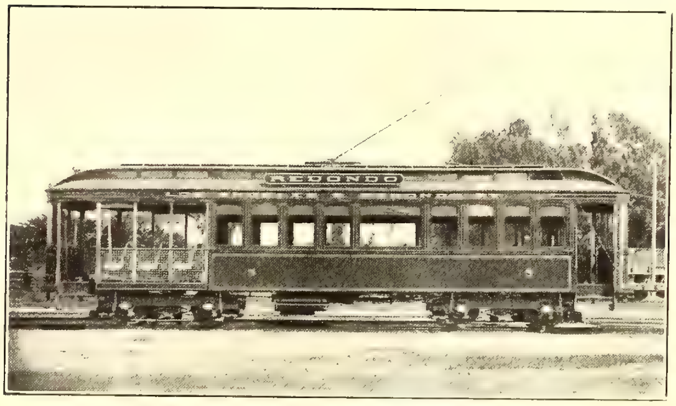


FIG. 12.—STANDARD PASSENGER CAR

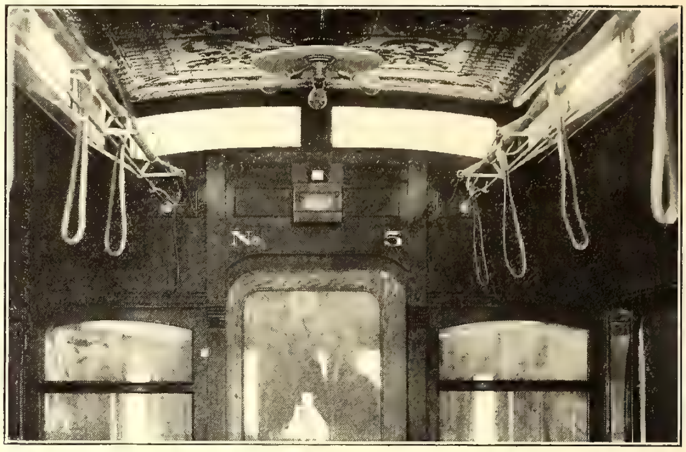


FIG. 13.—RECORDING WATTMETER MOUNTED IN PASSENGER CAR

FREIGHT CARS

The company has in service freight motor cars that were also constructed in its own shops. They are about 46 ft. long over all and weigh about 25 tons each. The equipment consists of four 38-B Westinghouse motors mounted on 37-A McGuire trucks, with K-17 controllers and D-2 Westinghouse automatic air compressors. The motors have a gear ratio of 14:68. Each of these cars handles from three to five loaded freight cars besides furnishing space itself that is equivalent to one box car. Fig. 14 shows one of the motor cars unloading milk at the Los Angeles freight terminal and Fig. 15 is a view of another motor car with a train of seven box cars at the same point.

These cars are also furnished with recording wattmeters from which readings are taken to show the power consumed each trip. The controllers on these cars are located at the right side of the vestibule and a hinged platform extension over the steps on the controller side enables the motorman to stand where he can conveniently observe signals, as shown in Fig. 15. For shunting cars on side tracks a lever is fastened to the coupling pin and projects through the dash of the car so that the motorman can cut his train loose by simply pressing on the lever with his foot.

SWITCHING LOCOMOTIVE

As will be mentioned more in detail later, the company owns three shipping wharves at Redondo, all equipped for trolley operation. Steam locomotives were used there for switching purposes up till recently, when the electric locomotive illustrated in Fig. 16 was put into service. This switching car was designed by the company's electrical engineer, L. B. Pemberton, and was built in the company's shops under his direction. This car possesses many novel and distinct advantages that merit special consideration. Fig. 17 is an elevation of the car and Fig. 18 is a floor plan showing the location of the equipment. The locomotive is 17 ft. 6 in. long over the drawbars and 8 ft. wide. Its total height is 12 ft. 2½ in. and its weight, 13 tons. The floor, which is 3 ft. 8 in. above the

FIG. 14.—FREIGHT MOTOR CAR UNLOADING MILK AT LOS ANGELES TERMINAL

rail, is built of four longitudinal 7 in. x 16 in. wooden sills, with space in the center under the car for trap doors. The space between these sills is fitted with old rails laid in concrete so as to give the car enough ballast for efficient traction effort. The cab is 7 ft. 2 in. long, with projecting roof and extends the full width of the car. A 37-A McGuire truck with 6 ft. wheel base and equipped with two 38-B Westinghouse motor propels the car. An ingenious arrangement was made so that but one controller is necessary. A false floor was built in the cab 10 ins. above the main floor and the controller was placed horizontally in the center between the two floors. The controller rod was then extended to both sides and connected by means of bevel gears to vertical rods which are operated by means of the ordinary controller handles. This arrangement permits the motorman to operate the car from either side and, besides dispensing with one controller, gives more room in the cab.

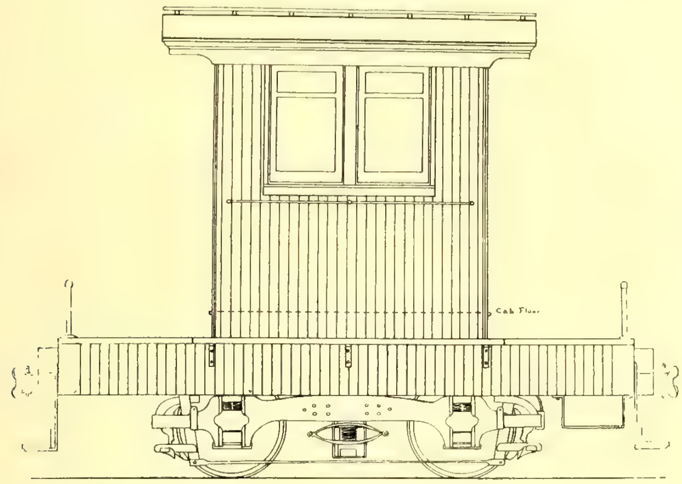


FIG. 17.—SWITCHING LOCOMOTIVE ELEVATION

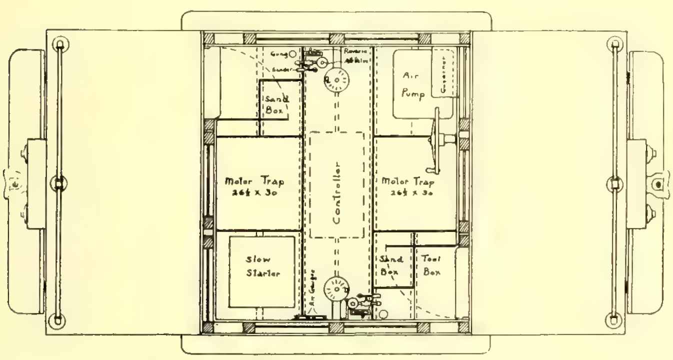


FIG. 18.—PLAN OF SWITCH ENGINE

It is well known that there is a source of danger in switching and coupling with electric motor cars on account of the quick start of the car when the motors are thrown on the first notch. To overcome this difficulty Mr. Pemberton devised a soapstone resistance which is connected to the first notch of the controller. This cuts down the current so that the car can be started up very gradually without any sudden jump. The resistance is located in one corner of the cab, as indicated in Fig. 18. The rest of the engine's equipment comprises an air

FIG. 16.—SWITCHING LOCOMOTIVE

FIG. 15.—FREIGHT MOTOR CAR WITH TRAIN OF CARS

compressor and governor, sand boxes, tool box, air whistle and vertical wheel hand brake. An ordinary trolley arm is used at present, but it is planned to equip the locomotive with a

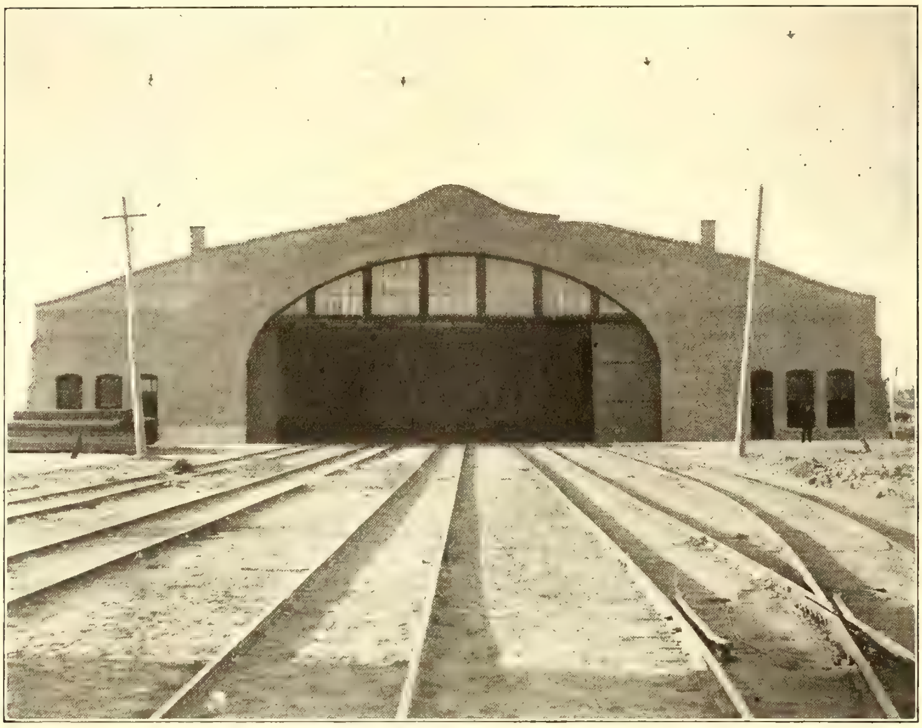


FIG. 19.—SHOP AND CAR HOUSE BUILDING AT REDONDO

diamond or bow-shaped trolley, so that it will not have to be turned every time the car is reversed.

This switching engine has proved to be a very useful part of the company's equipment, as it takes the place of steam engines and is much easier and cheaper to handle. It easily hauls five loaded box cars up a heavy grade in Redondo, where the steam locomotive could only haul three cars.

SHOPS AND CAR HOUSE

The car house and shops are united under one roof and Fig. 19 shows the general design of the building, which is of

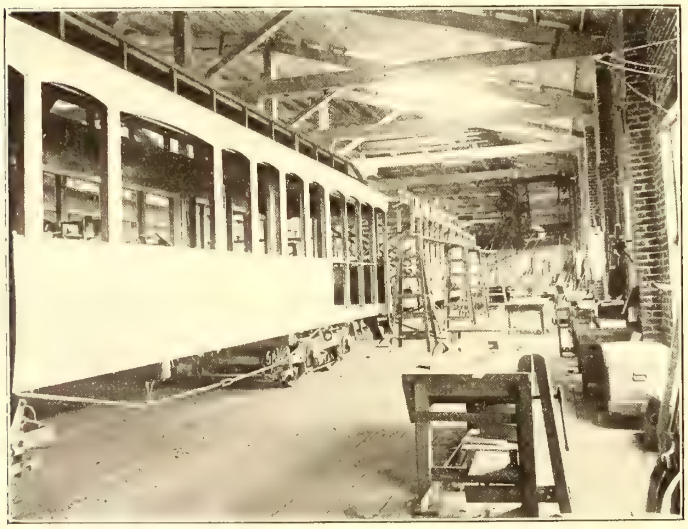


FIG. 20.—CARPENTER SHOP

brick, 120 ft. wide x 160 ft. long. The arch at the entrance has a 65-ft. span and is said to be the largest brick arch in the State. Five tracks with capacity for sixteen cars run the length of the building and the shops are located at the sides. The three center tracks are over one large concrete pit, thus giving ample room and light for working under the cars. The rear wall of the building is of temporary construction, so that the building can be easily extended.

On the south side of the building are located the armature-winding room and carpenter shop, a view of the latter being shown in Fig. 20. On the opposite side are the blacksmith shop, Fig. 21; the machine shop, Fig. 22, and the storeroom, Fig. 23. The tools, which are electrically driven, are of the best and include all the machines necessary for building cars and for general repair work. The paint shop is located in a separate building.

It has been the aim of the management to standardize every detail used in the construction of the road or its equipment, so that any part needed in passenger or freight car service or for track or overhead repairs can be furnished by the storeroom without any question as to type or pattern required or any complications that so frequently arise from lack of uniformity.

ELECTRIC FREIGHT SERVICE

This company has been something of a pioneer on the Pacific Coast in the handling of carload freight by electricity and the success it has met with will doubtless be of interest to suburban electric roads generally. For the handling of local freight, baggage and express packages and perishable commodities where regularity of service rather than extreme heavy tonnage is the rule, it goes without saying that experience proves the efficiency of electric traction from every point of view. This company has proven that it can handle carload freight, however, with its electric locomotives, at a less outlay in power consumption than it had previously experienced with steam locomotives, and, aside from this, there is the material advantage of saving in labor account, as two men can handle the trains in lieu of four and the services of a high-priced locomotive engineer are dispensed with.

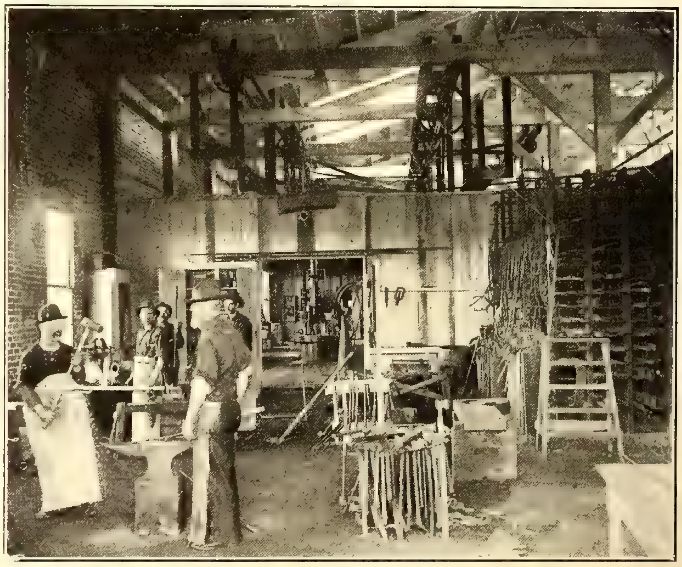


FIG. 21.—BLACKSMITH SHOP

WHARF TERMINALS AT REDONDO

The accompanying view, Fig. 24, shows a shipping scene at Redondo, with vessels discharging lumber and merchandise over the company's wharves. On each dock three rails are laid to accommodate the 3 ft. 6 in. electric gage and the Santa Fé standard gage tracks. The Santa Fé Company,

owing to its interior connections, brings a large tonnage that is valuable to the wharf owners and in turn receives privileges on the wharves that are correspondingly valuable to it, as

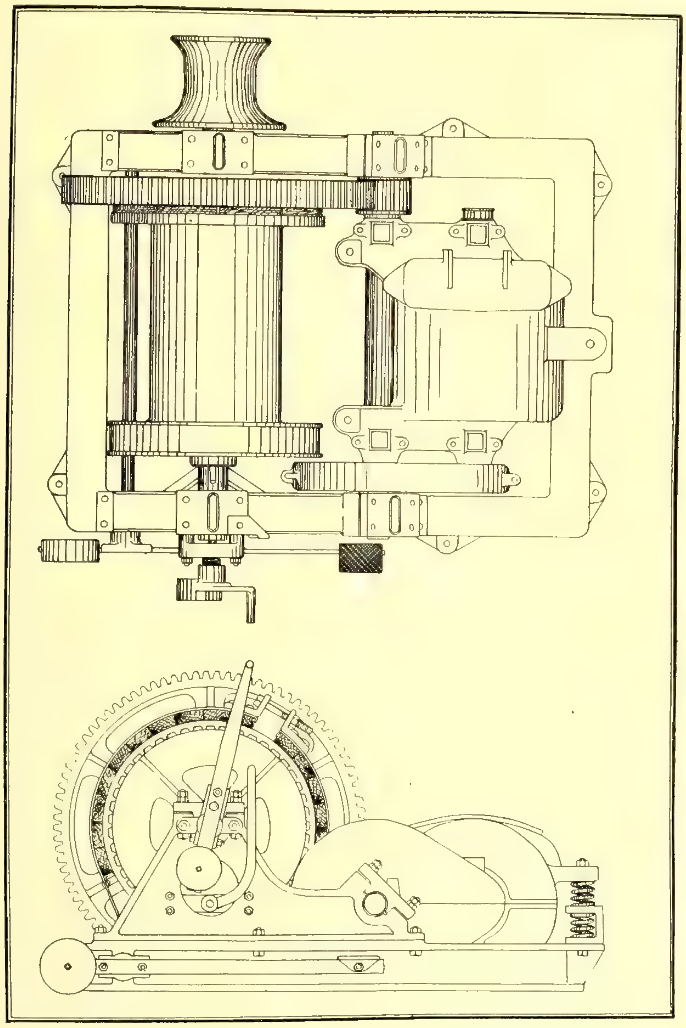


FIG. 27.—PLAN AND ELEVATION OF ELECTRIC HOIST

Redondo is the only coast terminal for Santa Fé tracks between San Francisco and San Diego.

The peculiar and advantageous formation of the water front at Redondo is partly illustrated in Fig. 24. The deep gorge heading at Redondo not only relieves this port almost wholly from the usual undertow but enables vessels of deepest draught to approach near the shore line, thus obviating the necessity for very long wharves and correspondingly reducing maintenance expenses. The depth of water at these wharves varies from 25 ft. to 70 ft. and the length of the docks vary from 600 ft. to

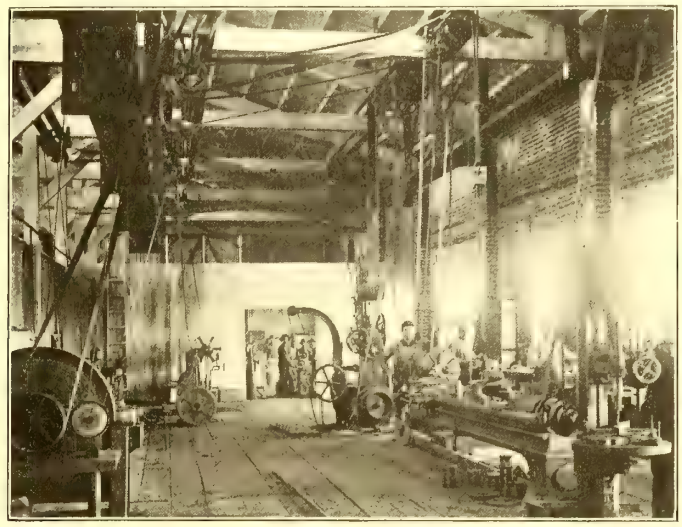


FIG. 22.—MACHINE SHOP

FIG. 23.—STOREROOM

1200 ft. It is interesting to compare this harbor with Port Los Angeles, near Santa Monica, about 16 miles north of Redondo, where the Southern Pacific Company has had to build a wharf

FIG. 24.—SHIPPING SCENE AT REDONDO, SHOWING RAILWAY COMPANY'S THREE WHARVES

about 1 mile long in order to reach deep enough water for its shipping.

The motive power used in hoisting on the Redondo wharves

FIG. 28.—HOTEL REDONDO

has been steam up to a recent date, when electric hoists, Fig. 25, were installed on the new wharf. The results of tests have shown a saving of more than one-third in power consumption

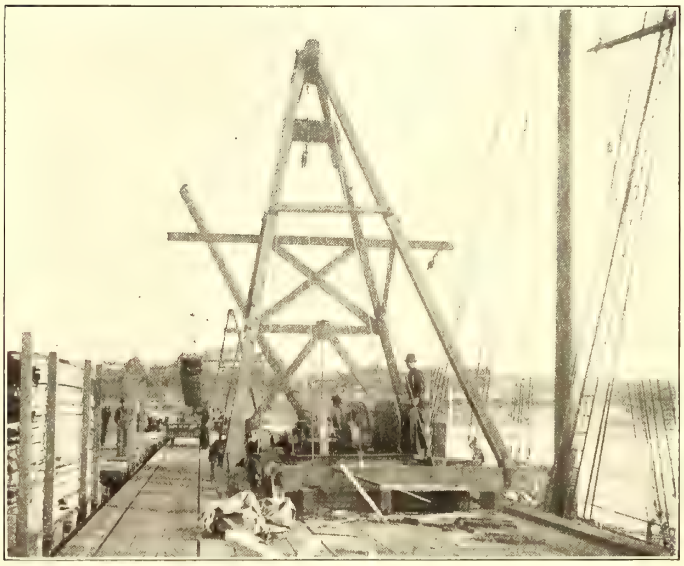


FIG. 25.—ELECTRIC HOIST ON REDONDO WHARF

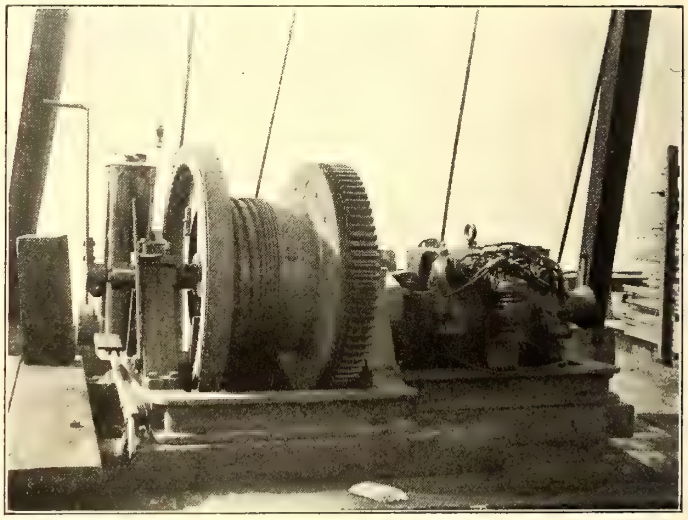


FIG. 26.—DETAIL OF ELECTRIC HOIST

in favor of electric motor as against steam, to say nothing of the labor saved in steaming up. It is the company's purpose ultimately to install electric hoists on all the wharves, as the cost of operation and maintenance is not only less but they are always ready for immedite use in emergencies and there is no power wasted when they are not in use.

The electric hoist illustrated in Fig. 25, and in detail in Fig. 26, was designed by the company's chief electrician and built by the Fulton Engine Works, of Los Angeles. Fig. 27 shows a similar but more compact design adopted for the other hoists. A 25-hp 12-A motor is geared to a drum 30 ins. in diameter, and gives the hoist a speed of 200 ft. per minute. An ordinary K-17 controller is used and a friction band is provided by which the drum is thrown into or out of connection with the motor. A band friction brake is operated by the foot.

EFFECT OF ELECTRIC SERVICE ON REALTY HOLDINGS

Primarily, the object in giving good railroad facilities to Redondo was the expected beneficial effect on the realty holdings and the benefits that have resulted to the real estate controlled by a subsidiary company, the Redondo Improvement Company, amply justified the improved service even if the move had not been justified as a railroad measure.

One of the special charms of Redondo lies in its rolling contour, every knoll affording an attractive site for a home, with views in all directions that are fascinating. A great deal has been done and is being done by those interested to develop the natural advantages. The hotel, Fig. 28, costing a quarter of a million dollars, one of the handsomest and most attractive on the Southern Coast, is surrounded on the water front by several acres of tropical trees and overlooks the water at an elevation of about 30 ft., with excellent views north and south of the highlands that bound the horseshoe bay from which Redondo (round) derives its name. The usual amusements common to resorts of this character are in evidence and liberally indulged in, especially during summer months. An attraction which has probably done more than all the advertising to bring Redondo into notice is its famous carnation fields. Several acres of these flowers bloom the year round and furnish flowers for shipment to all parts of the United States. An abundance of artesian water and a good distributing system, besides gas, electricity and an excellent climate, all com-

FIG. 29.—WHARF NO. 3 AT REDONDO

bine with nature to make this resort popular. The Los Angelos & Redondo Railway Company is a close corporation, being virtually owned by two people. It has the following named officers: President, L. T. Garney, Los Angeles; vice-president, Percy T. Morgan, San Francisco; secretary-treasurer, purchasing agent and manager, H. B. Ainsworth, Redondo; superintendent, L. J. Perry, Redondo; electrical engineer and general foreman, L. B. Pemberton, Redondo. The construction and improvements noted in the above description have been effected under the personal supervision of the energetic manager, Mr. Ainsworth, who has been ably assisted in the design and construction of the mechanical and electrical features by Mr. Pemberton, the electrical engineer.

THE POWER PLANT AND ELECTRIC RAILWAY OWNED BY THE STATE OF NORTH DAKOTA

The State Capitol Building at Bismarck, North Dakota, is a trifle over 1 mile from the city hotels and depots, and the transportation of the members of the Legislature to and from the Capitol Building has always been accomplished with some difficulty and inconvenience as well as expense to the members, as hacks and other conveyances charged 25 cents for a trip in either direction. This, with a lack of room at the Capitol, led to the renting of many committee rooms down town, which has proved an expensive though convenient arrangement.

During last winter's session a bill was passed authorizing the building of another wing to the Capitol. This permitted plenty of room at the Capitol for committee rooms, but did not solve the transportation problem. Hence a bill was passed later making an appropriation for the building of a trolley line from Bismarck to the Capitol Building.

The heating plant in the present building had been in continuous operation for nineteen years, and was in need of a general overhauling, nor was it large enough to furnish heat for the new wing. The lighting of the building had never been entirely satisfactory, as it was too far from the city plant for good service, the voltage being 220 direct-current, and

FIG. 1.—EXTERIOR OF POWER STATION

the distance over 1 mile. The Board of Capitol Commissioners decided to remodel the heating plant and build a lighting plant in connection with the power plant for the electric railway. It appointed Charles Foster to prepare suitable plans and specifications for the remodeling of the heating plant, for the installing of the lighting and power plant for the Capitol Building and the railway, and to superintend the construction of the entire installation.

The power house, which is shown in Fig. 1, is 53 ft. 4 ins. x 56 ft. 4 ins., and is built of brick, with cut stone trimmings and Bodine fireproof roofing. The smokestack is of brick, has an internal diameter of 4 ft, and is 60 ft. high above foundation. The core is built separate from the outer shell and extends to within 4 ft. of the top. A suitable air space is carried up from the foundation to the top of the stack,

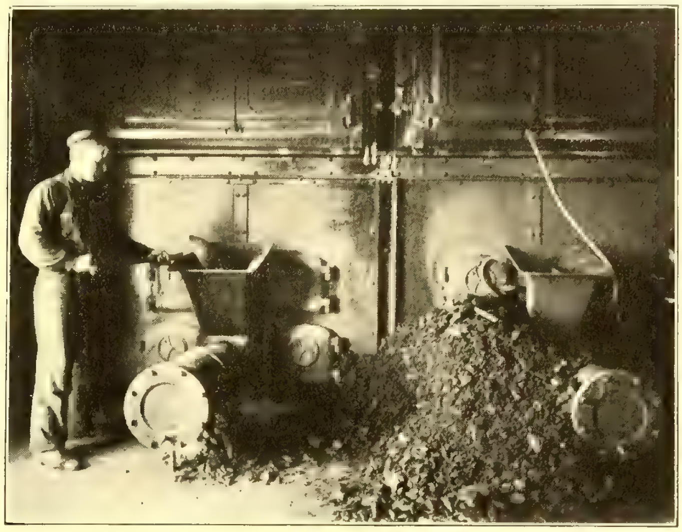


FIG. 2.—FIRING FURNACES IN POWER STATION.

and at no point do the core and outer shell touch. The building is finished very plainly on the inside. The walls in the engine room and storeroom are painted with asbestine cold water paint. The two rooms mentioned have a steel ceiling. All floors are of cement tile, except the coal room, which is 3-in. plank. All transom windows have suitable lifts, so that the building is easily ventilated.

The boiler room is on the east side of the building, and contains the boilers, blower, pumps, heater, return tank and all auxiliary apparatus, such as traps and oil separator. The boiler plant consists of two Heine boilers, rated at 150 hp each, and built for 160 lbs. working pressure. As shown in Fig. 2, these boilers are equipped with Jones' stokers, automatically controlled by the Cole automatic controller. Air is supplied by a Sturtevant 54-in. fan, directly connected to a double 4-in. x 3-in. Sturtevant engine. The controller is belted to the fan shaft, and the engine is regulated by a Foster fan engine regulator. This arrangement is found to work very satisfactorily with but little variation in the steam pressure, as the air and coal are delivered in the right proportions for complete combustion. The coal used is North Dakota lignite screenings. It will evaporate about 4 lbs. of water per 1 lb. of coal, and burns very freely leaving some clinker.

There are two 6-in. x 4-in. Blake duplex boiler feeders and one 1½-in. Penberthy injector, both of which can be used to feed the boilers and the pumps. These feeders are so piped that either may be used to pump into either boiler, that is, both may be in use, one pumping into one boiler, and the other pumping into the other boiler; one may be pumping hot water and the other pumping cold water, but by manipulating the valves, the pumps may be reversed, and the first feeder be made to pump into the second boiler, and vice versa. A hose valve is connected to the pump discharge, and a 100-ft. hose reel attached to the wall in a convenient place, so that in case of fire in the plant, direct pressure can be had almost instantly.

The heating plant in the Capitol was partly a one-pipe system and partly a two-pipe system, but has been remodeled to a certain extent and the Paul vacuum system installed. The exhaust steam from all engines, pumps, etc., passes through a Triumph oil separator, which removes the oil and then passes into the heating system. It has not been found necessary to

carry any pressure on the heating main, as with a vacuum 12 ins. to 18 ins. on the air line, the vacuum on the steam line will be from zero in coldest weather to 5 ins. or 6 ins. in mild weather. This is of great advantage when using exhaust steam. When the exhaust steam is not sufficient for heating, live steam can be furnished through a Davis 3½-in. reducing valve. The exhaust steam from the exhauster is used to heat the engine room of the plant. The returns from the building, as well as from all other sources except the oil separator, flow into a tank under the boiler room floor, and from there are pumped to the boilers.

The engines are both Ideal engines, built by A. L. Ide & Sons, Springfield, Ill. The generators were built by the Commercial Electric Company. The lighting unit consists of a 12-in. x 12-in. engine direct-connected to a 50-kw 125-volt generator, running at 290 r. p. m. The railway unit consists of a 14-in. x 14-in. engine, directly connected to a 100-kw 550-volt generator, running at 275 r. p. m.

Both generators are attached to the engine shafts by flange couplings, this arrangement allowing the removal of the armature for repairs without disturbing the engine. The foundation is made up of one solid block of concrete 24 ft. long, 16 ft. wide and 3 ft. deep.

The switchboard consists of two panels of white marble, one panel for each machine. The recording instruments are of Weston manufacture; the switches are Crouse-Hinds, and the circuit breaker I-T-E.

It is proposed to install a storage battery to take care of night lights for the watchman and for vault lighting for daylight use. The switchboard for this will be installed beside the other board, thus making a three-panel board. Above the switchboard is a gage board, having mounted on it a clock, two gages for the heating system and one for the boiler pressure. On the wall of the engine room is also mounted a recording gage which records the boiler pressure.

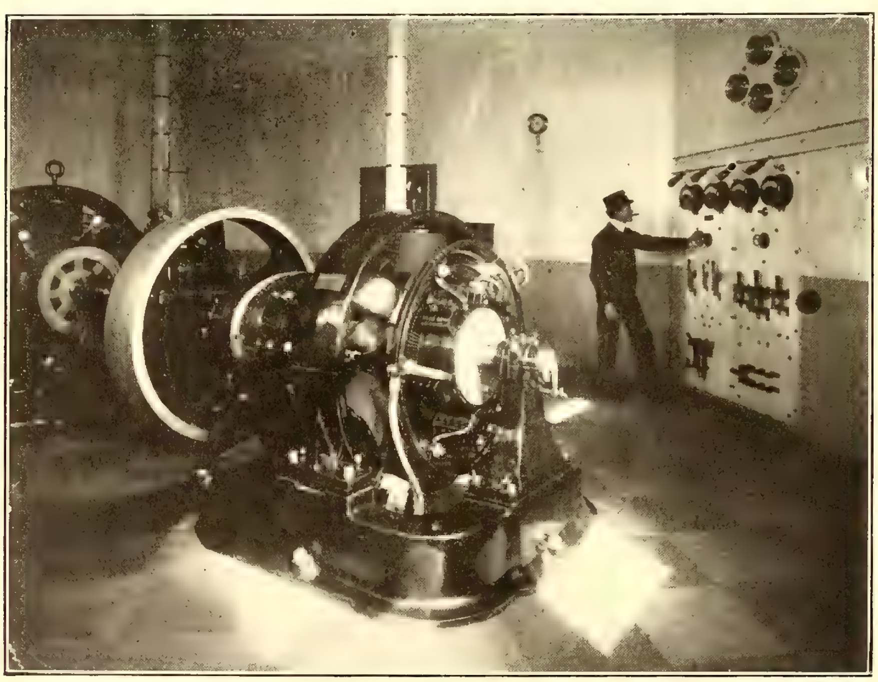


FIG. 3.—GENERATING SETS AND SWITCHBOARD IN POWER STATION

The railway is of standard gage, using 45-lb. T-rails bonded with the General Electric Company's ribbon bond. About two-thirds of the line is through the city and on the city streets, and the other third through what is known as the Capitol Park Addition. Inside the city proper the grade of the road was carried to the established grade of the streets, but on that part of the line running through the Capitol Park Addition, a cut of 4 ft. was made for about 300 ft., a fill varying from 0 ft. to 8 ft. for over 600 ft. long, and another fill varying from 0 ft. to 6 ft. about 400 ft. long.

FIG. 4.—CAR USED ON THE CAPITOL LINE

The overhead material was furnished by the General Electric Company. The poles are made of cedar and are 30 ft. long.

Only one car is in use at present. It was built by the American Car Company, of St. Louis, Mo., and described in the STREET RAILWAY JOURNAL of Feb. 27. It is 34 ft. 6 ins. over end sheathing, and has fourteen reversible rattan seats and four stationary ones. The electrical equipment is Westinghouse, and consists of four 12-A 30-hp motors and two controllers. The air brake equipment is of the Christensen type.

The car is equipped with standard Jenny couplers, as it is expected to have two or three special hopper cars built for hauling coal to the power house. The mines from which the coal is secured are about 25 miles from Bismarck. Track connection will be made with the steam road running to the mines, and the special cars sent to be loaded, then switched to the electric line and hauled to the Capitol, where the power house is located.

All the engineering work was done by Mr. Foster. This installation is, perhaps, one of the most complete small plants that can be found in the West, or outside of large isolated plants in the larger cities. No contracts were entered into, except the changing of the piping for the heating plant and the power house, all other apparatus being purchased and installed under the direction of the consulting engineer. From a financial standpoint it cannot be said that the car line is a complete success, but under the existing conditions it cannot be said to be a failure, as during the winter months all the exhaust steam is used for heating, and the difference in efficiency between the new manner of heating and the old will do much toward making up the cost of coal for the summer months. The problem of transporting the members of the Legislature is solved effectively, as it takes but a few minutes to transport the whole body.

SIDE-DOOR STEEL SUBURBAN CARS FOR THE ILLINOIS CENTRAL RAILROAD

In view of the interest in the rapid and safe transportation of a dense passenger traffic in elevated, suburban and similar rapid transit service, a detailed description is given herewith of what is really an epoch-making step in car design for such service.

The Illinois Central side-door steel suburban cars were briefly described in the Street Railway Journal of July 4, 1903, page 21, at the time their construction was about to begin. Of the different plans then presented, the one illustrated herewith was chosen as being the most flexible for all conditions of service. Although the plan shown in the previous article as having doors on one side only, and seats in groups of ten extending to the opposite side of the car, was preferred because trains could be run with the doors on the west side of the cars, thus avoiding exposure to the lake winds, this plan was rejected finally at a sacrifice of twenty seats because of the excessive cost of remodeling masonry and bridges along the line incident to moving the platforms to the west side of the track at all stations.

An order for additional cars, now being carried out, embodies the changes found necessary by the severe seven months' service test to which the first lot was subjected. These changes, together with the reasons therefor, are given below, through the courtesy of A. W. Sullivan, assistant second vice-president, and of William Renshaw, superintendent of machinery of the Illinois Central Railroad, who have designed the many original features set forth in the following mechanical description:

DETAILS OF CONSTRUCTION

The under framing of the car has four 9-in. 21-lb. steel I-beams for sills, 64 ft. long and spaced nearly equal distances apart. The end sills are 9 ins., 25-lb. channels, riveted to the sills with double angle-plate reinforced by gussets. There are four body bolsters arranged in pairs on 4½-ft. centers, and built of 7-in. x 1-in steel bars. These are bolted to the lower flanges of the sills and carry a heavy truss, which, in turn, carries the center plate. The truss rods proper are solid, passing over the inner body bolster and anchored to the outer, and are adjusted by eight vertical screw queen posts, bearing at the bottom on the rod and at the top on the 7-in. and 15-lb. I-beam which extends entirely across the car underneath the sill, forming an additional cross-brace. The underframe is additionally stiffened by 6-in and 12¼-lb. I-beams placed between the longitudinal sills over the body bolsters and needle beams.

Upon the metal sills a steel floor of ¼-in. plate 60 ins. in width, is laid with planed butt joints and double riveted to the upper flanges of the sills.

The butt joints are held rigidly together by 1¾-in. x 3-16 in. T-irons riveted underneath, extending across the car between I-beams. This gives a continuous metal surface extending the entire length and width of the car, insuring perfect rigidity and complete fire protection from underneath.

The upper frame work is built up of 3-in. and 4-lb. steel channels, with solid forged ends, which are riveted to the upper flanges of the side sills, and at the top are covered by a ½-in. iron plate 4½ ins. wide, which extends in one piece throughout the length of the car and vestibules. These channels are so spaced as to form the window and door posts, being set back to back 2 ins. apart so as to form hollow side walls, within which the doors slide when opened. By reference to the drawings, a very stiff girth and diagonal bracing with gusset connections will be noticed below the windows and in the end panels of the car. The corner posts are two 4-ins. x 5¼-lb. channels, set transversely on the side sills and spaced 11 ins. apart. The corner posts are very firmly tied together across the car, and also braced with a 4-in. and 5¼-lb. channel to the corner posts of the vestibule located on the car platform end sill. The carlines are 2 ins. x ⅜ in. iron and are so located that each rests directly on the side plate over the door posts, all the carline plate and door posts being riveted together. The framing of the car body is thus continuously connected in a very stiff manner throughout the entire body, giving great resistance and stability.

The cars are finished outside in poplar, inside in mahogany panels inlaid with a border design. This finish is secured to the frame by a very unique method; strips of hard maple 1½ ins. thick were fitted neatly to the inside of the channels for the door posts. The channel and maple filling were then placed in a chuck upon the bed of a planer, the channel below. Then with a specially designed tool, the upper edges of the channel flanges were split down to 3-16 in. deep, and the inner portion of this edge rolled down and turned over upon the filler cold compressing and firmly enclosing it within the channel walls, thus making the maple filler an integral part of the channel without the use of any screws or bolts whatsoever. This is clearly shown in the horizontal section through the door and window posts in Fig. 2.

Horizontal nailing strips of oak 1½ ins. x 3¼ ins. are tightly fitted and bolted to the metal frame between the channel posts, and on top of the metal plate above the doors hard pine, 4 ins. x 1½ ins. is tightly fitted between the metal carlines and bolted to the plate. This greatly increases the re-

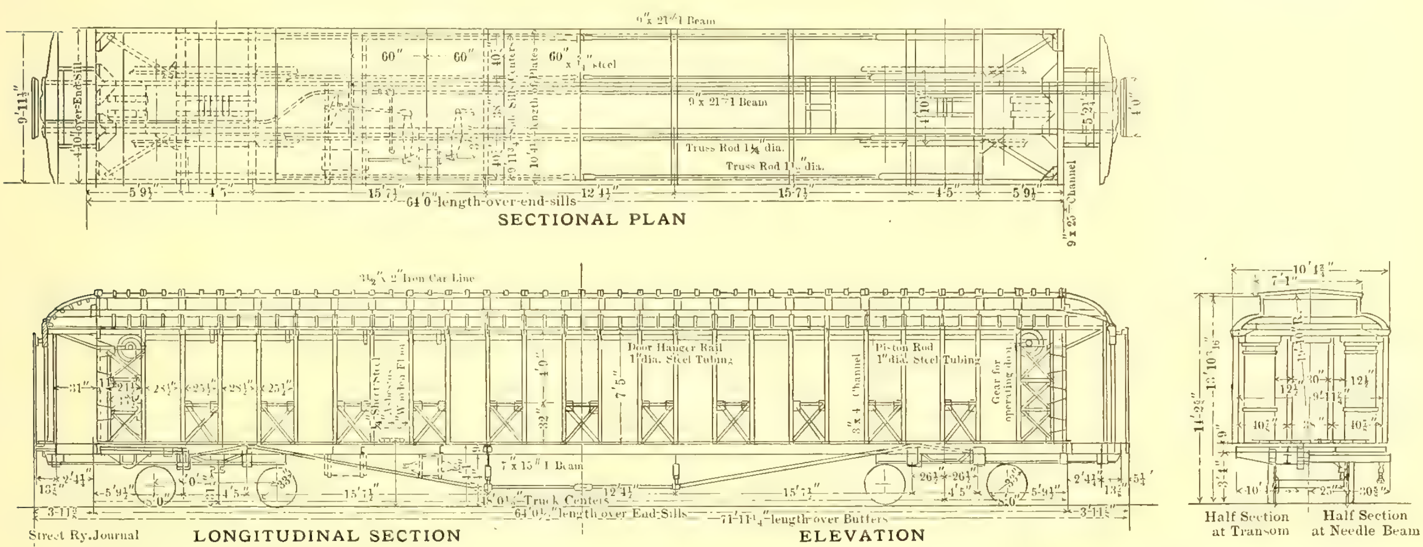


FIG. 1.—DETAILS OF STEEL-FRAME, SIDE-DOOR PASSENGER CAR CONSTRUCTED BY THE ILLINOIS CENTRAL RAILROAD

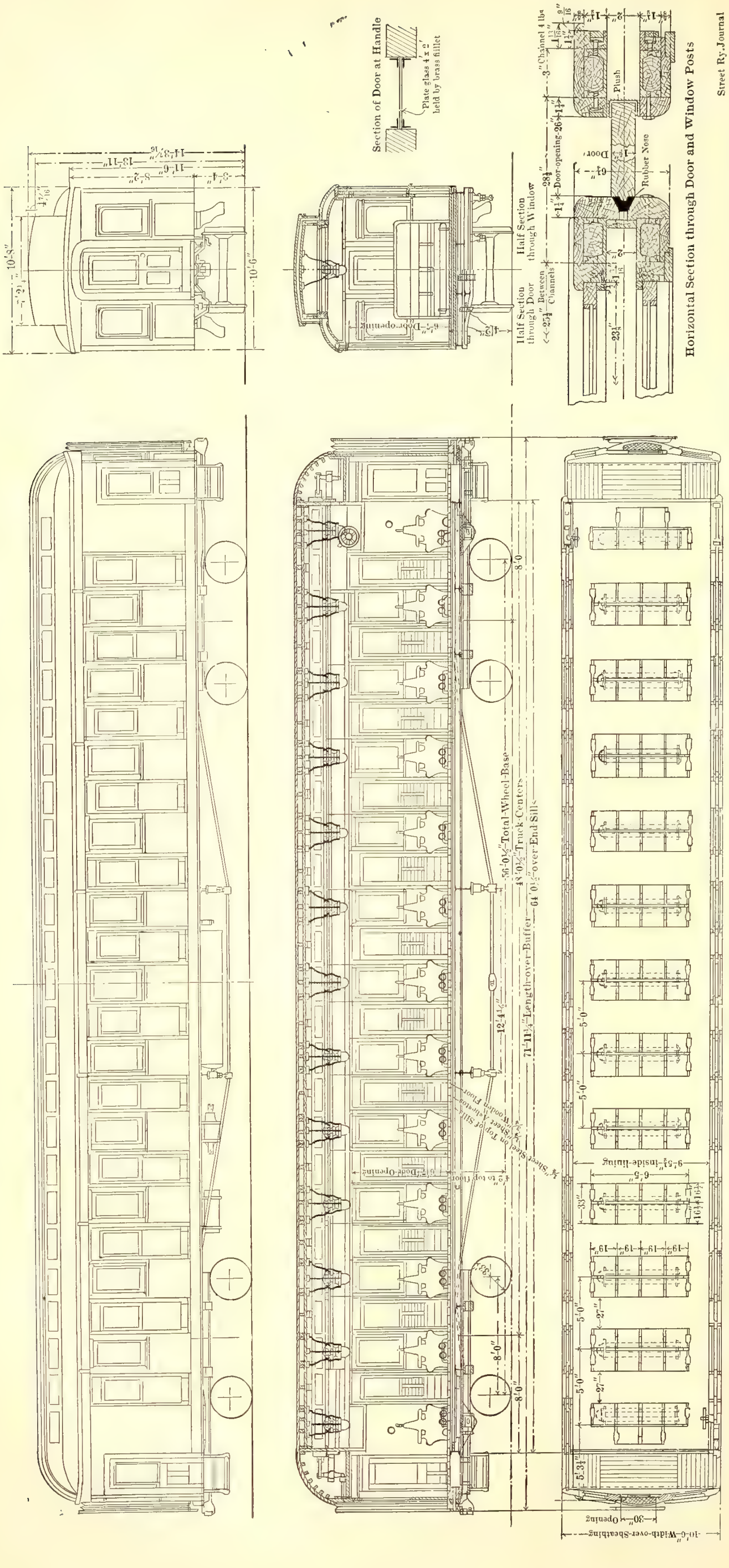


FIG. 2.—SIDE AND END ELEVATIONS, SEATING PLAN, CROSS SECTIONS AND CONSTRUCTION DETAILS OF ILLINOIS CENTRAL RAILROAD SUBURBAN CAR

sistance of the car in addition to forming an entirely adequate foundation for attachment of the sheathing in the usual manner. The carlines have poplar nailing strips bolted to each side, and the roof, which is of 13-16-in. poplar, is nailed to these strips in the usual manner. Upon the steel plate bed of the floor ¼-in. asbestos is laid, and upon this the maple flooring is placed cross-wise in matched strips 2¼ ins. x ¾ ins.

The problem of securely fastening this flooring to the steel bed plate was solved by glueing up the flooring on the bench in sections 12. ins wide, then by heavy clamps, glueing and forcing these sections one by one into position. Underneath both ends of the seats, also the center of the car floor, brass strips 1 in. wide were gained into the flooring the entire length of the car, to which the seats and heating coils were fastened, and which were in turn fastened to the bed plate by 5-16 in. screws having a wide countersunk head. This affords better access than any bolt arrangement, and also gives instant signal of loose condition. A special air machine had to be devised for drilling, tapping, reversing and backing out of these holes automatically. The nailing strips at the side are on top of the flooring, and thus hold its ends down very securely.

ARRANGEMENT

The interior of car is open throughout its entire length to the end platform sills of the vestibule, the flooring being continuous, thus permitting the steps of the vestibules to be utilized as a part of the interior of the car. The platform trap doors over the steps open against the ends of the car, and the vestibule side doors swing across the ends of the side aisles to prevent passengers walking into the opening of the steps. The seating arrangement provides a passage around these side doors and an aisle along both sides of the car. The vestibules are also provided with swinging end doors to close the ends of the cars and to allow of access through the vestibule to adjoining cars. The seats are of an entirely new design of mahogany throughout, with no upholstering whatsoever.

By reference to the floor plan it will be seen that there are sliding side doors opposite each section of seats. These doors are carried on ball-bearing rollers and work be-

tween the walls of the car. They are connected by a mechanism within the wall, which is so arranged that all of the doors on one side may be opened, closed, locked or unlocked simultaneously. This mechanism has duplicate control, one for air, with a cylinder 2½ ins. in diameter, and the other with a hand wheel about 30 ins. in diameter. In practice the doors are unlocked from either end as the train stops, leaving the opening of such doors as are needed to the passengers who desire to use them. They are then closed and locked simultaneously by the trainmen before starting.

In Fig. 3 the sockets for the key (which the trainmen carries in his pocket) to control the air valve are seen on each side of the car in the panel just next to the vestibule door, while at the left is seen the hand wheel, and also between it and the wall the lever, which, by a quarter circle movement toward the end of the car throws the hand operating mechanism into gear.

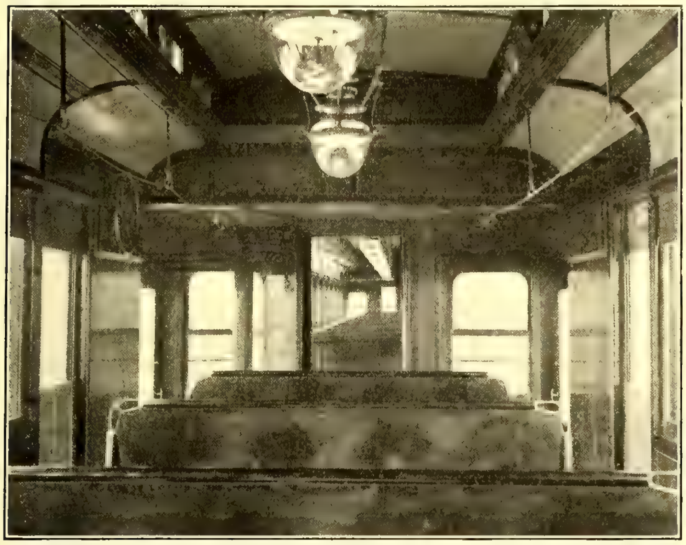


FIG. 3.—END OF ONE CAR AND VIEW OF FOLLOWING CAR, THROUGH VESTIBULE

FIG. 5.—VIEW OF INTERIOR, SHOWING LIGHTING ARRANGEMENT

A study of the engraving will reveal many of the good points of the design. The glass in doors and windows is sufficiently high to afford a clear view of the outside to both seated and standing passengers without the necessity of stooping, and they are also protected from the direct rays of the sun.

The ceiling is of canvas-covered veneer painted a light shade of green, to harmonize with the entire mahogany finish. The ceiling of the lower deck is mounted in hinged sections 5 ft. long, held by thumb-screws, with a cotton flannel joint underneath. This allows instant access to the door-operating mechanism behind it. These cars are illuminated by Pintsch gas, the lamps being 18 ins. lower than usual. The heating is by steam from the locomotive under the Safety Car Heating & Lighting Company's system. The elevations show clearly the arrangement of piping. These cars are also equipped with the Westinghouse quick action automatic brake and four-wheeled trucks of standard passenger construction, with 33-in. rolled-steel wheels and 5 ins. x 9 ins. steel axles. Standard steel platforms and couplers and the Session friction draft gear are used. As the center sills are 3 ins. apart a ¾-in. steel plate is bolted through the main sills of the under frame and the sub-sills of the platform with ⅝-in. fitted bolts, and the draft gear attached to this.

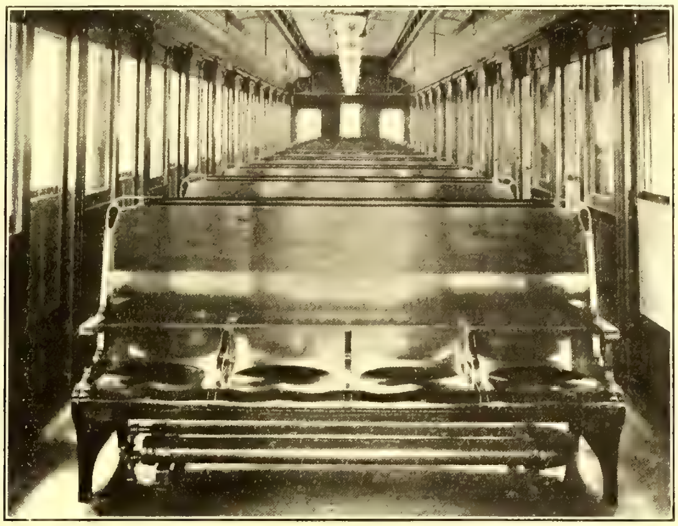


FIG. 4.—ARRANGEMENT OF SEATS AND HEATING COILS

Referring to the illustrations: Fig. 3 shows clearly the end of one car and a view of the next through the vestibule, the connecting doors of which are open. The hand-wheel and air-key connections for the door mechanism, the hand bell cord signalling apparatus are seen, and also the cord to the conductor's valve of the air brake. This latter cord is dark red, and runs completely around the car up close to the monitor junction with the roof.

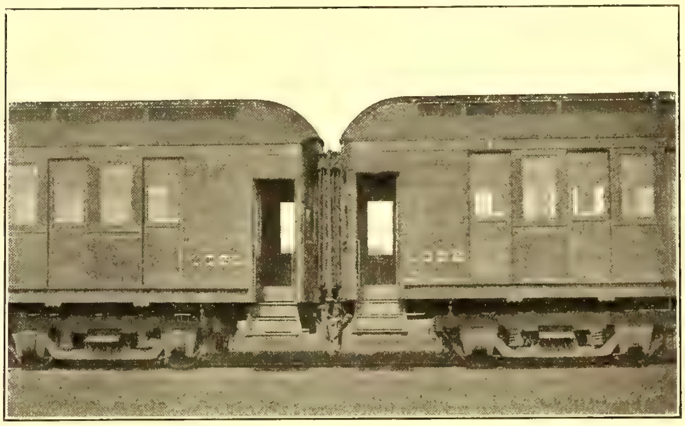


FIG. 6.—SHOWING MANNER OF COUPLING CARS AND CARRYING CABLES

Fig. 4 shows the exquisite inlaid mahogany finish, the seats and doors, and the heating coils and utter absence of any pockets to impede air circulation.

Fig. 5 gives an idea of the excellent interior lighting and general arrangement of the car.

Fig. 6 brings out the great flexibility of the car in service in meeting any conditions. The electric cable connecting the door alarm circuit can be seen coming out on and along the roof of car No. 1052, near the end, whence it leads down beside the vestibule diaphragm and terminates in a coupling similar to the air hose.

Fig. 7 is a general view of the appearance of the car.

Fig. 8 is the same as Fig. 7, but with the side doors opened, showing the free access to the interior.

RESULTS OF OPERATION

Eight of these cars have been in regular service now for seven months, and one of them has just been installed at the St. Louis Exposition. They were built in two lots, of four each, in the company's works at Burnside, and have run during an exceptionally severe winter, undergoing, up to this time, over 100 degs. total variation in temperature.

Of the objections urged against this design at its inception, not one has arisen in service. There have been no failures and no important structural changes are necessary in the order for new equipment, which includes eight more cars.

In the original design, however, expansion joints were provided at both ends of the frame to allow for the theoretically necessary expansion of three-fourths of an inch, and to prevent its localization at any one point, the entire structure was tied tightly at the center. The bolt holes through the floor were also slotted. In the new cars all provision for expansion has been entirely omitted, as it is found not necessary, the cars being built tight from end to end.

These cars have proven the most economically heated and the best heated and ventilated of any cars of the company, the exhaust steam from the locomotive air pump being quite sufficient. Those cars having one-half partitioned off for a smoking compartment have simple swinging door therein, which is entirely successful in keeping tobacco odors and smoke from the other end of the car. It was feared this might not be accomplished. The reason for this success is thought to be the absence of any draperies or pockets which would obstruct the perfect circulation now obtained. The side doors have recorded against them no failures in closing or opening, as planned and desired in the severest of winter and summer weather.

In the new cars, slight changes found advantageous by experience in operation, will be adopted, and are as follows: Originally the edge of the door was made solid of wood. On new doors, this taper edge is cut away, leaving only a small moulding, and the edge is composed of rubber glued on, as shown in the horizontal section through the door. This is to avoid noise in closing. The edges of the rubber are tacked down by brads as a precaution against possible loosening of the glue by action of frost. The hand holes for opening the doors are now made, as shown in the sketch, of a small rectangular piece of plate glass, 1¼ ins. x 7 ins., set in a metal frame in the center of the thickness of the door. They are more easily discerned at night by the passengers outside, owing to the light shining through the glass from the inside of the car.

The doors and surroundings are most carefully designed to prevent any possible personal injury. As the doors weigh 60 lbs. each, and as it frequently is necessary to close all twelve doors on one side at each stop, it was feared that to move this weight of 720 lbs. would call for too much muscular effort. Therefore, in the first four cars an air-closing cylinder was installed. In actual operation it was found that a 4-oz. pressure on the wheel of the hand gear is sufficient to close one door; therefore, 48 ozs or 3 lbs. pressure would suffice for one side. The friction of the packing in the air cylinder is several times as great as the force necessary to close the doors. The hand wheels of the apparatus are thrown into gear by a lever behind the wheel against the wall. This is never used except in emergency, as the doors are customarily operated by the air. Possibly an additional air connection will be installed at the middle of each side for the convenience of the men when collecting tickets.

Rattan seats will be fitted to a few cars, as some passengers have objected to the mahogany now used, although the new wood seats are much better in every way. The present cars are equipped with the hand signal bell cord, whereby the man in the last car in the train signals when he is ready to start to the man in the next car ahead of him, and this is transmitted car by car by hand to the locomotive cab. It is found that a greater delay is frequently occasioned by this method of signaling than by all the necessary work during a stop. To avoid this a series circuit is being wired from the cab down one side of the train and up the other side, including every door in the train in series and back to the cab. This circuit is so arranged as to ring a bell in the cab when any door in the train is not locked, thus breaking the main circuit, hence the bell in the cab will ring during the five or six seconds of stop, and its cessation notifies the engine man that all is in condition for him to proceed. The hand-signal apparatus will still be maintained as a reserve system.

The capacity or these cars is 100 passengers seated, and 200 passengers standing. No extensive figures are available at present covering time required in continuous service for loading and unloading, but such tests will be made shortly. It is certain, however, that there is a great saving.

From the floor plan it is seen that the efficiency of this design, as regards loading and unloading, is equally high at full capacity and at minimum capacity, thus allowing great

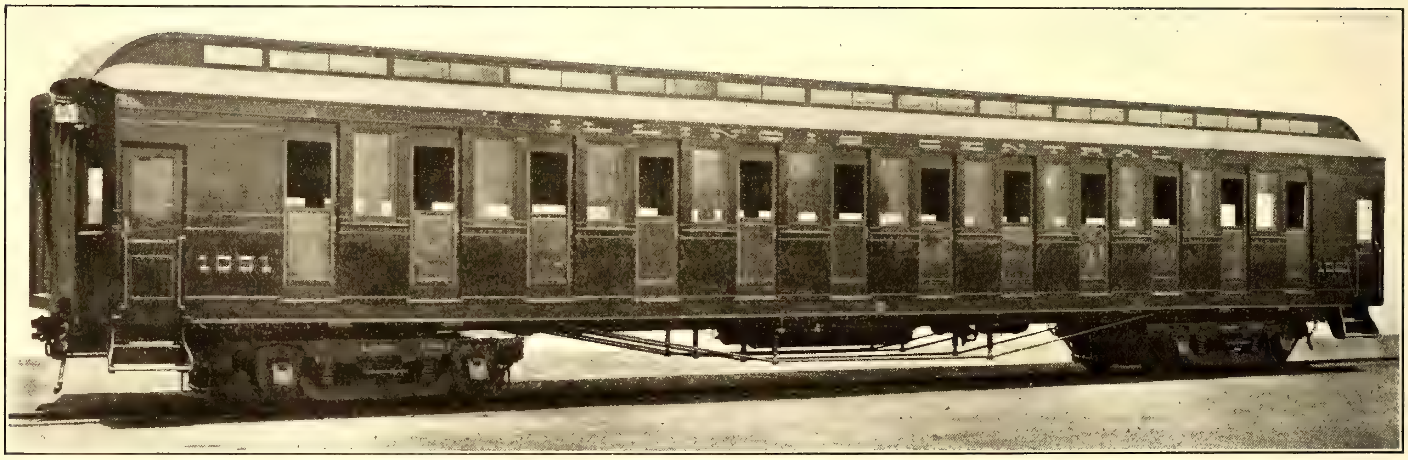


FIG. 7.—VIEW OF CAR WHEN SIDE DOORS ARE CLOSED

uniformity of station stops, and improvement and regularity in schedule at all times of the day.

ADVANTAGES SUMMED UP

Mr. Sullivan, who is responsible for many of the features of the design of the car and for its adoption by his company, urges, among other things, the following points in its favor:

1. Steel construction throughout of the under frame and upper frame, giving greater protection to the passengers against accidents and from fire.

2. A floor plan combining with transverse seats an aisle on both sides of the car, affording access to every part of the car from either side.

3. Side doors which slide within the walls of the car, and end doors, with vestibules connecting all the cars, affording access from within to every part of the train.

4. Carrying capacity far in excess of any other car, with seats for the greatest number of passengers.

5. Perfect system of lighting, heating and ventilation.

6. Electric connection between the side doors of the entire train and the locomotive, giving signal automatically to the engine man of the opening and closing of door.

7. Absolute control by the train men of the opening and closing of the side doors.

8. Inability of passengers to expose themselves to danger.

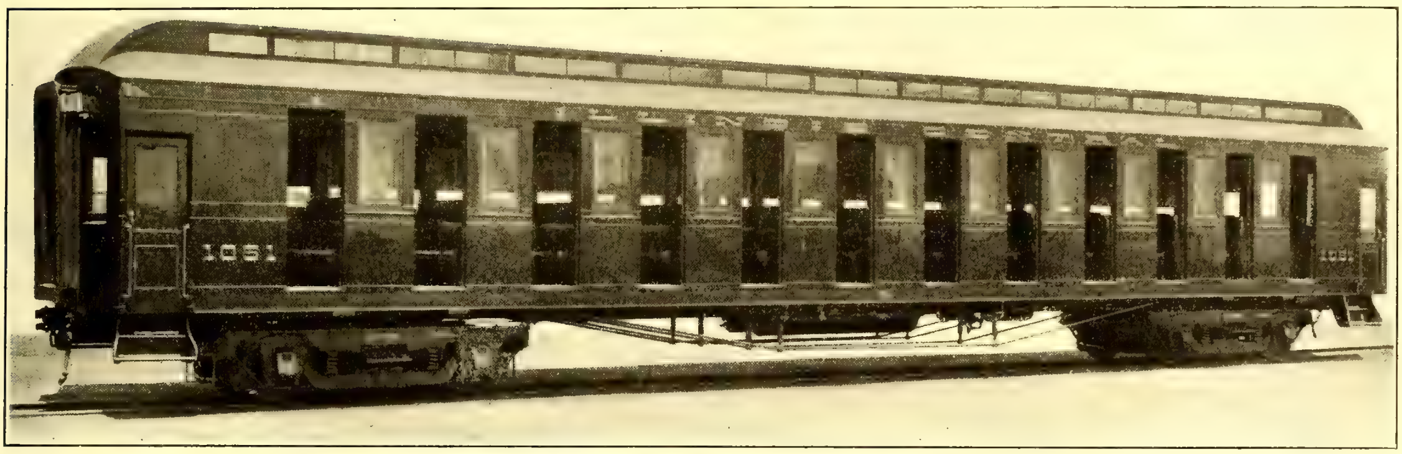


FIG. 8.—VIEW OF CAR WHEN SIDE DOORS ARE OPEN

9. Rapidity of loading and unloading passengers without disturbance of those who remain in the cars.

10. Distribution of passengers throughout the car or the entire train after it has resumed motion.

11. Distribution of passengers evenly on station platforms with assurance that the train can be entered at any point.

12. Short stops at stations, with consequent improved train schedules.

He further calls attention to the fact that while the seating capacity is 100 passengers, there is standing room for 200 more. During the rush hours the load is usually 210 to 225 per car. The cars first built weighed 84,600 lbs., but this will be reduced on those under construction. The net weight of car per passenger is less than can be obtained with any form of wooden construction. One new car takes the place of two old cars.

He reports that as many as forty-six passengers have been discharged from one car at an intermediate station in two seconds.

This speaks for itself as to the rapidity of unloading, which is the greatest single point in the car's favor. There is comcomparatively little difference in the time consumed by trains at stations as between a light and heavy business.

Aside from this one very important end being secured by the Illinois Central Railroad, is the increase in the passenger carrying capacity of its suburban service without any corresponding increase in its suburban terminal at Randolph Street.

THE WABASH & ROCHESTER ELECTRIC RAILWAY

The Wabash & Rochester Electric Railway, now under construction between Wabash and Rochester, Ind., will be constructed up to the standard of recent interurban practice, and will be a model for a road of its kind. The route between Wabash and Rochester extends through Roann, Gilead, Akron and Athens. The maximum grade will be 1 per cent, except in Wabash, where about 1 mile will have a maximum grade of 2 per cent. Larger ditches and small streams will be crossed either by concrete arches or small bridges, having Portland cement concrete abutments and steel stringers with standard bridge floor system of ties and guard rails. The bridge across Eel River at Roann will be of steel construction. The rails will be 70-lb. T type, except in towns where the girder or Shanghai rails will be used.

The power house will be of brick with stone or concrete foundation with steel roof trusses and tile floor, the building to be large enough to contain additional machinery equal to the present installation. The power house machinery will consist of two 750-hp heavy duty compound condensing engines, direct connected to two 500-kw three-phase 25 cycles revolving field type, alternating-current generators to operate approximately 125 r. p. m.

All wiring for high potential current will be suitable for 26,000 volt current. There will be three sub-stations of sufficient size to allow for a waiting room and ticket office.

The car house will be of brick with offices, stock room and repair shop, with capacity for ten cars.

The rolling stock will consist of six combination passenger cars, 50 ft. in length, with smoking compartment and toilet rooms. The motorman's compartment will be sufficiently large to provide for the carrying of baggage and express. The cars will be provided with hot water heaters and air brakes. There will also be two express cars of heavy construction.

ELECTRIC CAR AS AN AID TO LIFE SAVERS

An ingenious use of an electric car and its arc headlight was recently made at Redondo, Cal., a Pacific Coast town near Los Angeles. A lumber schooner which had anchored during the day off the beach broke her chains at night and was blown on to the shore. Efforts were immediately taken to rescue the men, and to assist the work, one of the interurban cars of the Los Angeles & Redondo Railway Company was run to a position back of the beach from where the bright illumination of its headlight could be thrown on the vessel. The bright rays gave some heart to the crew of the boat as well as materially aided the rescuers in getting a line to them. H. B. Ainsworth, secretary and manager of the railway company, directed the movements of the car.

REPAIR SHOP NOTES—PHILADELPHIA RAPID TRANSIT COMPANY

The Philadelphia Rapid Transit Company has made many improvements in the equipment of its Dauphin Street and Kensington repair shops, and now has unexcelled facilities for repair work in the maintenance of its rolling stock. The work of heavy repairs for the entire system is now concentrated in these shops to provide for all classes of work met in the service. Both shops are similarly equipped for heavy repairs with the exception that all wheel work is carried out at the Eighth and Dauphin Streets shops, while electrical construction and repair work is done at the Kensington shops only. Repair parts and stock materials are, however, interchanged between the two works as required by the varying classes of work on hand.

Many interesting shop kinks characterize the work of these shops. In the electrical department of the Kensington shops, where all commutators required for the system are built new, an interesting centering clamp or chuck is used for assembling the commutator segments; it consists of an adjustable or expandable ring, which acts as a chuck for clamping the commutator bars in position for fitting. This is a most convenient arrangement for building up, either in repairing or in assembling new commutators, as it may be used to hold the bars securely and accurately placed for boring and machining. In detail, it consists of a heavy, solid steel ring, with inwardly projecting set-screws which may be used to force inward the expandable ring or chuck, which consists of a series of steel segments interlocking each other with tongues and grooves; this is placed over the loosely assembled commutator segments when first set up and is clamped tightly around them by carefully moving the centering screws equally inward. This serves to bind the commutator so tightly together that it may be machined as a solid unit. The device has proven very effective and is the best arrangement of the kind that has yet been called to general attention.

The equipment at these shops for winding field and armature coils is very complete. All coils required for the motor repair work are form wound at the Kensington shops and insulated ready for use, large stocks of each type of coil being, of course, kept in stock for immediate use at any time. The winding forms are in most cases built of brass and are either of the well-known sectional or collapsible type for ease in removing coils after winding. They are mounted upon and operated by a very simple type of winding lathe, with a foot lever for starting and stopping. The entire winding systems have been reduced to methods of the greatest simplicity of operation, so that the work may be carried on by cheap labor and yet very carefully and thoroughly done.

Another labor saving method that has been introduced by Mr. Wampler, foreman of the Kensington shops, is for the cutting out of the insulating discs for protecting the armature windings at either end next to the shaft. The cutting out of these discs, both of cloth and in fibre, by hand formerly required the time of from three to five boys working constantly, but it is now done by a punching machine, which accomplishes the same work in a very small fraction of the time required by hand labor. This press is operated in a manner similar to the modern methods of cloth cutting, a hardwood plate upon the upper moving head being used to press upon a set of circular knives, with strippers, on the lower bed of the machine; in cutting out the discs several layers of the cloth or fibre are placed over the knives and the action of the press is that of driving the cloth down and past the knife edges, thus cutting out the discs to shape, while the spring stripper plates surrounding the knives push the cut discs out where they can be removed with ease. This machine is operated only a few hours, once or twice a week now, in order to replace the constant services of from three to five boys formerly required to cut by hand.

A notable feature of this shop is the use of jigs for the machining and drilling of duplicate parts, and also of punches and dies for the duplicate manufacture of sheet metal pieces in quantities. All castings that are required in quantities are machined by the use of carefully made jigs for ease of location in drilling holes and surfacing of parts. All contact fingers, connecting strips and other sheet metal pieces that are required in the repair or rebuilding of controllers and other electrical apparatus, are punched to size by special sets of punches and dies which are provided for each class of work; these dies are usually of the two-stage type, arranged to also locate the necessary holes in addition to stamping to size, so that the pieces are ready for use with no other machining. These jigs and dies, while expensive to build in the first place, are a source of great saving where the parts are required in quantities; the savings that have been effected at the Kensington shops by these processes are almost beyond the possibility of calculation.

The practice, which was some time ago instituted, of babbitting armature shells and of making the axle bearings of solid babbitt metal has proven very successful and is now being used exclusively. A further improvement has been added, however, in that now they have found it possible by the use of carefully sized mandrels to avoid the necessity of scraping the bearings to fit. They have found that the bearings and shells when poured with care, come out so closely to size that they may be placed in service with little or no scraping, as was formerly found necessary. The bearings soon wear down to a good surface after being placed in service, and no trouble whatever has been experienced from thus using them without scraping. This is an important saving in time and expense and has elsewhere also been found entirely feasible.

Another radical departure in detail of repair shop operation may be seen at these shops. In connection with the transfer tables, a traversing motor truck is used for shifting cars and car trucks to different parts of the shop. Some difficulty was found in devising a trolley for carrying current to the motor truck, but the problem has been solved in a novel and surprising manner. A system of depressed protected third rail was resorted to which provides protection from contact with machinery and from injury to the workmen. The conductor rail is embedded in the concrete flooring, with a slot opening above it extending to the surface; contact is made by a sliding shoe which reaches down through the narrow slot and bears on the rail. This slot is not more than 2 ins. wide and about 3 ins. deep, and is therefore so narrow that no difficulty is experienced whatever from personal contact and it has been found that pieces of machinery or apparatus can not easily get to it.

This arrangement of third rail has operated very successfully, no trouble having been experienced in its operation or from the dirt that will necessarily accumulate in the slot; the dirt is easily brushed out and a good contact is always to be had. One of the important features of this shop, however, which accommodates itself to this scheme is that of its remarkable cleanliness; it is one of the cleanest shops that can be found, which enhances the value of the depressed contact rail.

IOWA STREET & INTERURBAN RAILWAY ASSOCIATION

The Iowa Street & Interurban Railway Association was formed at Des Moines last week, April 21, at a meeting of the representatives of seventeen such companies operating in Iowa, held at the Kirkwood Hotel. The formation of this association is due to the efforts of George B. Hippee, general manager of the Des Moines City Railway. Very few companies were not represented. It was at first thought that the street railway men

might join in with the Iowa Electrical Association, which is an organization of Iowa electric light men, which held a convention in Des Moines last week at the same time that the street railway men met. After a conference between representatives of both, however, it was decided that it would be better to keep the two organizations separate, with the understanding that for the present the conventions of the Iowa Street & Interurban Railway Association and the Iowa Electrical Association shall be held at the same place the same week, and made to overlap one day so that topics of interest to both lighting and railway men can be taken up that day. This will suit the convenience of several members who operate both railway and lighting properties and who belong to both associations.

The first meeting of the Iowa electric railway men was held at 2 p. m. April 20, and a temporary organization effected. Permanent organization was completed Thursday morning, April 21.

The officers elected were: George B. Hippee, of Des Moines, president; J. F. Lardner, of Davenport, vice-president, and L. D. Mathes, of Dubuque, secretary and treasurer.

The constitution provides that the membership shall consist of companies or individuals operating street or interurban railways in the State of Iowa. The admission fee is $10 and the annual dues are $10.

The companies represented and officers present at the meeting were:

Des Moines City Railway Company—J. S. Polk, president; Geo. B. Hippee, general manager, and A. G. Maish, superintendent.

Tri-City Railway Company, Davenport & Rock Island—J. F. Lardner, secretary, treasurer and general manager.

Union Electric Company, Dubuque—L. D. Mathes, manager; J. R. Lindsay, secretary and treasurer.

Independence & Rush Park Street Railway Company—S. B. Hovey, manager.

Keokuk Electric Railway & Power Company—A. D. Ayres, president.

Marshalltown Light, Power & Railway Company—M. W. Hovey, general manager.

Mason City & Clear Lake Railway Company—F. J. Hanlon, vice-president and secretary.

Oskaloosa Traction & Light Company—J. F. Springfield, secretary.

Ottumwa Traction & Light Company—J. F. Springfield, general manager.

Sioux City Traction Company—E. L. Kirk, manager.

Tama & Toledo Electric Railway & Light Company—W. C. Walters, president and manager.

Waterloo & Cedar Falls Rapid Transit Company—Frank McDonald, purchasing agent.

Peoples' Gas & Electric Company, Burlington—W. L. Bowers.

Omaha & Council Bluffs Street Railway Company—R. A. Leusler, secretary.

Citizens' Electric Light & Gas Company, Centerville—Frank S. Payne, president.

Council Bluffs, Tabor & Southern Railway Company—Mr. West.

Interurban Railway Company, Des Moines—H. H. Polk, president.

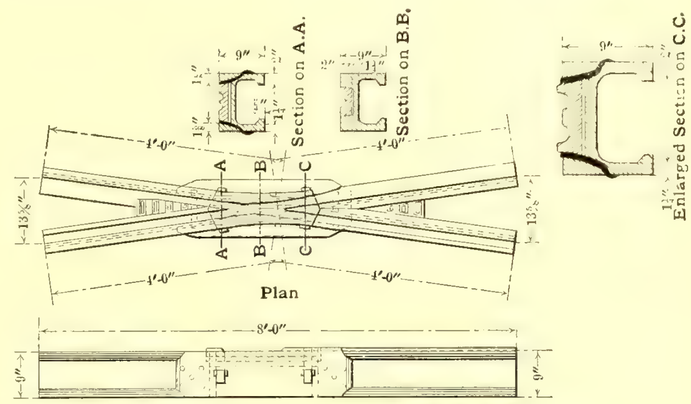
The next meeting will be in Dubuque in April, 1905.

SPECIAL WORK WITH INSERTED HARDENED CENTERS

The problem of obtaining special work with centers that will withstand the wear met in severe conditions of street railway operation has been a very difficult one for the track maintenance departments. The New York Switch & Crossing Company, of Hoboken, N. J., has developed a method of constructing street railway frogs, crossings and switches, with inserted hardened steel centers, which meets the requirements in a new and most satisfactory manner. Instead of casting or forming its special work with the wearing centers permanently in position, this company has adopted the method of inserting the centers into the special work, holding the same in place by a combined method of keying and babbitting, which has proven in practice to be a most secure method.

The accompanying illustration indicates clearly the method in which this is accomplished upon a frog. The rail ends are held in their relative proper position by the cast-iron body cast around them, as shown in the lower part of the sectional view; the wearing centers are located in the cored openings in the upper face and securely fastened there. In casting the supporting or binding body, small, flat holes are cored on either side of the face opening, left vacant for the wearing center, through which special malleable iron keys are driven in such a manner as to wedge the center tightly and hard down onto its bed. As shown in the drawing, the center is tapered inward at points opposite the cored holes in order to take advantage of the wedging effect of the keys. After driving the wedge keys in, they are secured in position by merely clinching the ends which project out at the sides below—these keys are shown in solid black in the drawing.

An important feature of this construction of special work is that, in inserting the hardened steel wearing centers, babbitt is poured in between the casting and the center before keying



DETAILS OF FROG, SHOWING KEYED-IN CENTER

the latter up tight. This causes all vacancies or openings between parts of the center and the frog casting to be filled up tightly so that the battering tendency of the jar and wear is minimized. After the babbitt is cooled the keys are driven tightly into place and clinched. An additional advantage of this keyed construction is that if at any time the wearing center should become loose, it may be readily tightened by merely driving the wedge keys further in; this can be done easily from the surface without disturbing the pavement or either side of the joint. In case it is desired to renew a wearing center it may be easily lifted out and a new one refitted, by merely disturbing the pavement on either side of the joint sufficiently to permit the wedges being driven out from below. After the new center is in place new wedges are driven in as before.

For all wearing centers this company uses the very best grade of hammered 40-point steel, which is carefully hardened after being machined to shape. This in conjunction with the novel keying and babbitting method of fastening in the wearing center, makes the work very durable.

The method of casting-in of the steel centers has proven to be an absolute failure, principally on account of the unequal shrinkage between the steel and the iron portion, which inevitably causes eventual loosening of the center. The new method here described was invented to prevent this disagreeable and destructive loosening, and it has been entirely successful.

It is found that these centers are very durable, as they will wear almost indefinitely and rarely, if ever, give trouble. This method of inserting the centers is also found to be very successful, as they universally remain absolutely tight; special work of this type has been in use for several years in all classes of service and has been used under the most severe conditions that can be found in street railway operation, and has yet to meet with failure.

CAR FOR HIGH-SPEED TRACTION

Among car builders, the John Stephenson Company was one of the first to recognize the possibilities of high-speed traction, and as a result of this belief it has given considerable attention toward designing cars whose construction would permit them to run with entire safety at speeds even as high as 120 m. p. h. The company has now completed a car of this type, and has arranged to exhibit it at the Louisiana Purchase Exposition, where visitors will have ample facilities to examine its merits.

The car body is framed very rigidly, being exceptionally well braced and trussed to withstand the heavy and severe strains experienced in high-speed service. The principal dimensions are: Total length, 61 ft. 6 ins.; length over the corner posts, 46 ft.; length over the bumpers, 51 ft.; width over sheathing, 8 ft. 9 ins.; height from bottom of sill to top of roof, 9 ft. 8 ins.

The floor framing consists of six sills, the four center sills being 6-in. I-beams, with wood fillers, extending the entire length of the car. The side sills are double, and are made of yellow pine, with steel plate sandwiched between them. The cross bars are of malleable iron, each carrying two tie rods. They are so arranged that electric or air brake apparatus may be easily suspended from them. On top of these bars is laid ¼-in. Transite board. The floor is placed above this and securely fastened to the fillers of the side and center sills. All of the wood fillers are also covered with Transite board, thus greatly reducing the possibility of fire in the entire underside of the car, and at the same time producing a frame that will not give out the disagreeable resonance common in cars constructed entirely of metal.

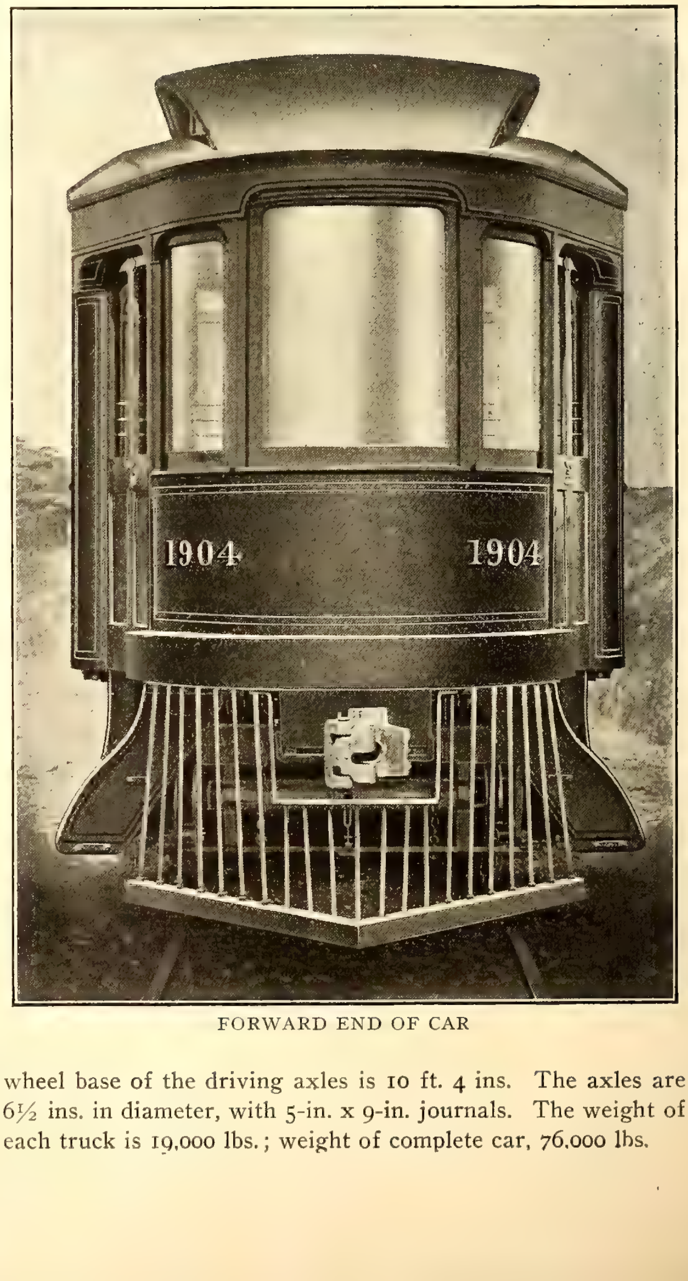
The bottom frame is equipped with built-in double bolsters, having steel centers, all parts being machine-fitted. Special care has been taken in the construction of these bolsters to make them as rigid as possible. The king pin is 3 ins. in diameter, and the center is exceptionally heavy. The total weight of the bottom frame is 20,000 lbs.

The car is divided into three compartments—passenger, smoking and private. The passenger compartment is finished in quartered oak, and has rattan upholstered walk-over seats. The smoking compartment is finished in cherry, and has leather upholstered vis-a-vis seats. The private compartment is finished in mahogany, and is furnished with six plush-covered revolving chairs. The total seating capacity of these compartments is fifty-two. The builder used a different finish for each compartment for the purpose of giving the railway men inspecting this car an opportunity to note the various results obtained by the use of different woods.

The car platforms, or vestibules, are constructed to accommodate one or two operators, according to conditions, and are not made to carry passengers. Although the vestibule is somewhat small there is enough room in the center to permit the motorman to operate, and at the same time allow free passage to and from the car for other persons. The vestibules taper toward the car ends so as to present the least possible air resistance.

VIEW SHOWING SIX-WHEEL TRUCKS, DOUBLE VESTIBULES, ROOF CONSTRUCTION AND OTHER EXTERIOR DETAILS

As the car is intended to run smoothly even at the highest speeds, the company built for it special six-wheel trucks. These trucks will tend to make roadbed defects far less apparent to travelers than if four-wheel trucks were employed. On account of the motors these trucks will carry, they are built heavier than the ordinary six-wheel truck. The side frames are made of I-beams with solid steel fillers, all of these fillers being milled and machine fitted. The truck bolster is of special construction, and built exceptionally rigid. The oil boxes are of malleable iron. All other castings are either of malleable iron or steel, gray iron being used only for the brake-shoes. The wheels are 36 ins. in diameter, steel tired, with M. C. B. standard treads and flanges. The flange has been omitted on the center wheels to enable the trucks to take 60-ft. curves. The wheel base of the driving axles is 10 ft. 4 ins. The axles are 6½ ins. in diameter, with 5-in. x 9-in. journals. The weight of each truck is 19,000 lbs.; weight of complete car, 76,000 lbs.



FORWARD END OF CAR

FINANCIAL INTELLIGENCE

WALL STREET, April 27, 1904.

The Money Market

The two features of the week's money market have been the heavy exports of gold on the one hand, and the further large receipts of currency from domestic sources on the other hand. The leading question now is how nearly these two movements are likely to balance during the coming weeks. Hitherto income has very greatly exceeded outgo. The Japanese gold consignments, coming together with the extraordinary return of cash from the interior has, notwithstanding the withdrawals of gold to Europe, raised the reserve holdings of the local banks to an unparalleled total. Last Saturday's statement showed a further gain of $11,000,000 in specie and legal tenders, and a surplus reserve the largest sum for the period in recent years. This superabundant money supply, taken in conjunction with the falling demands for mercantile and speculative purposes, explains, of course, the almost nominal figures at which loans are now offered. Call money on the Stock Exchange continues to rule at from 1 to 1¼ per cent, sixty-day money at 2½ per cent, while loans for six months and longer are being negotiated commonly at 3¾ per cent. But opinion in banking circles is getting stronger that a decided change is likely to occur befor very long. Within the last few days a great impetus has been given to gold exportations. On Saturday and Monday alone engagements of $6,700,000 were made, and yesterday's steamer carried out to France the full capacity allowed for a single consignment for the precious metal. Following this large out-flow sterling exchange has reacted somewhat, and were the conditions as they were a fortnight ago, a pause in the shipping movement might be expected. As it is, however, the sterling rate has declined again at Paris to the lowest of the season, thus affording an offset to the lowering of our own rate, while the nearer prospect of another great Russian loan to be floated on the Paris market has revealed a strong additional incentive to the accumulation of gold by the French banks. The chances seem to be that the outgo of gold will continue rapidly, and that New York banking reserves during the next few weeks will be curtailed, in which event some hardening of local money rates is probable.

The Stock Market

The stock market has now fairly settled back into the rut which it occupied before the Northern Securities decision six weeks ago. Trading has dwindled to small dimensions and a series of petty fluctuations in prices with the tendency slowly downward makes up the record of the past week. Absence of real investment demand has become more painfully apparent than ever. Investment capital is heavy enough to go into the high-grade issues which stand outside the speculative arena, but it positively refuses to have anything to do with the ordinary favorites of the Stock Exchange. As for the speculative public, they have scarcely been a factor in this season's market, and the recent dealings have merely shown their absence more forcibly than at any other time. Professional traders make up the daily business and the larger interests seem content to let them have a free rein. Under these circumstances liquidation has naturally cropped out in various quarters, not in sufficient quantity to cause any sharp decline, but enough to discourage operations for the rise and to expose the market to the attack of bearish speculators. The bear party has made considerable headway against the steel shares, which are down again to within a short distance of last autumn's low prices. A general feeling exists that the policy of the Steel Corporation management in maintaining the 7 per cent stock dividends was unwarranted, and this conviction has been strengthened by the recent trade reports, indicating that the recent trade revival was more or less in the nature of a flash in the pan. The uncertainty of the outcome of the interminable Northern Securities litigation has had a depressing effect upon all the stocks concerned, Union and Southern Pacific suffering the worst of any. Along with this, the extraordinary duration of the cold spell throughout the country, interfering, as it has, with railway traffic, has been additional reason for the weakness in the railway share list. It is altogether not a very pleasing prospect which confronts Wall Street at the moment. Even the most sanguine are forced to admit that there is not much of a chance for an important advance in prices until the outlook for the crops is clearer, and until it can be seen more distinctly what effect the presidential canvass is going to have on business and finance.

The local traction stocks have displayed a rather better resistance to the general tendency than any other group. There is no special reason for this, apart from the comparatively independent position which these shares always occupy in the market. Brooklyn Rapid Transit has been the active specialty and undoubtedly is one of the few objects on which bullish efforts are willing to concentrate. According to one reliable authority, a speculative party which has just completed a successful turn in Consolidated Gas has ventured its profits on the long side of Brooklyn Rapid Transit. This would account for the leadership which this stock has assumed during the brief periods when the general market has been inclined to move upward. No further signs of the recent liquidation are visible in Metropolitan. Both this stock and Manhattan have merely followed the general fluctuations in prices.

Philadelphia

Some rather heavy buying of bonds—an obvious reflection of reviving investment activity elsewhere—has been the main development in Philadelphia during the past week. Consolidated Traction of New Jersey 5s, which have been selling around 105 for some time, were taken in large blocks up to 106. Fractional improvement occurred in the other traction bonds, like People's Passenger 4s and Electric People's Traction 4s. Consolidated of New Jersey stock was systematically affected by the strength in the bonds, 200 shares changing hands from 64½ up to 65. Union Traction and Philadelphia Traction held their recent rise, the former selling at 49⅝ and 49¾, while the latter sold between 96 and 95¾. Philadelphia Company common was notably strong, advancing from 38¼ to 39½, but later receding to 38¾. On the other hand, Philadelphia Electric showed the ill effect of further liquidation, induced by the rumor of an assessment coming on the shares. Rochester Passenger was a feature, selling at 99, with 100 bid later. Fifty shares of Hestonville Passenger preferred went at 71½, Pittsburg preferred sold at 49¼, Reading Traction (125 shares) at 29¾, Philadelphia Rapid Transit at 13¼ to 13½, and two or three odd lots of American Railways at 44½.

Chicago

The recent decision of the Appellate Court sustaining the contention of the shareholders of the underlying properties, has placed Union Traction Company affairs in a tangle that even the lawyers themselves do not see their way out of. It is now the opinion that this ruling will cause the modified leases to be overthrown on the ground that the Union Traction Company has forfeited all rights since it has defaulted on payments of the guaranteed rentals, and that consequently the North and West Chicago lines will be turned back to their old owners. This new development has caused a fresh outburst of liquidation in the securities concerned, more particularly in West Chicago stock, which has made the new low record of 38 during the past week. Five hundred shares were sold on the decline from 40½. Only one transaction occurred in North Chicago, but this was made at a loss of 3 points from the last previous sale, the stock changing hands at 70. Union Traction issues have not been particularly affected by the decline in the subsidiary shares. The common sold as low as 5⅝, but later recovered to 5⅞ while the preferred, after touching 30¼, recovered to 31. Metropolitan issues have again been somewhat weak, especially the preferred, which lost a point from 47 to 46, on a few scattering sales. The common, after selling as low as 15, recovered to 15¾. Two hundred shares of Northwestern Elevated common sold between 16¼ and 16, and later a minor lot went at 15⅝. One sale of the preferred occurred at 44. One hundred shares of South Side sold at 92. Lake Street receipts sold as high as 3⅝, and as low as 3¼, ending at 3½. A few small blocks of City Railway were dealt in at 160.

Other Traction Securities,

The feature of the week's dealings in Boston has been the sharp rise in Elevated, which went up from 140⅛ to 142½ on transactions of over 1000 shares. The unusual activity in this stock is ascribed to a demand from investors desiring to put their funds in non-taxable securities before the State assessments are taken on May 1. For the same reason West End issues have been strong, though

much less active, the common holding at 92½, and the preferred gaining a point from 112 to 113. A recovery in Massachusetts Electric carried the common up from 19 to 20⅜; the preferred, however, after reaching 75, reacted to 74. In Baltimore there have been no transactions in United Railways stock during the week. The income bonds continued weak, dropping from 50⅞ to 50½, but the 4 per cent bonds were firmer, recovering from 89¾ to 90½. Other sales for the week included Macon Railway & Lighting 5s at 91½, Anacostia & Potomac 5s at 96, City & Suburban (Baltimore) 5s at 114, City & Suburban (Washington) 5s from 98⅝ to 100, Lexington Street Railway 5s from 99 to 99½, Atlanta Street Railway 5s at 105¼, Knoxville Traction 5s at 101, and Norfolk Street Railway 5s at 107.

Speculation in Miami & Erie Canal Transportation stock continues the feature of the Cincinnati market. Several lots sold early in the week at ⅞, and then large blocks changed hands at ½; total sales were 2200 shares. The impression is gaining ground that a stock assessment will be made and holders are anxious to unload at any old figure. Cincinnati Street Railway was active and reached a new high mark of 139¾; sales 620 shares. Cincinnati, Covington & Newport preferred sagged to 85, and the common to 30⅛, sales in both being small. The first consolidated bonds of this company sold to the extent of $11,000 worth for 109 to 109½. Detroit United sold at 64, Toledo Railways & Light at 21½, and Cincinnati, Dayton & Toledo at 21, all small sales. Columbus Street Railway 5s sold at 106 for $7,000 worth.

Columbus Railway & Light was active at Columbus, and there were several sales at 40; more was offered at this price. Columbus Railway common was in good demand at 92. Columbus, Delaware & Marion preferred has been very active at around 90, and the demand exceeds the supply at this figure. Columbus, Buckeye Lake & Newark Traction preferred is also in good demand at 90. Rochester Railway preferred was wanted at 95, Springfield (Ill.) Railway & Light at 34½, East St. Louis & Suburban at 68, and Grand Rapids Railway preferred at 84½, and the common at 50.

At Cleveland, Northern Texas Traction featured and advanced to 36, making a high point record. A small amount of Miami & Erie Canal was unloaded at ⅞. Cleveland holders are less anxious to sacrifice than those in Cincinnati. There was considerable bidding for Aurora, Elgin & Chicago 5s, bids being three points above last sale; holders are asking 80 for these bonds. Cleveland Electric sold at 74 for a small lot.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid	
	April 19	April 26
American Railways	44	44
Aurora, Elgin & Chicago	a15	a14
Boston Elevated	140	142
Brooklyn Rapid Transit	44¾	46½
Chicago City	a162½	155
Chicago Union Traction (common)	5¾	5½
Chicago Union Traction (preferred)	30¼	30¼
Cleveland Electric	73½	72½
Consolidated Traction of New Jersey	64	64
Consolidated Traction of New Jersey 5s	105¾	106½
Detroit United	62	61⅜
Interborough Rapid Transit	107½	107⅝
Lake Shore Electric (preferred)	a40	—
Lake Street Elevated	3	3⅜
Manhattan Railway	141¾	142⅛
Massachusetts Electric Cos. (common)	19	20
Massachusetts Electric Cos. (preferred)	74¼	73
Metropolitan Elevated, Chicago (common)	15	15
Metropolitan Elevated, Chicago (preferred)	46½	46
Metropolitan Street	111¼	113
Metropolitan Securities	77¼	79½
New Orleans Railways (common)	9½	8
New Orleans Railways (prefered)	28½	28
New Orleans Railways 4½s	75	75
North American	81	82½
Northern Ohio Traction & Light	13	13
Philadelphia Company (common)	38⅜	39
Philadelphia Rapid Transit	13⅜	13½
Philadelphia Traction	95¾	96
St. Louis (common)	11¾	11¾
South Side Elevated (Chicago)	91	91
Third Avenue	120	120
Twin City, Minneapolis (common)	91	92¾
Union Traction (Philadelphia)	49⅝	49⅝
United Railways, St. Louis (preferred)	53	53
West End (common)	92	92
West End (preferred)	111	112

a Asked. * Ex-dividend.

Iron and Steel

The trade reports which have come to hand during the last ten days have suddenly weakened the more optimistic feeling which had begun to appear in the iron market. Doubt is now cast on the stability of the recent improvement, as something which went ahead too rapidly to last. In their haste to avoid a runaway market consumers of pig iron undoubtedly over-reached themselves in the active buying movement which set in six weeks ago. When the Steel Corporation canceled its large option order it gave the whole trade a rude awakening. Buyers saw they had been in too much of a hurry, and began abruptly curtailing their demands. Prices have not yet fallen, but it is a great question in view of the enormous addition to the recent output of iron whether a price reaction will not soon be due. The whole market continues to suffer severely from the shrinkage in the railway orders which are a part of the general policy of retrenchment that the railroad companies have inaugurated. This fact weighs much more than whatever slight improvement there might have been in the business supplied by the building industry. Quotations are as follows: Bessemer pig iron $13.85, Bessemer steel $23, and steel rails $28.

Metals.

Quotations for the leading metals are as follows: Copper 13¼ to 13⅜ cents, tin 28 to 28⅛ cents, lead 4 7-16 cents, and spelter 5¼ cents.

CHESAPEAKE TRANSIT MAKES PURCHASE—EXTENSIONS AND IMPROVEMENTS

The Chesapeake Transit Company, which operates an extensive electric railway system connecting Norfolk, Cape Henry and Virginia Beach, Va., has acquired control of the Norfolk & Southern Railroad, a steam line which has been a competitor of the Chesapeake Transit for the Norfolk-Virginia Beach traffic.

A. H. Flint, of Flint, Bacon & Company, of New York, formerly Flint, Jones & Company, is president of the Chesapeake Company, and J. C. Chaplin, president of the Colonial Trust Company, of Pittsburg, Pa., is vice-president. These gentlemen, together with Henry Sproul, of the New York and Pittsburg banking and brokerage house of Henry Sproul & Company, and J. T. Bacon, of Flint, Bacon & Company, compose the new directorate of the Norfolk & Southern, vice Chauncey M. Depew, Chas. T. Cox, E. V. W. Rossiter and George R. Turnbull, who have resigned. The new president of the railroad is A. H. Flint, he having succeeded John Carstensen, fourth vice-president of the New York Central Railroad, who, however, will remain on the Norfolk & Southern board. Henry Sproul has been appointed vice-president in place of Alfred Skitt. William S. Langford has been chosen as secretary and assistant treasurer. J. C. Chaplin is treasurer under the new regime.

The Chesapeake Transit Company now has 32 miles of electric railway in operation and proposes to equip electrically the steam line of the Norfolk & Southern lying between Norfolk, Virginia Beach and Cape Henry, a total distance of 27 miles. The company also intends to electrify the 22-mile line which runs from the Kempsville junction of the Norfolk & Southern to Munden's Point on Currituck Sound. This will give a total of 81 miles of electric lines. The central power station at Lynnhaven has a capacity of 2000 hp. It is equipped with General Electric apparatus, and the General Electric Company is now drawing up plans for the necessary machinery, etc, to take care of the proposed new mileage. Sub-stations will be built at both Kempsville and Virginia Beach. The additional cars to be used will be of Stephenson build.

Mr. Flint denies that the Gould interests are concerned in the Chesapeake, Norfolk & Southern deal.

COMPANY'S OFFER VOTED DOWN AT SAN FRANCISCO

The latest information concerning the negotiations being carried on between the United Railroads, of San Francisco, and its employees for a new working agreement to date from May 1, is that the men have just voted not to accept the terms of the company as given in detail in the STREET RAILWAY JOURNAL of April 23.

FAVORABLE REPORT OF NEW YORK CITY RAILWAY COMPANY'S SUBWAY PLAN

The plan and scope committee of the Rapid Transit Commission, of New York, on Thursday, April 21, practically decided to report to the commission in favor of the subway route proposed by the New York City Railway interests a few weeks ago. This runs down Lexington Avenue to Irving Place and Fourteenth Street, thence to Broadway, to Chambers, to William, through the financial district, and around the Battery, through West and Hudson Streets, up Eighth Avenue to Thirty-Fourth Street, and thence east to Lexington Avenue. It would afford a large loop system for the lower part of the city, and connect with the Grand Central Station and the new Pennsylvania station at Thirty-Third Street and Seventh Avenue. It is understood that the plan and scope committee are in favor of modifying this route so as to make it feasible for the Belmont interests to bid for the contract when it is let. Details of the proposal of the New York City Company, together with a map, were published in the Street Railway Journal of March 5, 1904. The estimated cost of this subway on the lines favored by Chief Engineer Parsons is in the neighborhood of $30,000,000.

Another thing favorably considered by the committee was the proposed route of an extension of the Brooklyn extension from Flatbush and Fourth Avenues down Fourth Avenue to Fort Hamilton. With this scheme is a tentative proposition for a new subway to run from the Williamsburg end of the new bridge to East New York. A subway over this route would be about 5 miles in length, and on account of the difficulty of constructing where an elevated road already occupies the street, its cost is put at $10,000,000. The extension down Fourth Avenue would cost not to exceed $6,000,000.

Importance is added to the decision arrived at by the plan and scope committee by the signing by the Mayor, of the two rapid transit bills which enable the commission to contract for new subways without being hampered by a $50,000,000 limit.

The Twenty-Eighth Ward Board of Trade, of Brooklyn, has sent plans to the committee for a tunnel from Union Square to Jamaica. The plans have been indorsed by every Board of Trade in the Eastern District, Brooklyn. They provide for a tunnel starting from Union Square, through East Fourteenth Street, New York, under the East River to North Seventh Street, Brooklyn, thence to Union Avenue, to Broadway and to Jamaica.

THE TERMS OF THE CONSOLIDATION OF THE APPLEYARD PROPERTIES

A. E. Appleyard & Company, of Boston, who control several important interurban properties in Ohio, have announced their plan for consolidating the various properties into the Ohio Union Traction Company, which was incorporated a short time ago. Holders of stocks and bonds of the Dayton, Springfield & Urbana Railway Company; Columbus, London & Springfield Railroad Company; Columbus, Grove City & Southwestern Railroad Company; Central Market Street Railway Company; Urbana, Bellefontaine & Northern Railway Company, Kenton & Southern Railway Company and Springfield & Western Railway Company are given until May 1 to exchange their 5 per cent bonds for the Ohio Union Traction Company's first and consolidated mortgage fives, based on their respective market values as follows:

For each $1,000 5 per cent bond of the Dayton, Springfield & Urbana Railway Company 110 and accrued interest in Ohio Union Traction Company first and consolidated mortgage 5 per cent gold bonds.

For each $1,000 5 per cent bond of the Columbus, Grove City & Southwestern Railway Company 105 and accrued interest in the Ohio Union Traction Company first and consolidated mortgage fives.

For each $1,000 5 per cent bond of the Central Market Street Railway Company 107 and accrued interest in the Ohio Union Traction Company first and consolidated mortgage fives.

For each $1,000 5 per cent bond of the Urbana, Bellefontaine & Northern Railway Company 105 and accrued interest in the Ohio Union Traction Company first and consolidated mortgage fives.

For each $1,000 5 per cent bond of the Kenton & Southern Railway Company 100 and accrued interest in the Ohio Union Traction Company first and consolidated mortgage fives.

For each $1,000 5 per cent bond of the Springfield & Western Railway Company 105 and accrued interest in the Ohio Union Traction Company first and consolidated mortgage fives.

For each share of Central Market Street Railway Company preferred stock 100 and accrued dividend in the Ohio Union Traction Company first and consolidated mortgage fives.

For each share of Central Market Street Railway Company common stock 30 in the Ohio Union Traction Company first and consolidated mortgage fives.

For each share in the Dayton, Springfield & Urbana Electric Railway Company preferred stock 95 and accrued dividend in the Ohio Union Traction Company first and consolidated mortgage fives.

For each share of the Columbus, London & Springfield Railway Company common stock 50 in the Ohio Union Traction Company first and consolidated mortgage fives.

For each share of the Columbus, London & Springfield Railway Company preferred stock 70 and accrued dividend in the Ohio Union Traction Company first and consolidated mortgage fives.

In all of the above exchanges of stock there will be 100 per cent bonus of common stock of the Ohio Union Traction Company. One hundred dollar receipts will be issued for parts of the amount, and fractions of $100 will be paid in cash.

Exchange mediums designated are A. E. Appleyard & Company, Philadelphia and Boston; Central Trust & Safe Deposit Company, Cincinnati, Ohio; Third National Bank, Dayton, Ohio; City Deposit Bank, Columbus, Ohio, and the Springfield National Bank, Springfield, Ohio.

An official statement is made by the company that the total bond issue, including the underlying issues, will not exceed $30,000 per mile of single track and $10,000 additional per mile of double track of main line, exclusive of turn-outs and sidings, outside of cities, and over $60,000 per mile of single track and $40,000 additional per mile of double track of main line, exclusive of turn-outs and sidings within cities, except that where lines are situated upon unpaved city streets the limitation shall be reduced by $5000 per mile.

The authorized capital stock of the companies to be consolidated is about $4,500,000, and the system includes about 165 miles of track, nearly all in operation.

PROFIT SHARING NOTES OF THE LONDON UNDERGROUND RAILWAY

Speyer & Company and Blair & Company, of New York, offer $10,000,000 5 per cent profit-sharing secured notes, due June 1, 1908, of the Underground Electric Railways Company, of London, England. The notes are offered at 96½ and interest. This is part of an issue of £7,000,000 sterling, of which $16,650,000 are payable in United States gold. The proceeds of this issue of notes are being used for the construction and equipment of the railways of the tube companies, and for electrically equipping the existing lines of the Metropolitan District Railway Company.

The Underground Railways Company of London, Ltd., has a capital of £5,000,000 fully subscribed (£2,500,000 paid up), and will control, through the ownership of securities and leases, the following railways:

Metropolitan District Railway, Baker Street & Waterloo Railway, Great Northern, Piccadilly & Brompton Railway, Charing Cross, Euston & Hampstead Railway, London United Tramways.

The Metropolitan District Railway is at present being operated by steam locomotives, but it is confidently anticipated that the electrical equipment will be finished and the road in operation under the new system by the end of 1904. The Baker Street & Waterloo Railway, Great Northern, Piccadilly & Brompton Railway, and the Charing Cross, Euston & Hampstead Railway are tube roads under construction. The greater part of the running tunnel of the Baker Street & Waterloo Railway, including the portion under the Thames, has been completed, and it is anticipated that this railway will be completed and in operation by the end of 1904, or shortly thereafter. The other two roads, it is expected, will be completed and in operation some time during 1904. The underground roads, when completed, will be about 45 miles in length. The London United Tramways system consists of about 30 miles of surface lines operated electrically.

The trust deed covering the notes provides that in case of the sale, while any of the notes remain outstanding, above 95 per cent, of any of the deposited ordinary shares of the tube companies one-half of the net profit shall be set aside by the company or trustee, whichever may receive same, for equal pro rata benefit of the notes outstanding.

The articles of association provide that Speyer & Company, of New York, the Old Colony Trust Company, of Boston, and Speyer Brothers, of London, shall during a period of ten years have the right to nominate a majority of the directors for the time being of the company, thus insuring a continuity of management.

Tickets for the through trip from Indianapolis, Ind., to Dayton, Ohio, have been placed on sale by the Dayton & Western Railway, the Richmond Street & Interurban Railway, and the Indianapolis & Eastern Traction Company. It is reported there is a good demand for them.

THE WORK OF THE LEGISLATIVE COMMITTEE OF THE OHIO INTERURBAN RAILWAY ASSOCIATION

The legislative committee of the Ohio Interurban Railway Association will make an interesting report at the meeting of the association to be held in Cleveland this week. The committee, composed of Warren Bicknell, president of the Lake Shore Electric Railway; H. C. Lang, of the Western Ohio Railway, and Judge Dennis Dwyer, of the Dayton, Covington & Piqua Railway, was appointed at the time of the Dayton meeting a month ago and had only a very short time to work in the Legislature, which adjourned last Saturday. During that time, however, the committee accomplished results that will be invaluable to the interurban lines of the State.

The most important step was the defeat of the Judy bill and the passage of the Bruce bill as a substitute. The Judy bill provided that electric roads should be taxed the same as express companies, telephone and telegraph companies, the basis being on the total of stocks and bonds issued. The result of such a bill would have been most disastrous. This bill had been favorably reported to the House and would undoubtedly have passed except for the efforts of the committee.

The Bruce bill, substituted for the above, provides that interurban roads shall be taxed the same as steam roads. The auditors of the various counties through which a line passes form an appraising board, and the taxes are distributed throughout the various counties upon a basis of the miles of road in a certain county. One of the most advantageous features of the bill is that power houses are considered as a part of the rolling stock of the road and not real estate, hence the tax on power stations is scattered throughout the various counties through which a road extends, instead of being taxed in the town in which it happens to be located. This has been the rule in the past, and where a power station had been located in a large city, the taxes have been excessively heavy. Heretofore the taxation of interurban roads has been indefinite, no law governing this point. While the Auditor of State has always instructed county auditors to tax such roads on the basis of steam roads, there has been no hard and fast rule on the subject, and where the village and township assessors have been familiar with the situation they have frequently caused the roads considerable inconvenience. In a great many cases after the county auditors have made their appraisments, the local boards of revision in villages and towns ships have stepped in and increased the tax on certain pieces of property. The interurban managers have been obliged to appeal to the State Board of Revision, as the State Auditor declined to take action on the matter, claiming there was no special legislation on the subject. It is apparent, therefore, that the passage of the Bruce bill will relieve interurbans of a large amount of trouble and excessive taxation. The legislative committee was assisted in the passage of this bill by a number of prominent electric railway men from various portions of the State.

The committee secured the passage of the Chapman bill, which makes possible the consolidation of interurban roads that are physically connected or that may be operated from one power station.

The Overturf bill, relating to grade crossings of interurban roads with steam roads, was passed. Heretofore the new road has been obliged to pay for the grade crossing. The bill saddles part of the expense of a grade crossing upon the old road.

The Hoiles bill, granting police powers to motormen and conductors, was passed, but it was amended through the efforts of the committee. The amendment provides that there shall be but one special policeman to 5 miles of track. This will enable the companies to select the men they desire vested with police authority.

The Heinlein bill, giving interurban roads the right of eminent domain in municipalities, was an important victory. This will enable interurban roads to condemn private right of way into a city or towns the same as a steam road.

Several obnoxious measures were killed through the efforts of the committee, among them the following:

The Schumen bill, which placed a special excise tax on interurban roads doing express business.

The Judy bill, which required the use of radiators or heaters in vestibules.

The Reynolds bill, which required electric roads to furnish the defendants with the names of witnesses in cases of accidents.

The Thomas bill, which required interurbans to erect waiting rooms at all stopping points, but not closer than one to the mile.

The Eggleson bill, which required roads to maintain overhead lights at all stopping points.

The Lerch bill, which required interurban roads to pay for sprinkling tracks in municipalities through which they pass.

MUNICIPAL OWNERSHIP SCHEME IN CHICAGO

The Municipal Ownership Central Committee has given out the following statement as the first steps urged toward municipal ownership under the Mueller law, which was adopted at the recent election:

For the purpose of testing the feasibility and legality of issuing street railway certificates under the Mueller law in order to raise money to pay for the street railroads of Chicago, the committee has decided to urge the acquisition of the lines of the Chicago Passenger Railway, either in toto or simply those which expire April 21 next. The reason the committee selected the Chicago Passenger Railway is because neither it nor its franchises are in any way affected by the ninety-nine-year act; because a large part of its franchises expire April 21 next, and the last April 8, 1906, and because the company is bound to remove its tracks and restore the street pavement at the end of its grant.

For the purpose of testing the power of the city to condemn the property and franchises of the street railway companies and for the purpose of obtaining a ruling as to the value of a franchise, the committee will urge that a suit be instituted to condemn the Clark Street and Wentworth Avenue line of the Chicago City Railway, which line raises most, if not all, of the questions to be raised concerning condemnation.

It is rumored that the receivers of the Chicago Union Traction Company and the shareholders of its underlying companies are unable to agree upon certain expenditures for improvements as opposed to apply the money toward dividends.

BILL FOR EMINENT DOMAIN IN MASSACHUSETTS

The committee on street railways of the Legislature has voted unanimously to report a general bill authorizing street railway companies of Massachusetts to take land by right of eminent domain.

The bill which the committee will report is as follows:

SECTION 1. No street railway company shall begin to construct any part of a proposed extension located subsequent to the first day of January, nineteen hundred and four, unless the same lies entirely within the limits of a single city or town, or incur any liabilities or issue any securities on account of such extension, and no company established subsequent to said date shall begin the construction of any part of its railway, or incur any liabilities or issue any securities, until the directors shall have complied with section thirty-nine of chapter one hundred eleven of the Revised Laws, all the provisions of which are hereby extended to street railway companies, nor unless the board of railroad commissioners shall grant a certificate that in their opinion the proposed railway or extension can be completed within the estimate of cost required by said section, and that the same when equipped for operation will be able to meet its proper fixed charges and the expenses of its suitable maintenance and operation, and that public necessity and convenience require the construction of the proposed railway or extension for the public accommodation in addition to that which is already furnished by existing railroads and street railways, or which, in the opinion of said board, the owners thereof are willing and able to furnish at less cost to the public for construction and equipment. In any proceedings relative to the granting of said certificate, existing railroad and street railway corporations shall be deemed to be interested parties, within the provisions of sections ninety-eight and one hundred of chapter one hundred twelve of the Revised Laws, and entitled to the benefits thereof.

SEC. 2. Any street railway company organized or in process of organization under the laws of this Commonwealth may, in the manner and under the conditions provided in sections nine, ten, and twenty-nine of chapter one hundred twelve of the Revised Laws, for the purpose of securing a more direct route, causing less interference with other uses of the highway, or operating its cars at a higher rate of speed in addition to the purposes specified in said section nine of said chapter, locate or relocate and construct, maintain and operate portions of its proposed or existing railway or any extension thereof upon private land outside the limits of public streets, roads and bridges; and any such company, duly organized according to law, may in the manner and under the conditions provided in chapter four hundred and seventy-six of the acts of nineteen hundred and three, take by right of eminent domain land or rights in land for any of the purposes above described in addition to the purposes specified in said chapter four hundred and seventy-six of the acts of nineteen hundred and three.

Governor Bates raised objection to the bills to allow the Old Colony Street Railway Company and the Bostorn & Northern Street Railway Company to refund their indebtedness on account of clauses allowing the two companies to take land by eminent domain to connect their power stations with their systems, and these clauses were stricken from the bills by the Legislature.

Members of the committee on street railways believe, however, that the Governor will approve a general bill affecting all street railways, though he is opposed to special measures which give certain roads the advantage.

The plans for the power station for the city terminus of the New York Central electric extension were filed with the city authorities on April 26. The station will be located on the south side of 149th Street, in the Borough of the Bronx, and 95 ft. from Long Island Sound. It will be a three-story structure 236.6 ft. x 156.4 ft.

WORK ON THE JOLIET, PLAINFIELD & AURORA RAILROAD

The Fisher Construction Company has vigorously taken up the completion of the Joliet, Plainfield & Aurora Railroad from Plainfield to Aurora, Ill. Since the work began April 1, the track has been laid from the center of the village of Plainfield west to the DuPage River, which will be crossed by a 155-ft. span steel bridge. The fills for both approaches of the bridge have been finished, and the concrete abutments are now being constructed. The bridge is expected to be in place by May 5. It is being erected by the American Bridge Company. About 2 miles of grading have been completed west of the DuPage River. Track is now being laid on this stretch, and it is expected to have the line finished to Normantown by May 15, and to Aurora by July 1. The railroad company has purchased ten acres of beautiful grove, located on either side of the DuPage River, immdiately south of the point where th road crosses the river. This property is being fitted up for picnic purposes. The DuPage River is being dammed at this point. This will give a 2-mile boating course and excellent bathing facilities. A livery of steel row boats and electric launches will be provided, all to be in readiness for the opening of the season.

BELGIAN CARS FOR MANILA

The cars to be used on the extensive electric traction system now under construction in Manilla, Philippine Islands, will be of Belgian manufacture. They will be built of teak, so as to withstand the ravages of the white ants so prevalent in the Philippines. The frames will be made of steel. Fifty-five ten-bench open cars to seat fifty passengers each have been ordered. La Metallurgique, of Brussels, secured the contract. The motors are to be of Westinghouse build. It will be recalled that the Manila system is being built by an American syndicate in which J. G. White, ex-President Buhl, of the Sharon, Pa., Steel Company; C. M. Swift, of Detroit, Mich., and the Westinghouse interests are chiefly concerned. J. G. White & Company are hastening the construction work to completion, and it is expected that the 30 odd miles of line will be in active operation by the close of the current year.

SOME RECENT FOREIGN RAILWAY REPORTS

At the sixth annual meeting of the Buenos Ayres & Belgrano Tramways Company, Ltd., held in London last month, the increase in receipts was reported as 7 per cent. New extensions are being built.

The Mersey Railway, which has recently equipped its line along the Mersey River with electricity, reports an increase in receipts of practically £8,000 for the half-year. The number of passengers during this time increased from 2,844,000 to 4,153,000. The train miles run during the last half-year were 400,000, as compared with 155,000 miles run during the half-year ended Dec. 31, 1902. The operating expenses per train mile under steam was 41.2d., as compared with 18.2d. under electricity.

The Anglo-Argentine Tramways, Ltd., report an increase in receipts during the year from £254,582 to £328,994. The operating expenses were reduced by £16,700, so that the net income of the company was £91,000 greater than in 1902. A dividend of 6 per cent on the ordinary shares was declared, £15,000 was devoted to the reserve and renewal fund, and £6,000 carried forward. A dividend of 5 per cent on the preference shares was also declared.

The Perth Electric Tramways shows receipts for the year amounting to £62,523, with a net of £29,971. The corresponding figures for the preceding year were: gross receipts, £56,157; net receipts, £20,591.

The Calcutta Tramways Company shows gross receipts of £113,756, operating expenses of £55,670, and a balance after crediting sundry receipts of £58,812. The directors recommend a dividend at the rate of 7 per cent per annum for the half-year, making 6 per cent for the year, after placing £12,418 for depreciation fund, and leaving £2,351 to be carried forward. The period under review has been the first complete year of operation by electric traction.

The Elevated & Underground Electric Railway, of Berlin, reports passengers carried on the main line in 1903 as 29,628,463, as compared with 18,813,994 in 1902. The gross receipts amounted to £190,903, and the operating expenses to £100,126. A dividend at the rate of 3½ per cent for the year on the capital of £1,500,000 was declared.

At the meeting of Willans & Robinson the reasons for the suspension of the dividends on the preference shares were pointed out. The chairman, Mr. Robinson, stated that the company was making gas engines of vertical high-speed type up to 250 hp, and larger engines of the horizontal type would be built. He also stated that the steam turbine work of the company was progressing, but that no turbines had yet been put in operation.

MINORITY HOLDERS WIN IN CHICAGO

Minority stockholders in the North and West Chicago Street Car Companies have gained a victory in the Union Traction case. By the decision of the United States Court of Appeals the decision of Judge Grosscup, concentrating all the traction litigation in the Federal Circuit Court, has been overruled, and the order restraining the prosecution of suits by the minority shareholders in the underlying companies of the Union Traction Company has been declared void.

By the decision of the Appellate Court the minority stockholders have won the right to attack the leases and contracts of the Union Traction Company in the State courts, and if the decision is sustained by the Federal Supreme Court the way is opened for a flood of litigation to test the validity of the modifications of the leases of the West & North Chicago Street Railway Companies. It renders the traction situation even more complicated than before.

REPORT OF CHICAGO UNION TRACTION FROM APRIL 23, 1903, TO FEB. 17, 1904

The receivers of the Chicago Union Traction Company have filed a report of the operation of the company from April 23, 1903, to Feb. 17, 1904, which shows as follows:

	301 days to Feb. 17, 1904	Year to June 30, 1902	Year to June 30, 1901
Passenger	$7,112,404	$7,801,076	$7,269,816
Advertising	27,940	33,525	33,525
Mail	25,783	19,779	15,101
Chartered cars	4,778	4,265	4,222
Rents	65,723	59,703	43,564
Total	$7,236,628	$7,918,348	$7,366,228
Receipts per day, passenger	23,629	21,373	19,916
Total per day	24,041	21,694	20,181

The report shows that the following amounts have been received from the sale of receivers' certificates:

August, 1903	$1,030,000
September, 1903	583,000
October, 1903	90,000
November 1903	10,000
January, 1904	50,000
February, 1904	400,000

The total amount of receivers' certificates outstanding is not stated.

OHIO & MICHIGAN COMPANY TAKEN OVER BY THE TOLEDO & NORTHWESTERN TRACTION COMPANY

The interests of the Ohio & Michigan Traction Company have been taken over by the Toledo & Northwestern Traction Company, of Toledo, Ohio, and the name of the latter will be retained. A syndicate headed by Lawrence Barnum & Company, of New York, has entered into an agreement to underwrite the bonds, and the company has closed a contract with the Patrick Hirsch Construction Company for the construction of the line from Toledo to Ann Arbor, Mich., the coming summer, work to start at once. At a meeting of the two interests held in Toledo a few days ago, J. H Southard, L. L. H. Austin, Col. J. C. Bonner, of Toledo; J. H Campbell, of Monroe, and John O. Zabel, of Petersburg, chief promoters of the Ohio & Michigan Traction Company, surrendered a certain amount of their stock in the company. The new Toledo & Northwestern Traction Company put up $200,000 as a guarantee of good faith with the Hirsch Construction Company. It is announced that the securities of the new company have been pooled for two years. The Hirsch Construction Company will open an office in Toledo, and material and equipment for the new road will be purchased in the near future. A considerable portion of the road was graded by the Ohio & Michigan Traction Company last summer. The line will extend from Toledo to Ann Arbor, Mich., by way of Milan, Dundee and Petersburg.

STREET RAILWAY PATENTS

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED APRIL 19, 1904

757,468. Brake Handle; Claude J. Kaplinger, Canton, Ohio. App. filed Dec. 7, 1903. The personal contact surface of the brake handle is insulated.

757,537. Method of Signaling for Electric Railways; Samuel M. Young, New York, N. Y. App. filed Nov. 6, 1903. Consists in creating a difference of potential between the traffic rails of the system, which separately form return paths for the power circuit and over which a current differing in character is flowing, actuating signal devices by the current due to such differences of potential, and shunting said current around certain of the signaling devices by the aid of apparatus actuated by the power current.

757,564. Electric Headlight; William H. Northall, Elwood, Ind. App. filed March 20, 1903. Means whereby the length of the arc may be adjusted, thereby permitting the lamp to be readily "turned down."

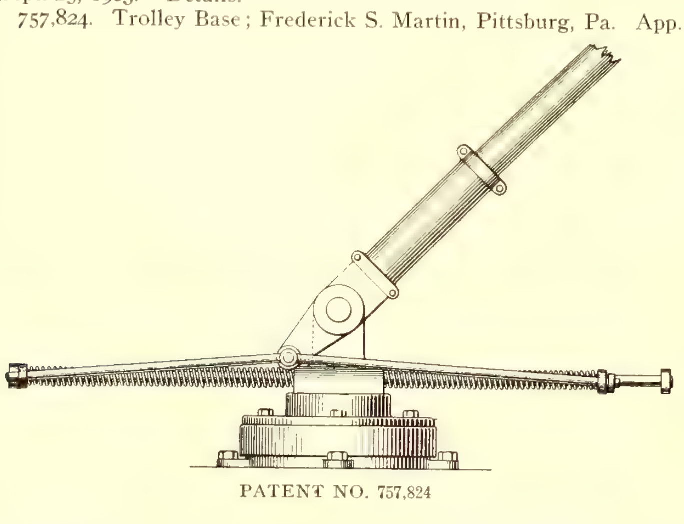
757,630. Safety Device for Trolley Poles; Phelam McCullough, Thomas Planey and Robert Baron, Liverpool, England. Details of a trolley-cord controlling spring drum.

757,746. Car Fender; Harry Howe, Toledo, Ohio. App. filed Dec. 10, 1903. A main and auxiliary fender and means whereby in case the main fender rises over an obstruction the auxiliary fender will come to operative position, both fenders being mounted on a common axis.

757,650. Means for Cleaning the Third Rails of Electrical Railways; Wilfrid Chausse, New York, N. Y. App. filed Sept. 30, 1903. A scraper consisting of a spring-depressed horizontal bar on which are mounted a plurality of diagonally arranged plates, the opposite ends of the plates being beveled at their opposite corners.

757,786. Trolley; Cyrus E. Smith, Fall River, Mass. App. filed Sept. 25, 1903. Details.

757,824. Trolley Base; Frederick S. Martin, Pittsburg, Pa. App. filed Sept. 4, 1903. The trolley base is ring-shaped and has a ball bearing upon a ring-shaped platform.



PATENT NO. 757,824

757,845. Car Fender; Earl Sherwood, Honesdale, Pa. App. filed Aug. 22, 1903. Comprises counterbalancing hanging devices, a separate pendent hanger and vertically-swinging counterbalancing members, the hanger members being provided with sockets or openings, and a folding fender frame having members separately and non-rotatably engaged in the sockets or openings of the hanger members.

757,906. Electric Railway; Geo. H. Frett, Springfield, Mass. App. filed July 14, 1903. By operating certain electric switches the motorman can move at will a switch point in the trolley wire.

757,910. Brake for Cars; William Gossett, Falls City, Neb. App. filed Sept. 10, 1903. The brake-shoes are so constructed and mounted as to be applied to the wheels and track rail at the same time.

757,925. Electric Switch; Charles F. Hopewell, Cambridge, Mass. App. filed Oct. 7, 1903. Details of a tappet switch for trolley wires.

PERSONAL MENTION

MR. W. H. HEULINGS, of the J. G. Brill Company, presented a lecture on "Types of Cars, their History, Design and Construction," at a meeting of the New England Street Railway Club, at Boston, on April 28.

MR. JOHN B. ALLAN, general manager of sales of the Allis-Chalmers Company, has resigned his position and expresses his intention of taking a vacation for a couple of months, in order to recuperate. Mr. Arthur West, assistant chief engineer of the Allis-Chalmers Company, has also resigned and will go to the Mediterranean for a holiday trip.

MR. GEORGE W. CUMBLER, of Highspire, Pa., president of the Steelton, Highspire & Middletown Street Railway Company, leased by the Central Pennsylvania Traction Company, of Harrisburg, Pa., is dead.

MR. JAMES SMITH, for fifteen years an official of the Consolidated Traction Company, of Jersey City, N. J., and recently division superintendent of the Newark division of the Public Service Company of New Jersey, died at his home in Newark a few days ago.

MR. S. S. BRADLEY has recently been appointed to the position of superintendent of the Scioto Valley Traction Company, with headquarters at Columbus, Ohio. Until March 1 Mr. Bradley was connected with the Seattle-Tacoma Interurban Railway as superintendent, in the employ of Stone & Webster.

MR. THOMAS C. PENINGTON, the popular secretary of the American Street Railway Association, was married at Chatham, Ontario, April 25, to Miss Ida Eileen Tompkins. Mr. Penington came East on his wedding trip and spent some time in New York, where he received the congratulations of all of his friends in this city who knew of his visit. After June 1, Mr. Penington will make his home at 4012 Drexel Boulevard, Chicago.

MR. JAMES M. JONES, assistant general manager of the Indianapolis Traction & Terminal Company, of Indianapolis, Ind., has resigned from the company to devote all his time to his personal interests. Mr. Jones has been connected with the company four years, during which time he made many friends. He formerly was Mayor of Kansas City, and has long been a firm friend of President Hugh J. McGowan, of the company.

MR. FRANK CHAPIN, the retiring assistant superintendent of the California Street Cable Railway Company, of San Francisco, Cal., was the recipient of a handsome diamond ring a few days ago from the employees of the company, on the occasion of his leaving the company to enter the employ of the new electric road in San Jose as superintendent. Mr. Chapin, who was very popular with the men, has been with the California Street Company for twenty-five years.

MR. ERVIN DRYER has resigned his position with the Westinghouse Electric & Manufacturing Company, and has accepted an appointment with the Allis-Chalmers Company. Mr. Dryer's connection with the Westinghouse Company extended over a period of sixteen years. He is one of the most competent salesmen in the electrical and mechanical field, and his wide acquaintance throughout the Western parts of the United States will be of great service to the Allis-Chalmers Company in the extensive new developments which it has undertaken. Mr. Dryer has already entered upon his new duties with the Allis-Chalmers Company, and his headquarters will be at its offices in the New York Life Building, Chicago. He will give his attention to the company's engine work as well as to the sale of Bullock electrical apparatus, which the Allis-Chalmers Company now controls.

MR. W. O. MUNDY has tendered his resignation as master mechanic of the St. Louis Transit Company, to take effect May 1. During Mr. Mundy's term of office many important improvements have been made, including the building of the new repair shops, which contained so very many excellent features that much space has been given to a description of them in these columns the past year. Previous to going to St. Louis Mr. Mundy designed and worked out the engineering details of the General Electric Company's type-M train control system. He is known as one of the leaders in his profession, and has contributed many ideas of value to electric railway shop practice and railway controller and motor construction. Labor-saving methods have been carried to a high state of perfection by him in the St. Louis shops. Recently he has invented an air-brake appliance, the details of which are not yet public, but which promises a marked economy in air consumption without undue complications.

W. O. MUNDY

INDEXED

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, MAY 7, 1904 No. 19.

Published Every Saturday by the

McGRAW PUBLISHING COMPANY

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues)............................... $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Hoisting Facilities in Shops

The speed and economy with which ordinary repair and renewal work can be carried on in an electric railway shop depends more on the hoisting facilities than on any other mechanical feature in the shops. When it is remembered that no small part of the repair work of a shop consists of hoisting and lowering car bodies, wheels, armatures and other heavy parts, it is no wonder that the best master mechanics are giving their most earnest attention to these matters. The investment in proper hoisting apparatus sometimes looks large to the directors, but it must be remembered that if considerable money is to be spent in this kind of apparatus it is well to spend enough to have it operate with sufficient rapidity to justify the investment, and not stop just short of that mark. To illustrate, it is poor economy to put in expensive traveling cranes or any other kind of overhead hoisting apparatus and equip them with slow hand-operated tackle.

On the other hand, it is useless to install expensive apparatus of this kind when the remainder of the shop equipment is of such a character as to waste the time saved by the crane. The entire equipment depends for its speed on the slowest part, so that if the cranes are not operated electrically, pneumatically, or by hydraulic means, it is often better to use some of the most efficient hand jacks, which call for little investment and can be used anywhere. Not that we advocate hand jacks where something better is justified, but there is no use in spending money unless enough is spent to make some real gain. We have seen hoisting apparatus, cranes and the like put up at considerable expense only to be handicapped by some antiquated method of actually doing the heavy mechanical work. For example, a traveling crane which can only be moved by several men, who must have the way cleared before them as they drag the crane through the shop, is hardly what one would call a good investment.

The Importance of Reporting Car Service

The description of the new system which the Brooklyn Rapid Transit Company has recently installed for the systematic reporting of its car service, with reference to the tracing of irregularities of headway, which is presented in this issue, calls attention to the importance of street railway systems having adequate means of this kind for examining and keeping track of the quality of service which they are rendering to the public. Few lines have given this matter sufficient attention, and the majority have no system whatever for tracing their car service. If a complaint is received that a serious delay has occurred on a certain line, it is usually impossible for the company to ascertain definitely what the service happened to be on that line at the particular time referred to. The advantage and real importance of a knowledge of these features of the car service of a large system can be readily appreciated by those particularly who have to face the complaints of the public.

We are pleased to be able to place on record a description of so complete a system as has been installed in Brooklyn. A most complete report is made of the regularity and condition of the service on each one of the various lines in operation, so that if a delay is complained of wrongfully or is exaggerated, the company has complete and accurate records with which to face the complainants in a most positive manner. Complainants are apt to abuse the privileges afforded them in making charges of this nature against the service, and the trouble that can be saved for a company, in this way alone, will often warrant the adoption of such a system. But of greater importance is the possibility opened up to the company of observing the actual results of improvements which it has made to the service by this record system. In no other way is it possible to ascertain so cheaply the effect of increased car service upon the number of passengers carried. The effects of delays are shown equally as well, and the causes can easily be traced in this way. A system of this nature serves as the "bookkeeping system" of the car service for the operating department, and should be pro-

vided for and maintained with as much care as the bookkeeping required in the financial department.

In confirmation of the benefits claimed for the use of this system the improvements that have recently been made by the Brooklyn Rapid Transit Company in its service on most all of its lines may be recalled. Before this system was installed complaints from the public as to irregularity and inefficiency of service were the rule rather than the exception, and the company had no means of proving its attempts to better the service. Since the installation of this system, however, weak points needing attention were revealed and were quickly remedied, and in other particulars where the service indicated a need of improvement additional car service was provided and attempts were made to improve the regularity of headways. While this new record system has only been in use during the past few months the results upon the service have been remarkable. So satisfactory has been the service to the public that not a single complaint has been received of irregularities of headway since the first of the year. There is no doubt, also, that the moral effect of this record system upon the employees has had a great deal to do with the improvement of the service, but of the greatest importance is the fact that has enabled the officials in charge to know exactly what is happening on every line, and upon whom to call for explanations as to bad service.

This again calls to mind the fact that the great desideratum in street railway operation in large cities is not so much a large number of cars in operation, or high-speed movements, but rather regularity of headway. The most disagreeable thing to a passenger is that of having to wait unnecessarily long for a car. If the headway is kept regular and the cars properly spaced apart the public will be satisfied in spite of other important shortcomings upon the part of the operating company.

The Coming Park Season

Scarcely does the street railway manager of Northern latitudes lay down the snowplow and the shovel before the question of park business for the coming summer demands attention. The effect of these resorts in stimulating traffic is now so well realized by operating officials that at this time there would seem to be little need of dwelling upon this phase of the subject. In the light of past experience, however, it is worth while at the beginning of a new season to consider what some of the essentials of success may be.

One of the first things to realize in carrying on a street railway park or planning such an enterprise is the great variation of taste and capacity for enjoyment which characterizes the general public. In just so far as everyone's personal enjoyment can be appealed to successfully will the traffic grow in magnitude. Of course, one must realize at the outset that it is next to impossible to suit everybody at one and the same time, but this is the mark to aim at. Many who go to these parks are unhappy unless a constant whirl of excitement and interest surrounds them; others desire to escape the brass band and flying horses, preferring to paddle silently up secluded river or pond channels where animal, insect and vegetable life are supreme. The manager who can provide within the limits of a single park system these two extremes; who can separate by invisible boundaries the lands of forest and hurdy-gurdies, and who can retain the attractiveness of each, bids fair to reap a harvest at the end of the season.

The choice of a park location profoundly influences the future of the enterprise, and it is not a matter to be settled in a three-minute consideration of the problem. A winter examination may fail to uncover many natural advantages, even as it may also overlook malarial and unsanitary surroundings. If it is possible to do so, the site of a proposed park should be visited in both winter and summer, and as any such resort is fundamentally supposed to be healthful as well as recreative, it is emphatically worth while to obtain the disinterested judgment of one or more reputable physicians upon the former qualification before definitely deciding to develop the place for public uses.

It is a mistake to suppose that heavy expenditures are essential to make every park attractive. A very little money will do a great deal toward putting a park on its feet if the location is attractive and not too far from the centers of population. Rustic seats may be thrown together with small expense and placed here and there among the trees and in the open; swings, hammocks and poles for climbing do not involve serious outlays, while the construction of a neat and tasteful bandstand, or a simple out-of-door theater is not an expense to cause recalcitrant directors to balk. If the theater plan is inadvisable it is generally possible in cities large enough to require an outside breathing space to give band concerts two or three times a week throughout the summer. Then, too, the purchase of a few good boats is nearly always an excellent investment, for a park without a pond or river and light water draft is deprived of no small source of pleasure and profit.

While it is true that a well-conducted and attractive park is its own best advertisement, it is none the less advisable for the operating company to make effective the advantages of the place known at home and abroad, by judicious use of suggestive newspaper hints, announcements of attractions in the card racks of its cars, and the distribution of pithy pamphlets artistically illustrated by photographs of the park scenery. There is little doubt that the possibilities of this kind of advertising are a long way from being exhausted. Whatever else such pamphlets tell, the running time of cars, fares and distance of the park from important points in the vicinity, should not be left out. Often the profit on advertisements in these publications easily pays the cost of the descriptive work, although there is a difference of opinion as to the policy of admitting advertisements to this class of pamphlet.

There is also room for divergent views in considering who shall superintend the detailed operation of parks. If the theatrical features are very prominent the problems of successful management call for special knowledge and time which an active railway man usually cannot give up. It would seem to be the part of wisdom either to lease this part of the park to an outside person or else to turn such details over to an official whose experience and duties will enable him to get the most out of the property in large systems, which would otherwise be embarrassed by park and amusement management. Small parks, chiefly attractive through natural location and surroundings, are generally best managed by the street railway company itself. Care should be taken by the railway company to retain general oversight in all cases where the superintendence and operation of a park is sub-let to parties outside the direct influence of the transportation system.

Finally, every effort should be made to throw open the great public reservations and park systems near the large cities to every man, woman and child who can be drawn out of the crowded districts into the beneficent regions of woods and fields. Attempts to prevent the running of trolley cars to the entrances of these reserved tracts of forest and meadow block the pro-

gress of suffering humanity toward the relief which fresh air and sunshine alone can give to the much elbowed dweller in flats and tenements. The purpose of the State in setting aside these regions for public use is thwarted if the only transportation available is that given by horses and automobiles. Even temporary relief from the wearing strain of twentieth century city life is helpful in the cure of social evils common to congested population. The automobilist often complains that he is shut out of these park reservation roads by unjust laws, but he has only himself to blame, through his dangerous and reckless speeding. Certainly if an automobile is allowed to scorch through these counrty roads like an avenging Juggernaut, the electric car should be permitted to operate at moderate speeds over a fixed pathway in the same region, for the purpose of carrying weary thousands to rest and recreation. In many cases it is probably best that the park reservations themselves should be free from both automobiles and cars, but the extension of transportation facilities to the entrances is demanded by every consideration which has the welfare of humanity at heart. In the furtherance of this work the street railway has the opportunity of doing great public good.

The Steam Piping System

Probably no feature of the power plant equipment has received so much careful attention and thought in its arrangement and design, and has yet proved so generally unsatisfactory, as has the high-pressure steam piping system. It has, as is so well known, too often been considered a matter of minor importance, and almost any arrangement that would get steam to the engine has been made use of, with the usual unsatisfactory results. On the other hand, even with the greatest possible care and forethought exercised in the design and installation of piping systems, successful results have not always been obtained, and it devolves upon the power plant engineers to give even greater consideration than ever before to this important detail of power plant work, particularly in view of the increasing pressures used and the use of superheated steam. An unfortunate feature of the design of a steam piping system is that an application of theoretical laws gives no clue to the practical solution of the problem; experience is absolutely the only guide in this work, and it has, indeed, proven to be a very expensive teacher.

As a result of protracted and troublesome experiences the fact has become settled and well accepted that simplicity of arrangement and detail is one of the most important factors to be sought for in the design of a steam piping system. Everything that contributes to complication in high-pressure steam piping seems to entail very detrimental results. The more sections, fittings, parts, connections, etc., that are used, the more joints and weak places are introduced which can and will get out of order and give trouble in the form of wasteful leaking; practice shows that they do invariably get out of order, and that the resulting trouble increases in proportion to the number of joints and connections used. This has proven a very serious matter in large systems, and has in most cases increased the expense of maintenance of the piping system to the real burden. The use of all ring or other duplicate systems of piping wherein complication is involved is thus discouraged, and it is to be noted that in recent new plants longer lengths of pipe are coming to be used and the number of extra fittings is being reduced to the lowest possible, consistent with flexibility of arrangement.

The trend of recent power plant practice is to make use of the general steam piping plan, involving the simple steam header placed crosswise between the engine arrangement on one side and the boilers on the other; this is being generally made possible by the tendency toward the parallel arrangement of boiler and engine rooms in power plant construction, so that the header may be conveniently located longitudinally along the separating wall between the two rooms, and the boiler and engine connections made direct and as short as possible therefrom. This arrangement in conjunction with the proper use of stop valves, evolves the multiple-unit idea of a grouping of individual power plants, each with its boiler and engine equipment arranged side by side, thus allowing each adjoining group of boilers and engine to operate independently of the others, if desired. Such an arrangement has been found most conducive to reliability of operation on account of the possibility of separating different parts of the plant apparatus off into units in case of necessity of repairs, thus making the duplicate system unnecessary. It also results in the most simple and direct arrangement of the steam connections possible between engines and boilers which will provide interconnections. It is also very favorable to the use of long-radius pipe bends for all branch connections, by which expansion is freely provided for with no extra joints.

In recent practice the use of the receiver in the piping between boilers and the engines is becoming very marked, and particularly in plants where the service is variable is the value of such a storage reservoir felt for meeting quick demands due to fluctuations. In some cases the main steam header is made to serve as one large continuous receiver, from which the engines take their steam supply directly, while in other installations the use of individual receivers in the connection to each engine is to be seen. Notable among the former class may be mentioned the power plant of the Elizabeth, Plainfield & Central New Jersey Railway Company, at Cranford, N. J., which was recently described in these columns. In this plant a single 14-in. header, 81 ft. long, without a break in it, is in use; this provides a receiver capacity which is ample, and which cannot be lessened, as there are no stop-valves in it, so that it cannot be divided. Each pipe branching away from it is, of course, provided with one or more valves, but a constant receiver capacity is ensured. The suggestion has arisen that in case of accident to this header the plant will be entirely shut down, as no provision has been made for cutting out any section of the same in case of trouble; but the extreme simplicity of design which was worked out in this case has placed the installation in the best possible shape to avoid trouble, and almost none is to be ordinarily expected. By the use of carefully installed metallic gaskets and frequent inspections, the header connections may be kept very tight, and in any event the very small number of joints will reduce the trouble from leakage to a minimum.

In another large installation, in which a similar arrangement of longitudinal steam header is used, a separate large receiver is connected into each engine branch, so as to provide a large steam storage capacity for the engine. In this particular case the steam receiver was found in the earlier experience of the engineers in charge to be of great advantage in connection with street railway power plant work. The rapidly fluctuating loads which were formerly found to present serious difficulties are now much more easily handled by the engines, on account of the much more even steam pressure supplied when most needed, as shown by indicator tests at the steam pipe connections to the engines.

SOME OF THE ELECTRIC RAILWAY FEATURES AT THE WORLD'S FAIR, ST. LOUIS

BY WINDER ELWELL GOLDSBOROUGH

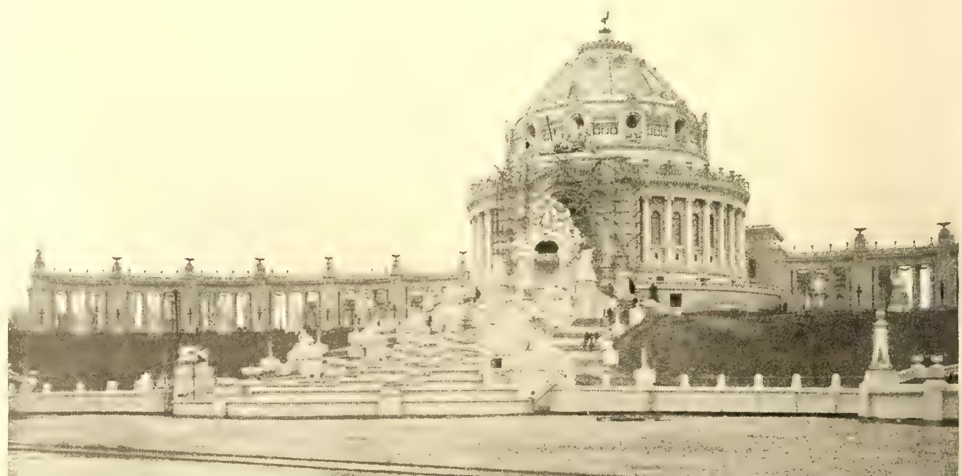
Of all the departments of electrical work there is no one which commands the attention of the engineering world more emphatically than does that of electric railway engineering. The interests centered in this field represent, in money value, far more than do those of any other branch of electrical activity, and the number of employees connected with electric railway properties outnumber those connected with other electric properties in about the same measure. Unfortunately, it cannot be said that the average of engineering ability possessed by the employees in the rank and file of electric railway undertaking measures up to that which is common in central station light and power plants, in telephony, or even in telegraphy, and any venture which will tend to stimulate interest in the technical side of electric railroading among the younger generation of engineers should be welcomed by the older men in the profession, and by the financiers connected with electric railway undertakings as well.

One of the movements which is developing with rapidity and assuming a very important aspect has been brought about by the active efforts of the Electric Railway Test Commission of the St. Louis Exposition. This commission was appointed by President Francis on Nov. 13, 1903, and consists of J. G. White, president J. G. White & Company, New York, chairman; H. H. Vreeland, president New York City Railway Company, New York; George F. McCulloch, president Indiana Union Traction Company, Anderson, Ind.; James H. McGraw, president McGraw Publishing Company, New York, and W. J. Wilgus, vice-president New York Central & Hudson River Railroad Company. Soon after the organization of the commission very active work was begun to devise ways and means for carrying out investigations on all available types of electric railway apparatus now in use or that is being placed on the market.

In a matter of this kind a great deal that "is not" has to be created. When entering upon an investigation of engineering appliances which have so many ramifications as do electric railway apparatus, large resources are required properly to meet unusual requirements, and it is no small undertaking to provide these. However, through co-operation, which is so marked a characteristic of the American people, much can be accomplished; and it has been through the united interest of those associated in the manufacture, the construction, the operation and the study of electric railways that the arrangements are now assuming so gratifying scope.

FRONT FACADE OF PALACE OF ELECTRICITY AT ST. LOUIS

The Exposition has come to the assistance of the commission, and set apart for its use terminals and tracks sufficient to accommodate twenty-four standard cars, and provide for the tests of these cars under all ordinary conditions likely to be met with in city or local interurban traffic. To take care of the more extended tests, recourse has been had to the very generous offer of the Indiana Union Traction Company, which has provided complete facilities for carrying on the high-speed tests in so far as a heavily ballasted, heavily railed, high-power line, level and straight for a distance of 8 miles, can meet such requirements.



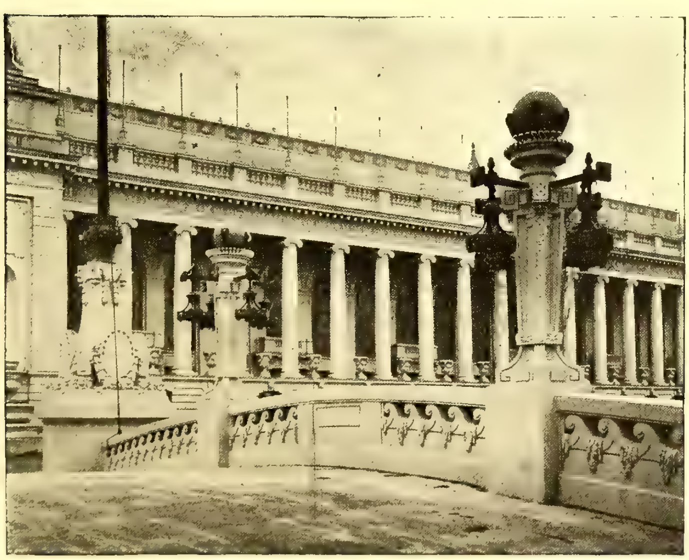
CASCADES AND THE ELECTRIC FOUNTAIN.

The electric railway test tracks and test-track terminals at St. Louis are entirely on the Exposition grounds. The test

tracks parallel the Transportation Building, running east and west along its north side. The test track terminals are to the west of the Transportation Building, and just north of the section of the grounds which is devoted to the foreign buildings. Everything is very conveniently arranged, as the tracks are quite near the power plant in the west end of Machinery Hall, as well as being within easy reach of the Electricity Building, wherein the standardization laboratory of the National Bureau of Standards and headquarters of the Electric Railway Test Commission are located. Probably, at this time, the importance of the laboratory, fully equipped and thoroughly organized, which has been made a feature of the exhibits in the Palace of Electricity, is not thoroughly appreciated by the electrical fraternity. When the installation of this laboratory is completed, it will undoubtedly be the finest electrical engineering standardization establishment in the world. It is fully equipped in all of its departments to take care of any demand that can reasonably be made upon it between the ponderous generators of Machinery Hall on the one hand and wireless telegraphy on the other. A complete cold storage plant eliminates all complications which ordinarily arise from temperature variations, and a corps of twenty trained assistants makes it possible to carry on a large amount of work, and do it well, in a short time.

MAIN ENTRANCE TO PALACE OF ELECTRICITY.

It is to this laboratory of the National Bureau of Standards that the Electric Railway Test Commission will turn for the calibration of all instruments used in its tests, and, if the expectations of the commission are realized, the work demanded of the laboratory by the commission will represent no small part of the large work which the laboratory will be called upon to do in connection with the many electrical devices which are subject to test and inspection at the Exposition.



ONE OF THE MANY BRIDGES ON THE GROUNDS, SHOWING ARTISTIC METHOD OF ILLUMINATION

There are other things, however, demanded besides a place to make the tests and instruments with which to test. A skilled corps of expert electric railway men must be at hand, and the commission has not been negligent in seeking out the best which the electric railway field in America affords in obtaining advice as to what is most to be desired in connection with work of this class.

One of the first steps taken by the commission was to invite the co-operation of electric railway engineers in mapping out a definite scheme for the organization of the tests in the several divisions of electric railroading. Four committees were appointed, and they immediately responded to the call of the commission:

(1) Committee on city and suburban electric railway equipments.

(2) Committee on interurban electric railway equipments.

(3) Committee on heavy traction equipments.

(4) Committee on new electric railway systems.

These committees diligently set about the preparation of their special reports (a digest of these has appeared in the STREET RAILWAY JOURNAL), and, taken collectively, these reports represent, in themselves, a very valuable addition to electric railway literature. They embrace the best thought of the best men on special and specific subjects. What more can be asked when much is desired? These reports are now in the hands of a committee of experts, employed by the commission to actively supervise the tests.

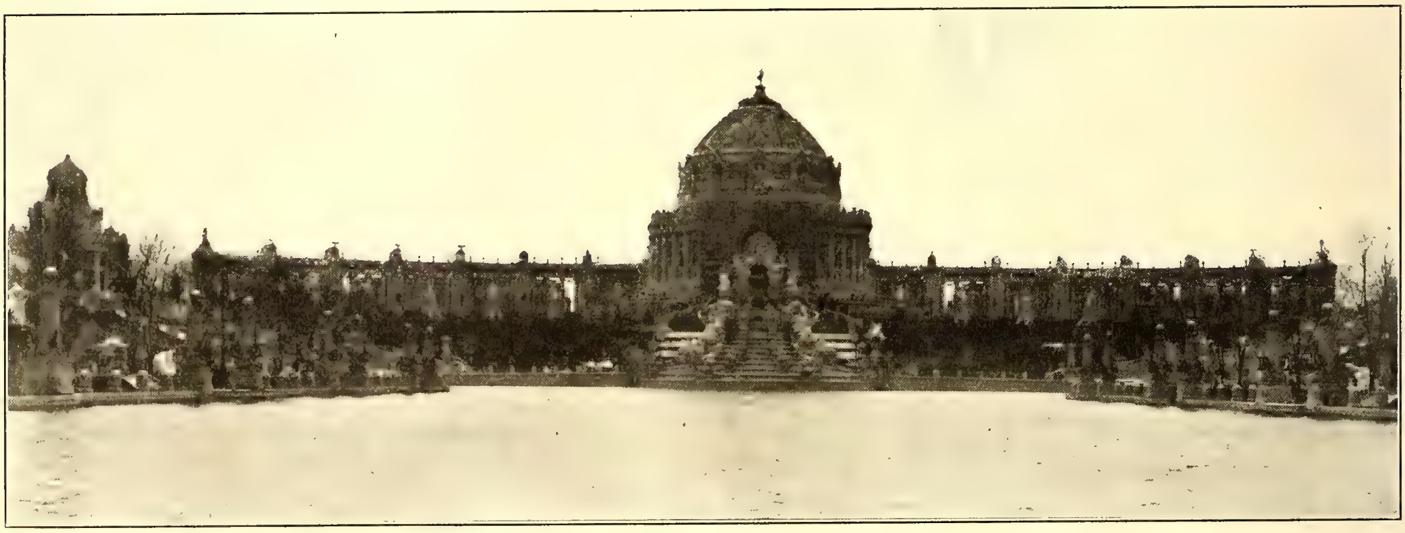
The commission has appointed Profesor Henry H. Norris, of Cornell University, superintendent of electric railway tests, and Professor B. V. Swenson, of the University of Wisconsin, and Professor J. W. Esterline, of Purdue University, assistant superintendents of electric railway tests. These gentlemen are now engaged in preparing a final report upon the specific work which is to be done, having at hand all of the information available concerning the facilities for carrying out this work, supplemented by special reports of the committees above referred to.

The Electric Railway Commission has also appointed an

advisory committee, consisting of A. H. Armstrong, of the General Electric Company; Clarence Renshaw, of the Westinghouse Company, and Ward S. Arnold, of the Bullock Electric Company, to act in conjunction with the other experts in an advisory capacity, and especially in matters related to the special features of the various equipments. The committee of superintendents and the advisory committee, together with the chief of the Department of Electricity, form a general committee, reporting to the Electric Railway Test Commission.

THE PALACE OF ELECTRICITY FROM THE JAPANESE GARDENS, DURING THE RECENT SNOWSTORM

WEST RESTAURANT BUILDING AT END OF COLONNADE OF STATES



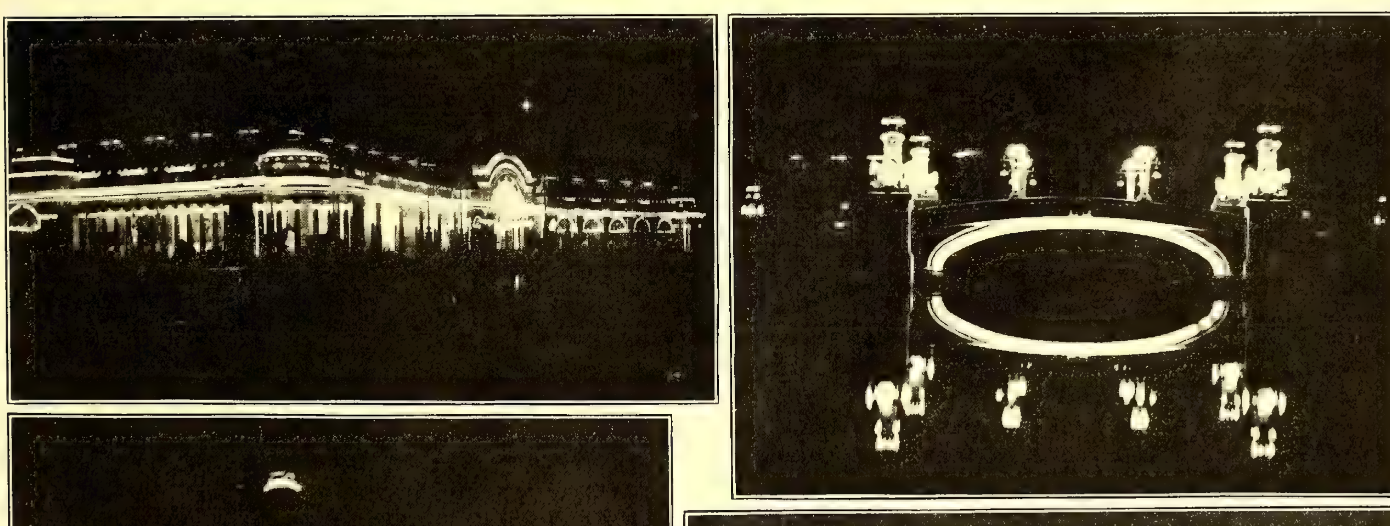
FESTIVAL HALL, IN WHICH THE STREET RAILWAY CONVENTION IS TO BE HELD, COLONNADE OF STATES IN REAR

Necessarily, in a scheme so broad in its scope as that which has grown out of a small beginning, through the diligent efforts of the Electric Railway Commission, a great many observers and computers will be required to make the work a thorough success. To this end, about thirty young engineers will be on duty during the summer and fall assisting in making records, and in keeping the derived results constantly abreast of what may be termed the "field work." In all, therefore, the undertaking is sufficiently broad and sufficiently well safeguarded to meet the ideas of the most exacting.

MACHINERY HALL, THE TRANSPORTATION BUILDING AND THE PALACE OF ELECTRICITY FROM FESTIVAL HALL

The scope of the tests, as related to the equipments to be tested, is as broad as is the scheme gaged from other aspects. All types of electrical apparatus used in the operation and

MAIN ENTRANCE TO MACHINERY HALL



TYPICAL VIEWS OF BUILDINGS TAKEN AT NIGHT

control of electric cars and railway systems come under the plan and scope of the tests, consequently a large variety of apparatus must be investigated, whether it relates to general operation, individual control, multiple control, train despatching, or other matters. All standard systems coming under the head of direct-current equipments and systems coming under the head of alternating-current equipments are at present being arranged for exhibit at the Exposition. The field will be covered very broadly, and the electric railway fraternity at large will have cause for congratulation in reviewing the very broad presentation which is given to this department of engineering work. Probably, no more general classification of electric railway items, ranging from light to very heavy equipments, has been brought together.

Thirteen different systems of electric railway apparatus are displayed for operation and test in the Palace of Electricity, and, at the present writing, nine additional systems are submitted for outdoor operation on the electric railway test tracks; and all this has been arranged and provided by the voluntary action of the parties interested, each working largely without the knowledge of the plans of the others.

Now that a more definite statement can be made it is to be expected that the manufacturers of electrical apparatus will supplement their voluntary offerings with a more comprehensive display of their apparatus, in order that city, suburban, interurban, heavy traction and special systems may be fully represented.

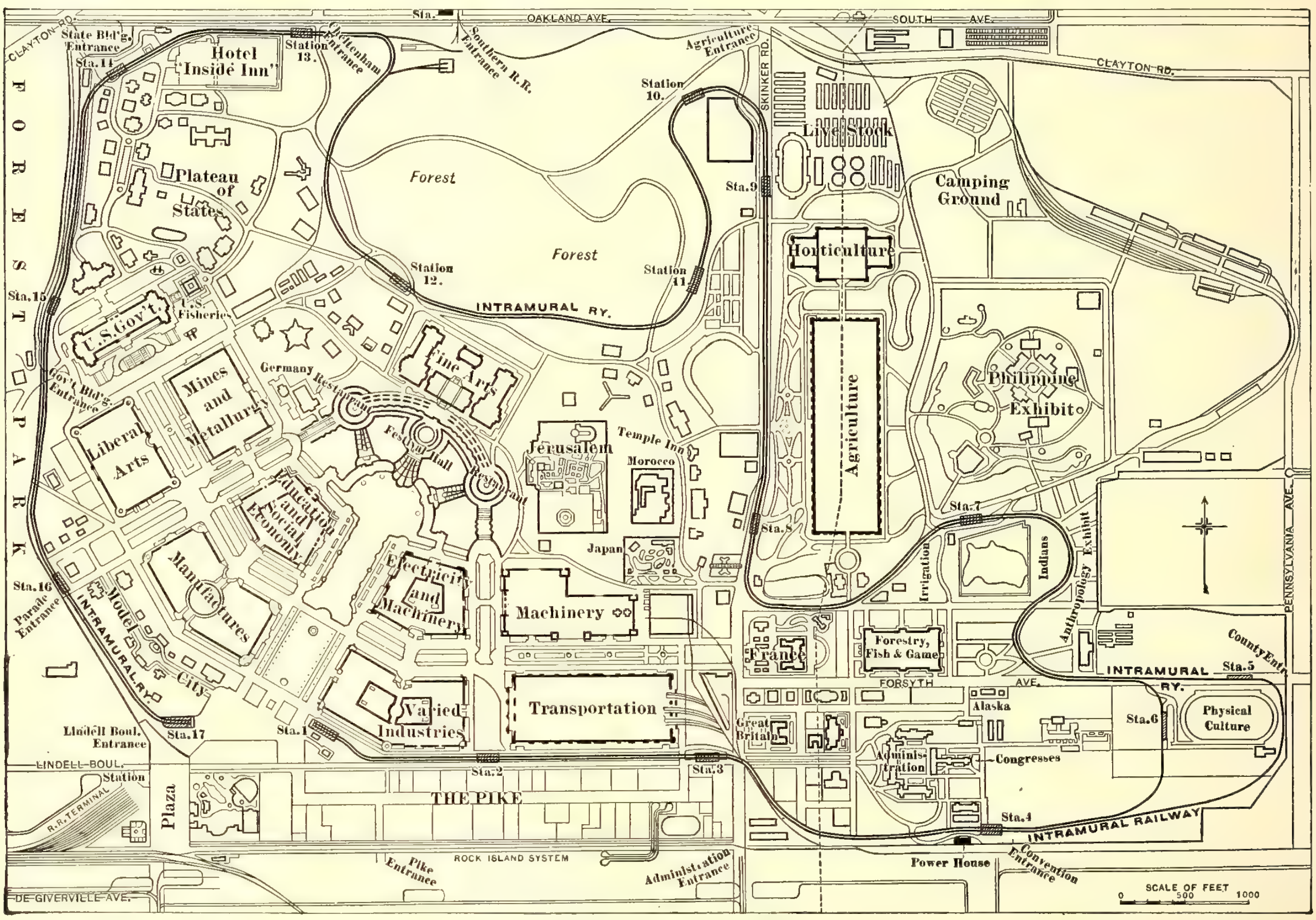
It is unnecessary here to catalogue, in itemized form, all of the apparatus which will be shown. Suffice it to say that the Palace of Electricity, the electric railway test tracks, the Palace of Transportation, the outdoor mining installation, and the German outdoor electric railway train control exhibit, will be the chief centers of interest to the electric railway public which visits St. Louis this year.

STREET RAILWAY INTERESTS AT THE FAIR

The great Exposition formally opened at St. Louis last Saturday will probably, before the season closes on Dec. 1, be visited by no small proportion of the electric railway men of the country. The decision to hold the next convention of the American Street Railway Association at St. Louis next October, and the holding of the electrical congresses in September, all serve to add to the general interest that electric railway men must feel in the great international show at St. Louis.

It would be useless to attempt here to review all the features of popular interest at this Exposition, and these remarks must, of necessity, be confined to an outline of the things of interest to the electric railway man in his profession.

First of all, to give a general idea of the arrangement of the Exposition the accompanying map can be studied. The main courts and buildings radiate like a fan from Festival Hall and the Cascades, which form the central features of the main panorama. Most of the main buildings, which are on these three radiating courts, are on low, level ground, while Festival Hall is on high ground on the edge of a bluff. The Cascades, which are a series of artificial waterfalls in front of Festival Hall, start at the foot of Festival Hall, and the water falls, step by step, to a lagoon in front of the Cascades. Three large courts radiate from the Terrace of States, of which Festival Hall is the center.



MAP OF THE EXPOSITION GROUNDS

On the west court are located the Electricity and Machinery Buildings and the Transportation Building, which will be the points of most interest from the electrical railway man's standpoint. The exhibit in the Electricity Building will consist mainly of smaller electrical apparatus, as most of the large generators shown will be located in the Machinery Building, where they will furnish power for the operation of the Exposition. The Machinery Building is the power house of the

Exposition. Here is located a service plant of 8000 kw, and also an exhibitor's power plant, consisting of engines and generators furnished by the different exhibitors, and all arranged to supply power for exposition purposes. All the steam for engines in the Machinery Building is furnished from a boiler house, known as the Steam and Fuels Building, just west of Machinery Building. This arrangement, which is shown on the map, has necessitated some excessively long steam pipe lines, amounting in some cases to several hundred feet, for units of considerable size. Adjoining Machinery Building on the north is the Transportation Building. This building is devoted mainly to track space for exhibits of rolling stock; in it electric railway trucks and car bodies will be shown, and also some electrical apparatus. The electrical apparatus, however, comes under charge of the Department of Electricity. Just north of the Transportation Building are two test tracks, to be used in electric railway testing. One of these test tracks is 1400 ft. long, and the other 2000 ft. The shorter one will be used for testing slower speed apparatus on short distance runs, and the longer track for testing high-speed apparatus. This is the first Exposition at which the actual testing of electric railway apparatus offered for exhibit has been attempted on a large scale. The plans of the electric railway test commission are discussed elsewhere in this issue by Prof. W. E.

Copyright 1904, Louisiana Purchase Exposition Co. A CORNER OF THE PALACE OF ELECTRICITY

Goldsborough, chief of the Department of Electricity, and were also described in the issues of March 26 and April 23, 1904.

THE INTRAMURAL RAILWAY

The Intramural Railway, which will furnish local transportation in the Exposition grounds, is located so as to form a

ENTRANCES TO TRANSPORTATION BUILDING

kind of outer belt line around the principal portion of the Exposition. The necessity for an intramural railway at the Exposition will be apparent when it is stated that the Exposition grounds cover about 1240 acres, as against 633 for the

World's Columbian Exposition at Chicago, and everyone who visited Chicago became fully aware of the great distances within that Exposition, and the necessity for intramural trans-

A CORNER OF MACHINERY HALL

portation. The original plans for this intramural railway were drawn up by C. V. Weston, C. E., of Chicago. They have been altered somewhat by cutting down the amount of elevated

GENERAL VIEW IN MACHINERY HALL

structure at first planned and in the general adoption of a construction that calls for less investment.

The route of the road has been planned so that a great amount of elevated structure is not necessary. It is approximately 10 miles around the grounds by this line, and there are sixteen stations at the various entrances and spaced conveniently along the track. Starting near the main entrance, whence a view of the Grand Basin and Festival Hall may be had, the cars pass between "The Pike" and the Varied Industries and Transportation Buildings. Then they wind about through the buildings at the western end of the grounds, turning the corner of the Great Agriculture Building and coming out upon the wooded sections beyond. After a stop at the Fine Arts Building, the cars make their way to the extreme northeastern corner of the grounds, skirt the Government, Liberal Arts and Manufac-

Copyright 1904, Louisiana Purchase Exposition Co.

TOWERS OF MACHINERY HALL FROM THE APPROACH TO THE CASCADES

tures Buildings, and finally return to within a short distance of the starting point.

This railway is owned and operated by the Exposition Company, which expects to carry hundreds of thousands of people on it during the spring and summer. Besides being a convenience and an object of interest for the general public, it serves also as an important industrial exhibit, because it will show an electric railway of the most advanced type, its carrying capacity and efficiency taxed to the utmost. In spite of the fact that the road passes all of the important buildings on the grounds it does not obtrude itself on any of the important vistas of the Exposition. This, to a certain extent, puts the road in out-of-the-way places, but the location of any intramural railway in any Exposition must always be a matter of compromise between sightliness and utility. The road will be operated like an elevated railroad, with fifty-two semi-convertible cars running in trains.

Starting at the station at the left of this entrance, the road runs a private right of way for a short distance on the surface, but soon mounts an elevated structure which brings it to the level of the bluff, where it operates on the surface or in cuts among the wooded portion of the grounds, remaining on the high ground until reaching the west end of the belt, where it again descends to the lower ground, finally terminating on a slightly elevated embankment back of the Transportation and Varied Industries Buildings.

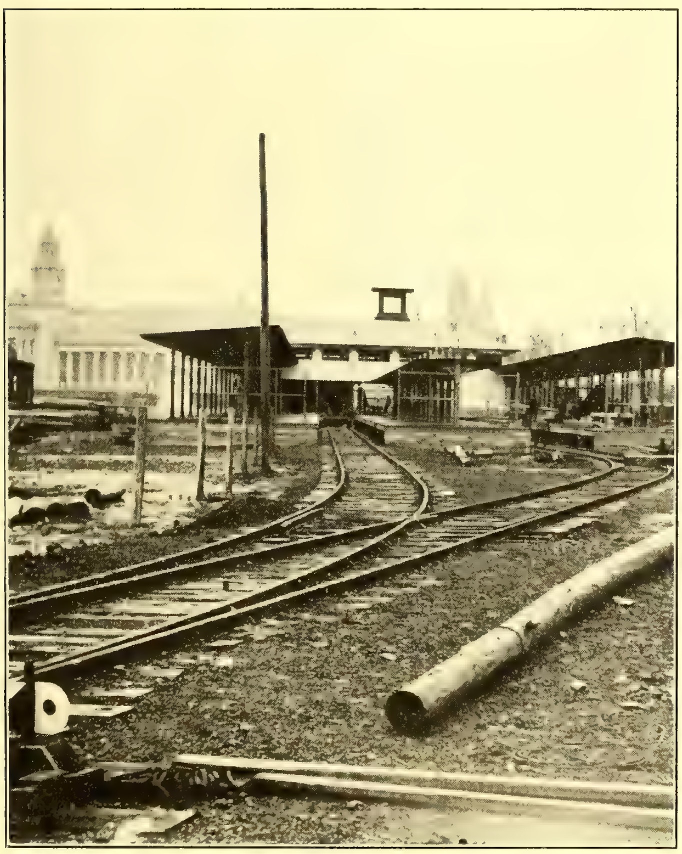
The cars are being built by the St. Louis Car Company, and are very similar to those which this company has built for the Chicago City Railway Company and for the St. Louis & Suburban Railway Company. They are a type which is becoming quite common, and of which a large number have been built. The length of body is 34 ft., and the platforms are 5 ft. long, making the car 44 ft. over all. These intramural cars, however, are not equipped with steps, as they will be loaded and unloaded at station platforms only. The motor equipment is four G. E.-70 motors, and the type-M train control will be used. Cars will be run in trains of three. There are no vestibule doors, platform gates being used in their place. The Christensen multiple-unit air-brake system and Van Dorn's couplers are used. The wheels are the Shoen solid forged and rolled steel wheels. The cars being a standard type for street railway use, can be sold to best advantage after the Fair is over, as it will only be necessary to add steps to adapt them to regular street railway service.

The roadbed is for the greater part on the surface, is cinder ballasted, of standard steam railway construction, 65-lb. rails and standard gage.

The power plant for the intramural occupies a space of about 10,000 sq. ft. in the Machinery Building. It is seen on approaching the main entrance of the building, and is one of the most striking electrical exhibits on the grounds. This will be described below. The equipment for furnishing power for the intramural line was supplied by the Crocker-Wheeler Company, and consists of seven units, having a combined generating capacity of 3500 kw. Each unit is a standard Crocker-Wheeler railway type generator, direct-connected to the prime mover.

There is one unit of 900-kw capacity, running at 100 r. p. m., and driven by a Buckeye cross-compound steam engine. A 600-kw generator, running at 85 r. p. m., is driven by a Lane & Bodley horizontal cross-compound 20-in. x 40-in. x 54-in. engine. Three units are of 500-kw capacity each, one with a speed of 100 r. p. m., and driven by a 26-in. x 48-in. single-cylinder rolling-mill type of Corliss engine, manufactured by the Murray Iron Works, the other two being driven by Brown-Corliss vertical cross-compound engines, at a speed of 135 r. p. m. The sixth unit is of 400-kw capacity, at 150 r. p. m., and uses a Harrisburg horizontal tandem compound 15-in. x 40½-in. x 26-in. engine. The last generating unit in the series is driven by a Doble water-wheel, made by the Abner Doble Company, of San Francisco, the water pressure being furnished by a Jeansville Iron Works pump. The unit is of 100-kw capacity, and runs at 700 r. p. m.


BOILER HOUSE


ONE OF THE TERMINAL STATIONS OF THE INTRAMURAL RAILWAY


A DOUBLE-TRACK TRESTLE ON THE INTERURBAN RAILWAY

POWER PLANT IN MACHINERY BUILDING

The power plant in Machinery Building will undoubtedly be one of the most interesting collections of large prime movers ever assembled under one roof. Here the latest things in steam turbines and gas engines will be shown, as well as some of the largest types of reciprocating engines.

The sources of electrical energy for the operation of the Exposition may be divided into three classes. The service plant of the Exposition, installed by the Westinghouse interests, contains four units of 2000 kw each. The engines are vertical, compounding, condensing. Two of them drive 25-cycle, three-phase 6600-volt Westinghouse generators, and the other two drive similar General Electric generators.

The Louisiana Purchase Exposition Company has also a contract with the Union Light & Power Company, of St. Louis, to supply 7500 kw in 25-cycle, three phase 6600-volt current.

The capacity of the exhibitors' power plant, which consists of the miscellaneous engines and generating units supplied by

various exhibitors, will probably total in the neighborhood of 8000 kw, in 6600-volt, 25-cycle, three-phase current; besides this, there is 3400 kw in 500-volt, direct-current machinery, part of which will be used to drive the intramural railway.

Most of the power for the Exposition will be transmitted about the grounds at 6600 volts, three-phase, and transformed at sub-stations in the larger buildings into the character of current needed for different purposes.

All of the larger engines in Machinery Building are designed to be operated condensing. The condensers in the Westinghouse service plant are supplied with cooling water by a set of cooling towers, placed along the east wall of the boiler house. The centrifugal circulating pumps and the fans for these cooling towers are driven by high-speed engines, located in the boiler house. The balance of the condensing water for the engines in Machinery Building is taken from the lagoons. The discharge water from the condensers passes into a conduit 1100 ft. long, which runs under the lagoons, and terminates at the suction of the pumps which supply the cascades. There

CROSS ROAD IN PARK OVER INTRAMURAL RAILWAY

are three centrifugal pumps for Cascades. Each pump is driven by a 2000-hp induction motor. The hot water from the condensers being taken by these centrifugal pumps and raised to the top of the Cascades is cooled by falling down the Cascades, and thus the Cascades serve as a cooling tower for the condensing water as well as an important part of the Exposition landscape.

The switchboard at the west end of Machinery Building, where the distributing feeders of all the 6600-volt, three-phase, 25-cycle current are controlled, is an interesting piece of switchboard construction. It occupies two floors of a gallery, the lower floor being given up to brick bus-bar compartments, and the upper floor having the oil switches and control board.

ENGINEERING AND ORGANIZATION

The construction and operation of the Exposition is under the charge of Isaac S. Taylor, director of works. Henry Rustin, mechanical and electrical engineer, made the plans for the electrical service features and decorative lighting, but illness compelled him to retire from all active work, and his position was assumed later by E. B. Ellicott, city electrician of Chicago, who has been in active charge since last December.

The Department of Exhibits is under the direction of F. J. V. Skiff. The exhibits in the Machinery Building and in the boiler house come under Thomas M. Moore, chief of machinery. The electrical exhibits in Electricity Building and the electric railway apparatus, such as motors and controllers that may be exhibited in Transportation Building, are in charge of Professor W. E. Goldsborough. The Transportation exhibits, with the exceptions noted, are under Willard Smith.

EXECUTIVE COMMITTEE MEETING OF THE ACCOUNTANTS ASSOCIATION

The executive committee of the Street Railway Accountants' Association of America met at the offices of Auditor F. E. Smith, of the Chicago Union Traction Company, on April 30, and made plans for the convention in St. Louis next October. Those present were: President F. E. Smith, of Chicago; Secretary W. B. Brockway, of Yonkers, N. Y.; C. O. Simpson, of Birmingham, Ala.; J. J. Magilton, of Schenectady, N. Y.; H. J. Davies, of Cleveland; S. C. Rogers, of Youngstown, Ohio, and H. M. Pease, of Buffalo.

Thirteen new members were voted into the association, viz., Youngstown & Southern Railway Company; Cleveland, Painesville & Eastern Railroad Company; Cincinnati, Lawrenceburg & Aurora Electric Street Railway Company; Northern Texas Traction Company; Cleveland, Painesville & Ashtabula Railway Company; Pennsylvania & Mahoning Valley Railway Company; Lima Electric Railway & Light Company; Indiana Northern Traction Company; Knoxville Traction Company; Niagara, St. Catherines & Toronto Railway Company; New Jersey & Hudson River Railway & Ferry Company; Boise Traction Company; Norfolk Railway & Light Company.

The accountants' convention will be held Thursday, Friday and Saturday, the last three days of street railway convention week at St. Louis, Oct. 13, 14 and 15, following the American Street Railway Association convention. One session will be held each day. The first day's session will be held at the Inside Inn. Those of the following two days probably at Festival Hall.

On the first day, a report, prepared by a joint committee of the accountants' and master mechanics, will be taken up. This report will be on shop records and accounts. H. M. Pease, of Buffalo, and W. G. McDole, of Cleveland, will represent the accountants in preparing this report, while the master mechanics will be represented by H. H. Adams, of Baltimore, and H. E. Farrington, of Chelsea, Mass. It was decided to make a question box a feature of this convention, and the secretary will invite members to file questions they may wish answered with him before July 1. The identity of the questioners will be kept confidential. The questions will be sent to members for reply, and the answers presented in pamphlet form and discussed at convention.

The report of the committee on collection of blanks by Elmer M. White, of Hartford, will be a feature of the meeting.

The matter of a headquarters hotel was left to a committee, consisting of President F. E. Smith and F. R. Henry, of St. Louis.

The inauguration of a question box this year adds still more to the practical value of membership in the association. Secretary Brockway has recently sent out a very neat little book, calling attention to the advantages of membership in the association, and it has been instrumental in adding a number of names to the membership.

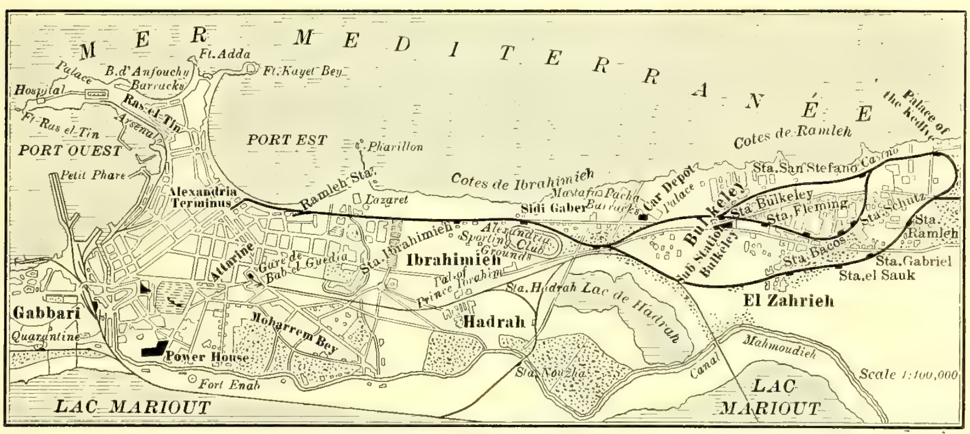
The long standing action of the city of Montreal against the Montreal Street Railway Company, involving percentages on the company's earnings, has been decided by the Supreme Court in favor of the city. The immediate amount covered by the decision is only about $15,000, but the judgment will affect the earnings during the twenty years of the unexpired franchise. By the agreement under which it secured a franchise in 1892, the company contracted to pay the city a percentage of the net earnings of its system, at the rate of 4 per cent for the first million dollars, and increasing to 15 per cent on all profits over $3,000,000. In 1893, however, the company refused to recognize this agreement as including lines outside the city limits, and withheld the percentages thereon from that date forward. The suit by the city followed this action.

A NEW ELECTRIC RAILWAY IN ALEXANDRIA, EGYPT

Approval of the electrical method of railway operation in the Far East is again made evident by the recent electrification of the Alexandria & Ramleh Railway, an old steam-operated road running out of Alexandria, Egypt, and in connection with this the installation of electric traction upon the lines of the Alexandria Tramway Company. An equipment which is strictly modern in every particular has been installed upon the combined system, partaking of the salient features of the most recent electric railway practice; notable among many interesting features may be mentioned a high-voltage alternating-current transmission system with rotary converter sub-stations and the use of compound condensing engines of a highly efficient pattern in the power plant.

The Alexandria & Ramleh Railway is one of the oldest roads in Egypt, some of the original equipment of locomotives and cars, which were built in 1866, being still in service on other lines; it also has the distinction of being the second railway in Egypt to be changed over to electric traction. It has long been one of the important roads of this country, operating mainly for passenger traffic between Alexandria and the points of Ramleh and Boukir on the coast of the Mediterranean Sea. The change to electric traction was begun by the company in March, 1903, and was completed in December last. The results of the electrification of this road have already proven more than satisfactory, the earnings of the system having increased by 33 per cent in the first month, and the outlook is very favorable for a heavy and profitable traffic.

VIEW OF THE ALEXANDRIA TERMINAL OF THE LINE



MAP OF THE ALEXANDRIA & RAMLEH RAILWAY

The route of the system is shown in the accompanying detail map of the city of Alexandria and its environs. The main line from Alexandria to Ramleh is a straight double-track line, while in Ramleh the line makes two loops through different portions of the city. The main line from Alexandria to Ramleh is double track with center-pole overhead-line construction. Eighty-six-pound rails are used in the track onstruction, being laid to standard gage (4 ft. 8½ ins.), with ties spaced 36 ins. apart. This provides an unusually heavy track system for electric railway work. The rail-joints are bonded for the return circuit with the Crown bonds, and every third pair of rails are interconnected by cross bonding.

THE POWER PLANT

As may be seen from the view of the power plant it is conveniently located for access to an abundant supply of water for condensing purposes, being located at Karmous upon a canal leading from the sea inland. The plant is situated some distance from the points of power consumption, which made necessary a high-voltage transmission system; this is provided for by a high-tension three-phase alternating-current distribution system, from which rotary converters are operated at sub-stations to deliver the direct-current supply to the trolley wires.

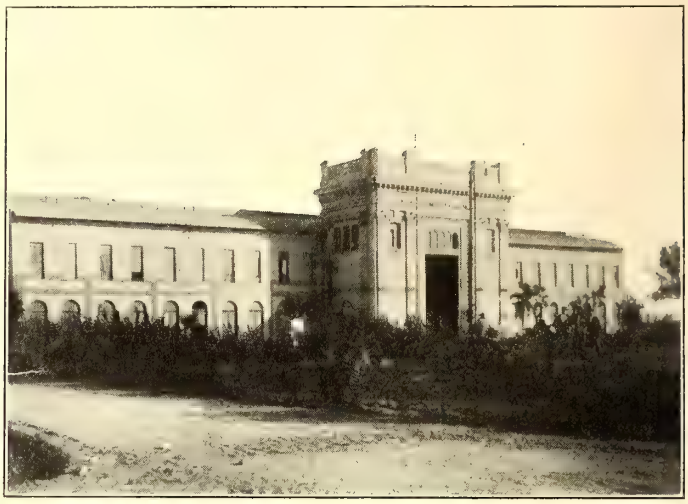
The steam generating equipment of the plant consists of ten boilers of the elephant type, arranged as illustrated in the accompanying illustration of the boiler room. They are designed to operate at a steam pressure of 135 lbs. per square inch. They are hand-fired, using bituminous coal, and are equipped with Green economizers for the heating of feed water. The boiler feed and other pumps used in the plant are Worthington pumps.

The engine equipment consists of

VIEW OF THE POWER PLANT AT KARMOUS

Two horizontal tandem-compound condensing engines, each of which operating at 107 r. p. m., with a steam pressure of 135 lbs., develops 800 hp. These engines were designed particularly for use with alternating-current generators, being guaranteed not to vary in angular velocity more than one-fourth of 1 per cent per revolution under constant load; the governor is of the Porter high-speed type, and is arranged so that the speed of the engine may be changed by sliding a weight upon the governor lever. The engines were built by Franco Tosi, Legano, Italy.

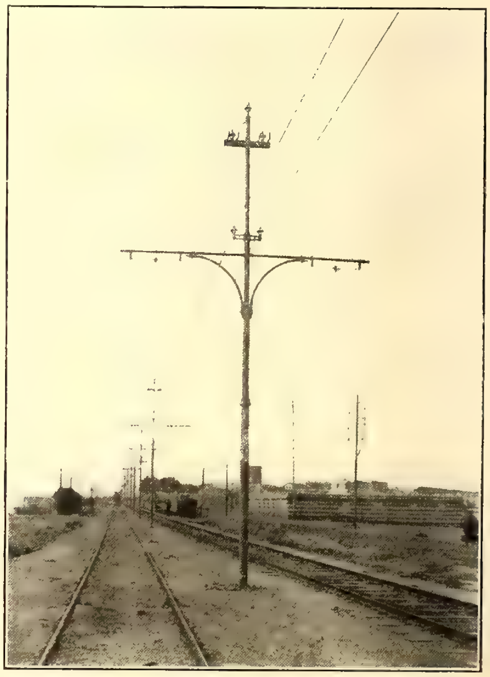
ANCIENT METHOD OF TRANSPORTATION IN EGYPT. "LADIES ONLY"



VIEW OF THE HOTEL AND CASINO OF THE COMPANY AT RAMLEH

The engines each have cylinders of 600 mm (23.6 ins.) and 975 mm (38.4 ins.) in diameter, with common stroke of 1200 mm (47.3 ins.). They are designed for operation with superheated steam, and have special features of jacketing; all the cylinders and heads are jacketed, through which jackets the steam entering the low-pressure cylinder is carried. Each cylinder has four separate valves of the poppet type for the steam distribution; the high-pressure inlet valves are two-seated, and all of the others four-seated, to shorten the travel and permit quick closure without throttling the steam. A feature of these engines is that the low-pressure piston is easily accessible for inspection or repairs from between the two cylinders. Effective lubrication is provided for journals, guides, etc., by means of a gravity system, with elevated oil tanks in the engine room for gravity flow.

VIEW OF THE MAIN LINE AND TYPE OF DOUBLE-DECK CARS USED, SHOWING FIRST-CLASS MOTOR CAR AND SECOND-CLASS TRAILER



VIEW OF LINE CONSTRUCTION, SHOWING ALSO HIGH - TENSION TRANSMISSION LINE

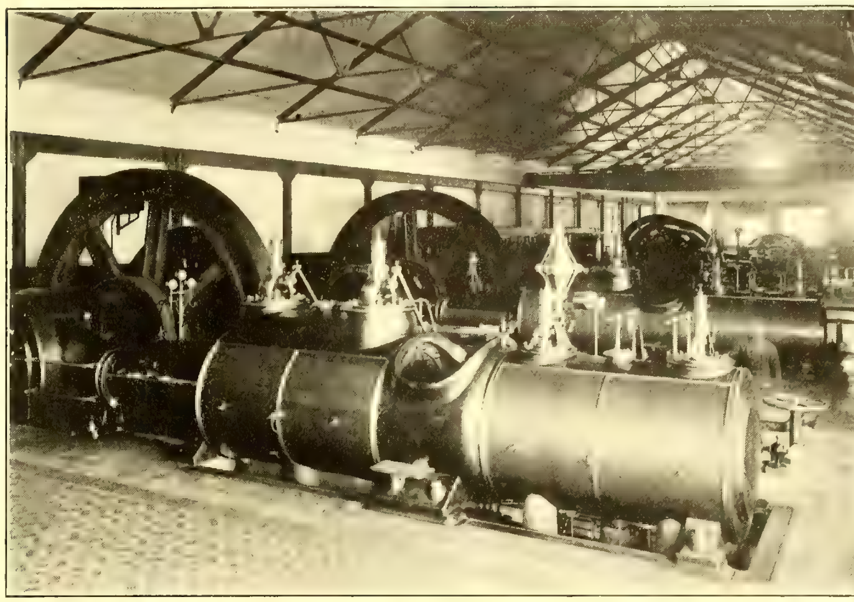
The condensers, which are located beneath in the basement, are mechanically operated from the main engines by means of beams and connecting rods to the main crank pins. The air pumps are arranged vertically in a single body for each engine, and are of the duplex single-acting type. Suction valves are omitted, whereby the resistance to the entering water is reduced and the pumps tend toward noiseless operation.

Each engine is direct-connected to a 600-kw Brown, Boveri & Company three-phase alternating-current generator, operating at slow speed for 25 cycles. They are of the high-tension revolving field type, delivering current at 6500 volts. The generator circuits, as well as the feeder and exciter circuits, are controlled from a convenient black marble switchboard, which is equipped with Weston measuring instruments and Brown, Boveri oil switches.

SUB-STATIONS

There are two sub-station equipments for supplying direct

current to the trolley wires at the line voltage of 500 volts, the main station being located at Bulkeley and the other in the main power power station at Karmous, as auxiliary to the main generators. The Bulkeley sub-station is located at the center of Ramleh, about 8 miles from the power plant, and contains three rotary converters, each of 300-kw capacity, and the necessary nine static transformers of 125-kw capacity, all of which were furnished by Brown, Boveri & Company. The sub-station equipment in the power plant at Karmous consists of one 600-kw rotary converter, which is so connected up that if an accident should occur to both of the main power generating units can be operated from the direct-current side with current from the direct-current generators of the Alexandria Tramway Company, located nearby, and thus deliver alternating current to the Bulkeley sub-station—this is a very convenient and desirable arrangement of apparatus under the existing circumstances.



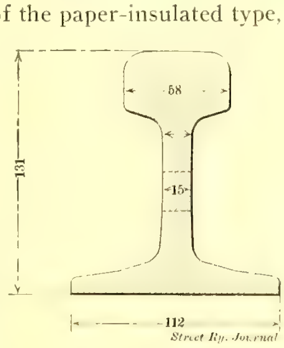
GENERAL VIEW OF ENGINE ROOM OF THE KARMOUS POWER PLANT

THE SUB-STATION AT BULKELEY

The Bulkeley sub-station has a neat, white marble switchboard, furnished with a complete equipment of Weston measuring instruments; Brown, Boveri & Company oil switches and Thomson-Houston circuit breakers are used upon the board.

OVERHEAD CONSTRUCTION

Current is led out from the power plant to the sub-station by two three-core cables with conductors each 50 mm (1.97 ins.) in diameter. These cables are of the paper-insulated type, designed for high voltage, and were supplied by the British Insulated Cable Company. They are metallic sheathed and are laid underground, on the slot system, at a depth of 70 cm (2.76 ins.) below the surface, as far toward Ramleh as the Sporting Club, where connection is made with an aerial line. From this point the high-tension feeders are carried to the Bulkeley sub-station upon the center poles of the system which are used to carry the trolley brackets; they are mounted upon porcelain insulators, upon cross-arms and pole tops, as shown in the view of the line and double-deck cars. A notable feature of this high-tension line is the provision of automatic grounding forks, under each line wire upon both sides of each insulator; in this way if a high-voltage wire breaks it drops into the fork, and is immediately grounded and rendered harmless.

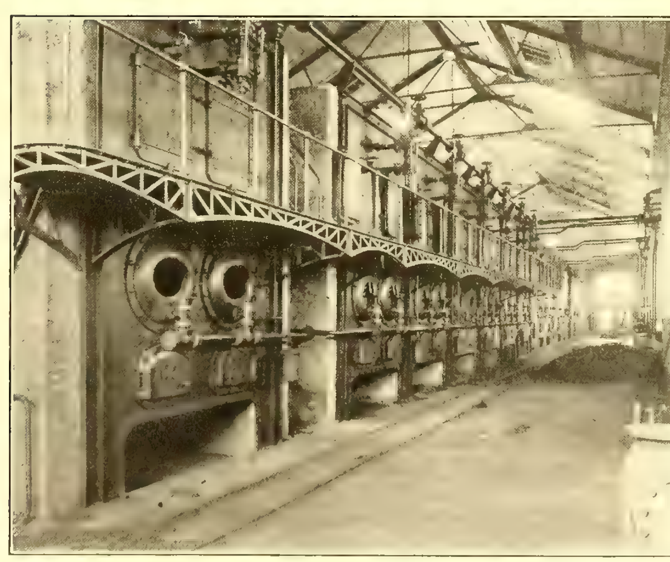


SECTION OF RAIL USED

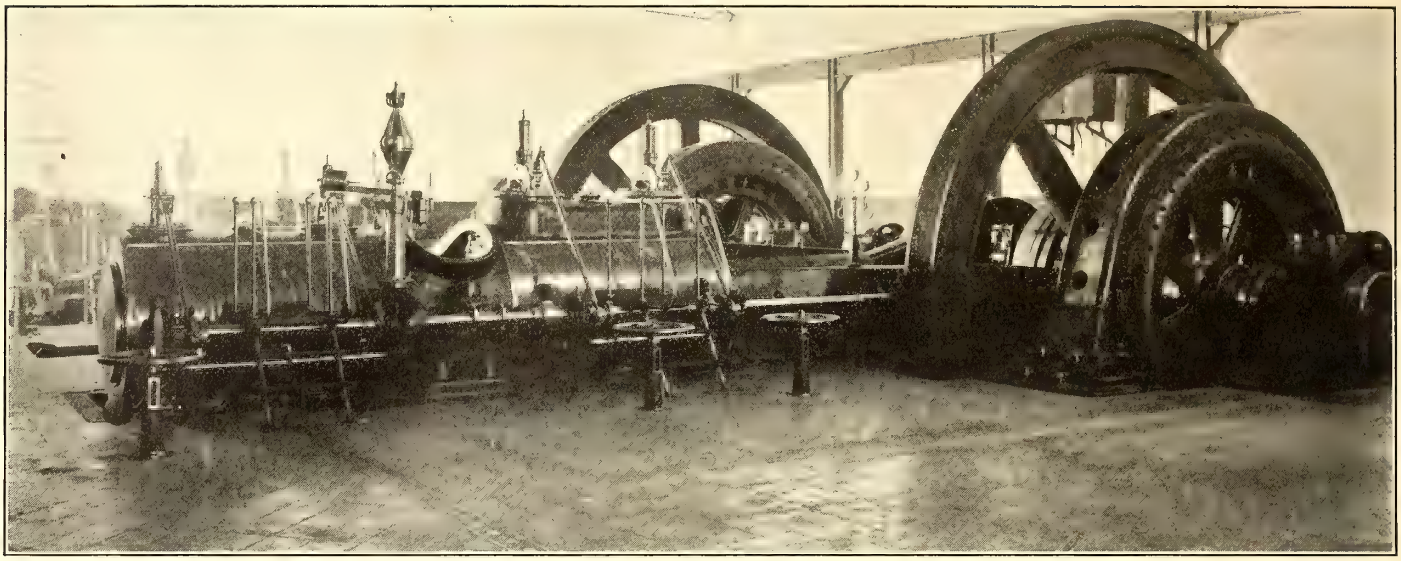
The important features of the trolley-line overhead construction may be seen from the accompanying line views. The center poles are of steel, supplied with particularly heavy bracket construction; the method of erecting is well shown in one of the detail photographs. The size of trolley wire used is No. 000, and the feed wires are No. 0000; all the trolley and feed wire was supplied by Roebling's Sons Company. The line material throughout, including line insulators, trolley frogs, breakers, etc., was supplied by the Ohio Brass Company, of Mansfield, Ohio.

CAR EQUIPMENT

The car equipment consists of fifty first-class and fifty second-class cars, all of which are of the double-deck type, corresponding with modern European practice. This is of particular interest at present to American street railway interests in view of the present



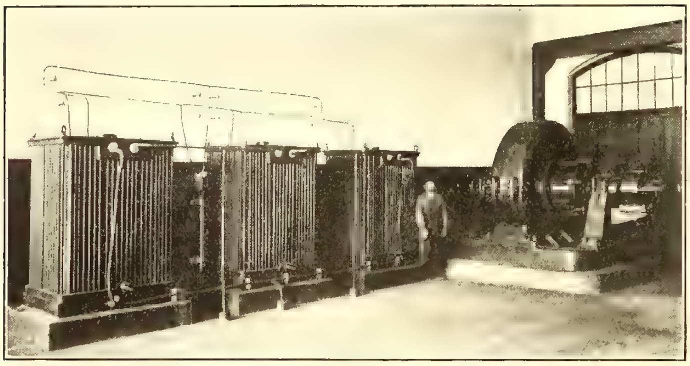
THE BOILER ROOM OF THE KARMOUS POWER PLANT



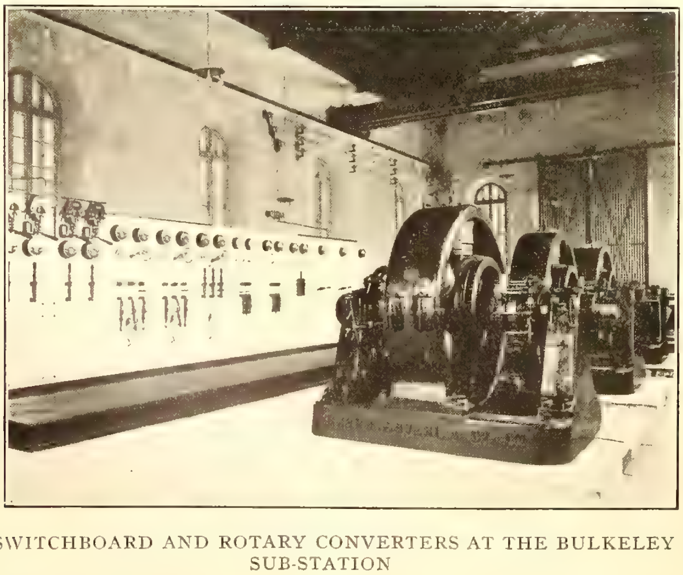
THE 600-KW GENERATING UNITS AT THE KARMOUS POWER PLANT

agitation that is being raised with reference to the use of double-deck cars.

The first-class cars are beautifully upholstered in royal blue and rattan cushions; they are finished with roller blinds and veneer roofing of Canadian maple, all highly polished. The second-class cars differ from the first-class ones only in the matter of finish, being furnished with plain seats instead of upholstered. The length of body of the cars is 18 ft. inside of posts, while the length of platform is 4½ ft. The seating capacity of each car is twenty-four inside and thirty-four upon the second deck, making a total of fifty-eight. The cars were built by the British Electric Car Company, of Manchester, and are equipped with McGuire trucks.

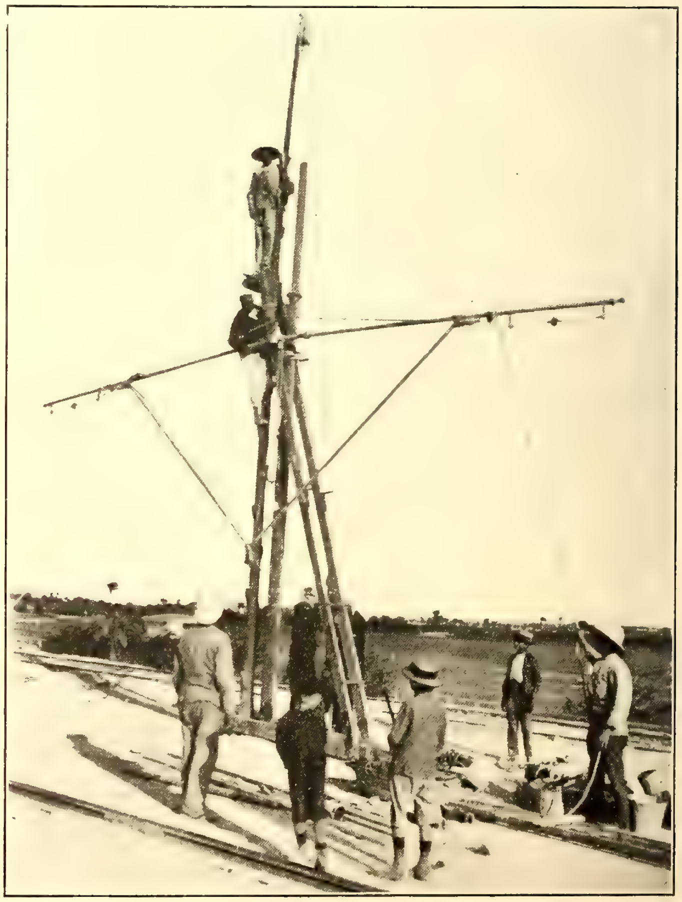


THE SUB-STATION EQUIPMENT IN THE MAIN POWER PLANT



SWITCHBOARD AND ROTARY CONVERTERS AT THE BULKELEY SUB-STATION

The first-class cars only are equipped with motors, the second-class cars being used as trailers, as shown in the view of the line and cars. The electrical equipment of each first-class car consists of two 35-hp motors, which is designed to give them a speed capacity of 30 m. p. h. These motors are the standard 3A-4 motors, built by Dick, Kerr & Company, Preston, England, and are of the usual heavy tramway pattern, with four-pole fields and slot-wound armatures, having four turns per coil and forty-one coils per armature. These motors are capable of developing 35 hp under a one hour's rating. They are mounted in the usual manner and drive through single re-



LINE CONSTRUCTION DURING STEAM TRAIN SERVICE UNDER CLOSE HEADWAY

duction gearing. A general repair shop and car house is provided for at Karmous, adjacent to the power plant, where all heavy repairing, such as wheel work and renewals and general overhauling of cars, including painting and finishing, will be done. This installation includes a foundry, a machine shop, a carpenter and pattern shop, and a paint shop, and is very fully equipped for prompt and efficient work.

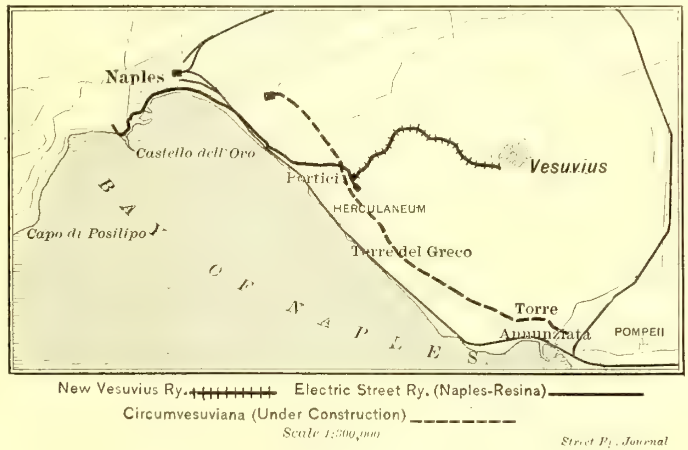
The main car storage house is located at Mustafa, near the Bulkeley sub-station, and has a capacity for storing seventy cars. This building is constructed of cut stone, with spacious and conveniently arranged interior and a substantial steel roof construction. It contains six tracks, each of which is built with a pit, and is equipped with Taylor pit jacks for the removal of motors.

This paper is greatly indebted for this information to Nelson Graburn, general manager of the road, through whose energetic efforts the entire installation was completed in nine months. The success of the new work was largely contributed to by the able and thorough co-operation of the chairman of the Alexandria & Ramleh Railway, H. E. Boghos Pacha Nubar, and of the chairman of the Alexandria Tram Company, J. Lumbroso.

THE NEW MT. VESUVIUS ELECTRIC RAILWAY

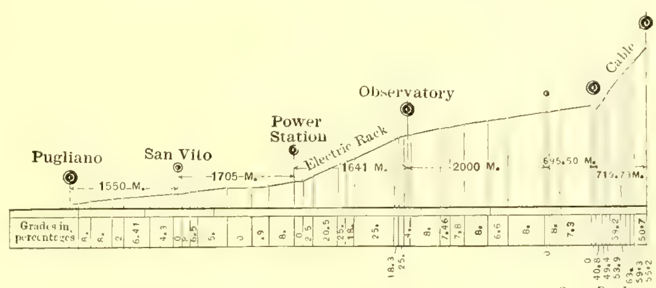
The problem of building a railway up Mt. Vesuvius is one that has had a peculiar fascination for the engineer. Its solution involves certain conditions that are not likely to occur again in Europe, for while that continent possesses several other active volcanoes, none of them is of such commanding importance and interest as Mt. Vesuvius. Its situation in one of Italy's most fruitful districts, and its nearness to a great city which for 3000 years it has never ceased to threaten with destruction, have helped to make Vesuvius a subject of perennial interest to the scientist and nature-lover alike.

The original Vesuvius line is a cable railway, which was built in 1880 by a Roman banking house, but which for some time has been owned by Thomas Cook & Sons, the well-known tourist agents. The line begins at the base of the lava cone, about 2450 ft. (749 m) above the sea, runs in an almost straight line up the steep, smooth sides of the cone and ends at a height of 3700 ft. (1182 m), in the vicinity of the old crater, and about 360 ft. (110 m) below the present crater. The grades on this line, which is practically a cable incline



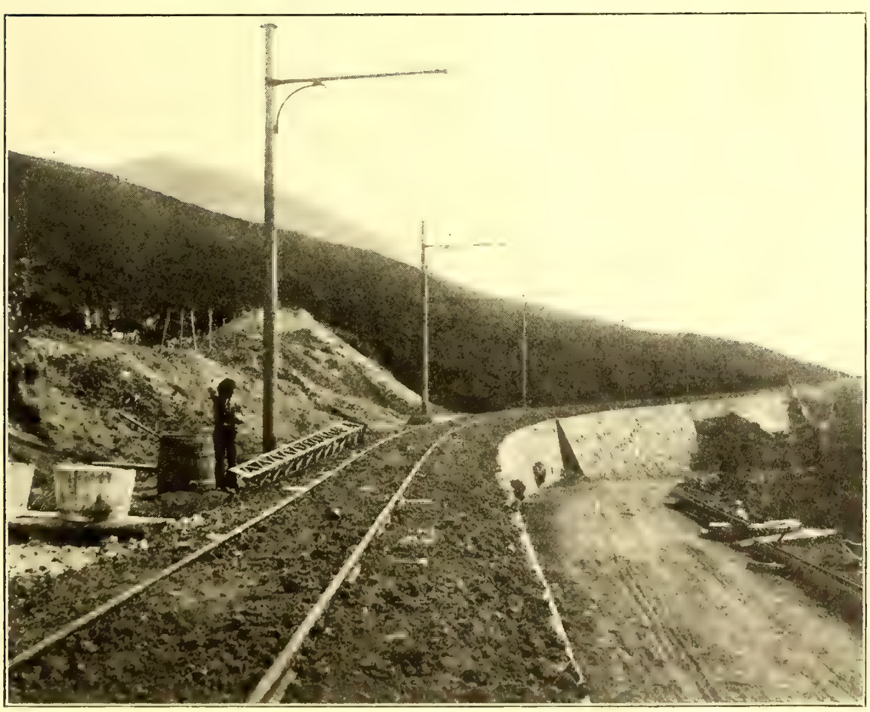
MAP SHOWING PRESENT AND PROPOSED LINES IN THE VICINITY OF MOUNT VESUVIUS

road, range from 39 per cent to 63 per cent, measured on the tangent method, and average 54 per cent, a figure which is not



PROFILE OF THE VESUVIUS RAILWAY

reached by any cable railway in Switzerland. The construction difficulties on this line were due principally to the lack of good supporting soil, as the lava banks were seldom packed solid. It is worthy of note that while the line was under construction red-hot lava sometimes flowed down the mountain within 500 ft (150 m) of the workmen.



VIEW ALONG ELECTRIC RAILWAY, SHOWING RETAINING WALL

Owing to the heavy tourist traffic it was long recognized by Messrs. Cook that some better means for reaching the base of the cable railway from Naples should be provided than the long and expensive carriage trip which, from the time the cable road was started until recently, was the only method available. With this end in view they considered a number of plans for the construction of an electric railway, and finally adopted the suggestions of E. Strub, the well-known engineer of Zurich, Switzerland. Mr. Strub's plans embraced the employment of ordinary and rack sections, to be operated by electricity, at an approximate cost, including right of way and power station, of $237,500 (1,250,000 Fr.).

The length of the completed line from Resina to the base of the cable railway is 4.5 miles (7.5 km), and the distance can be covered in 48 minutes, including stops at the intermediate stations. It will be seen, therefore, that cars can be started from each end of the line at intervals of 35 minutes, which give twenty trains in each direction every 12 hours. Counting thirty passengers per car the daily capacity of the line would be 600 persons.

OBSERVATORY ON MOUNT VESUVIUS

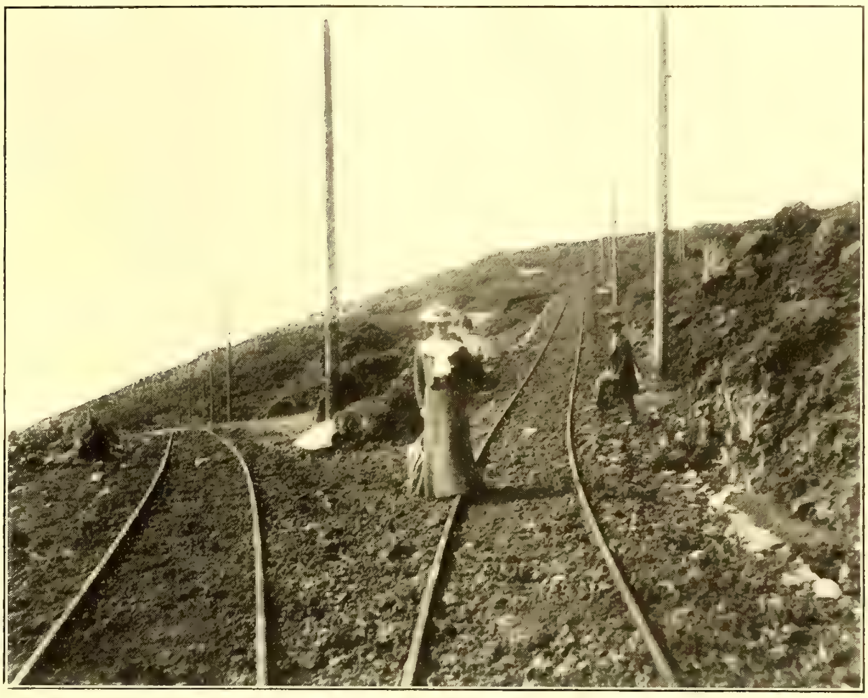
RESERVOIRS FOR RAIN WATER

APPROACH TO THE LOWER STATION OF THE CABLE RAILWAY

However, as in the past the cable railway has never been obliged to carry more than 300 people daily, the capacity of the new line should be ample for a long time to come. In this connection it should be noted that the top of Mt. Vesuvius is too small in area to permit the accommodation of a large number of people at one time, and, besides, the fare from Naples to Vesuvius and return is so high ($4), the line is not likely to be overcrowded. Of course, this high fare is due to the fact that the railway may be utterly destroyed at any time. If necessary, the capacity of the line could easily be doubled without using much more power by building turnouts and arranging the schedule so that when a train is going up the mountain another is traveling down toward the valley over the rack road.

ROUTE

As shown in the accompanying profile of the complete line, the grades between Resina and San Vito do not exceed 8 per cent. About the same grades are found between the Government Observatory and the cable railway. It was determined, therefore, to operate both of these divisions by the usual methods. For the section between the power station and the observatory a rack road was chosen, as that division includes grades as high as 25 per cent. On this division the motor car of the electric railway is hauled by an electrically-driven rack locomotive. The Vesuvius Railway, as now completed, has a gage of 39.37 ins. (1 m), and is divided into three sections, having a total length of 4.5 miles (7.5 km). The first section is an electric railway starting at Pugliano (the upper part of Resina), and extending 1.9 miles (3.15 km) to the power house and car house. The minimum curve radius is 164 ft. (50 m). The second section, as stated, is a rack road, and runs from the power house to the observatory. Its length is about 1 mile (1650 m), and its highest point nearly 1950 ft. (594 m) above the sea. The third section is an ordinary electric railway, similar to the first, and is 1.62 miles (2700 m) long. The roadbed in general is built in accordance with the practice adopted on the later Swiss mountain railways, with due consideration, however, to the fact that in autumn and winter there are very severe rain storms, which make it necessary to make liberal allowance for quick drainage. Careful surveys made it possible to avoid artificial construction to a great extent. The supporting walls are constructed of lava stones and a mortar made of lime and puzolla earth, a combination which, in time, becomes as hard as stone and possesses certain hydraulic properties—in fact, the same material has been used in building a large dry-dock in the harbor of Naples.

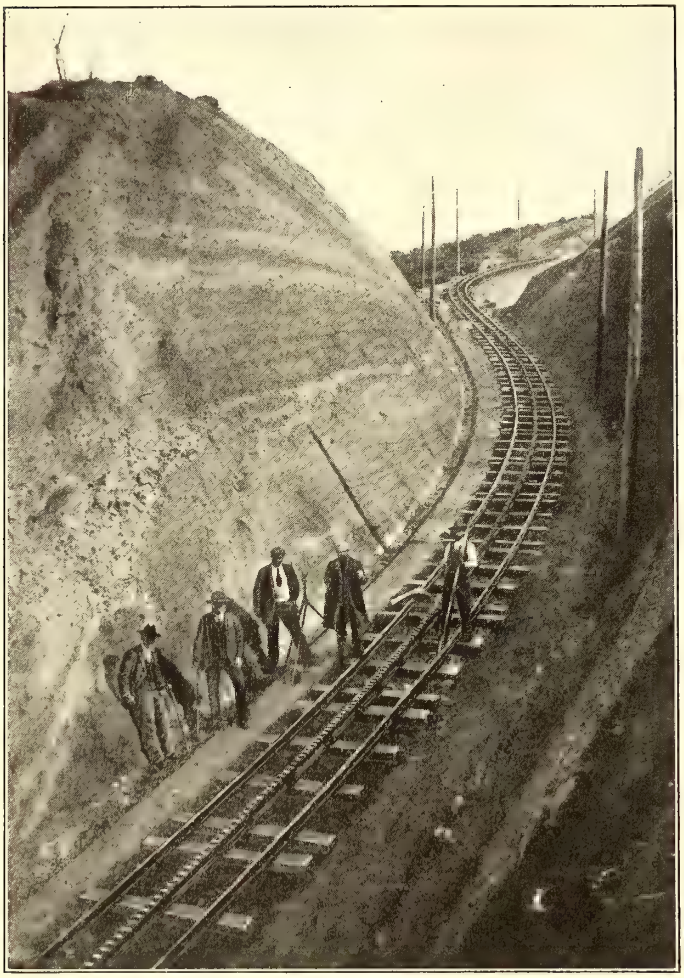


SCENE ALONG THE ELECTRIC RAILWAY

VIEW ALONG THE RACK RAIL DIVISION

The Pugliano station at the beginning of the line has not yet been definitely completed, owing to the fact that some arrangement is to be made for connection with the proposed Naples-Resina line. A connection is also proposed with the Circumvesuviana line, which is now under construction. From Pugliano the line traverses a very fertile agricultural district, and just before reaching the rack road passes through a number of petrified lava streams. The first station, San Vito, is in the middle of the garden district, about .87 mile (1.45 km) from the beginning of the line. From this point the railway runs for 1.02 miles (1.7 km) in an almost straight line to the rack road.

The lower portion of the latter road passes through inhabited territory, but soon enters a large forest, from which it does not emerge until it reaches the observatory. This section is cut

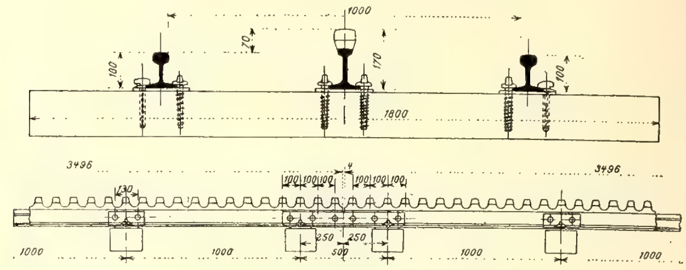


BUILDING THE RACK RAIL DIVISION

through by a large number of so-called "burroni," which are simply deep narrow cuts made through the light puzolla earth by torrents during the rainy season. Many of these cuts are 30 ft. to 60 ft. in depth. During the dry season they serve for paths, as the shelter they afford is very convenient. Where the railway is obliged to cross these "burroni" vegetation has been planted to strengthen the sides against future inundations. The observatory railway station lies very near the large hotel which has been built at this point by Messrs. Cook. There is also close to the station a little chapel and park. From this station the line is again of the ordinary electric railway construction, and traverses a distance of approximately 1.62 miles (2695 m) before reaching the lower station of the old cable railway.

TRACK CONSTRUCTION

The track construction of the electric line consists of rails, 3.94 in. (10 cm) high, weighing about 40 lbs. per yard (20 kg per meter). The rack rails are laid in 11-ft. 3-in. (3.5 m) sections, while the outside rails are 33 ft. 9 ins. (10.5 m) long. The rails on the rack road and the curves on the other divisions are anchored by means of iron tie-plates. On straight track of the electric railway divisions the joints are furnished with the usual base plates as well as angle-plates. Oak ties are used throughout rather than metal ones, as they can be replaced more quickly in case of lava overflows and because the Strub rack system operates equally well with metal or wooden ties. These ties are 6 ft. long, 6.3 ins. to 7 ins. wide, and 4.73 ins. to

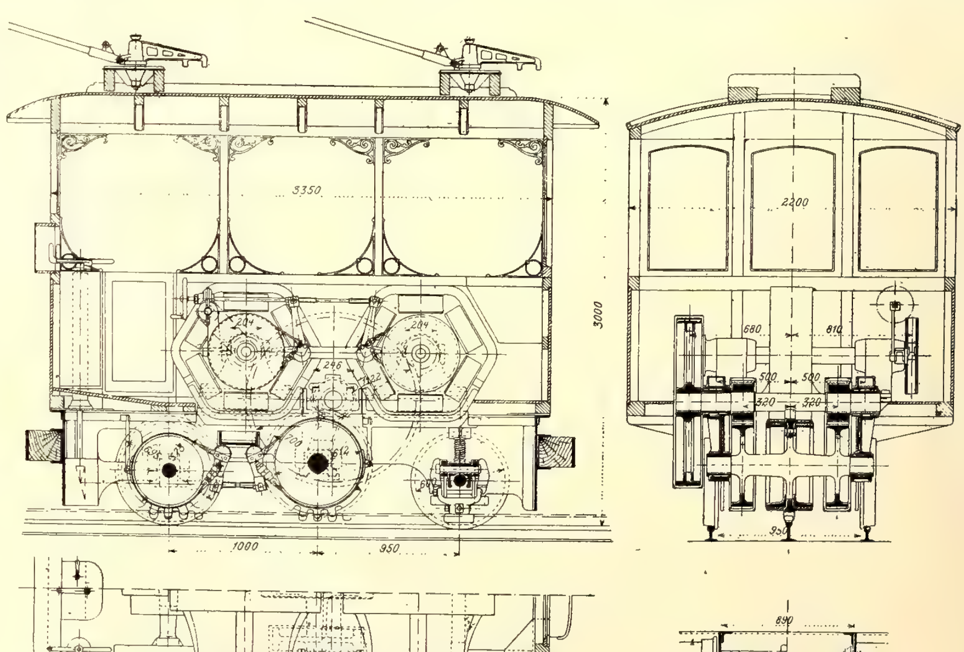


CROSS-SECTION AND SIDE ELEVATION OF RACK

5.52 ins. high. Plastic bonds are used for bonding in the rail return except at special work, where wire bonds are used.

ROLLING STOCK

The same cars are used on both the electric and rack divisions, but on the rack division, as stated, the cars are hauled by a special rack locomotive. To make possible a 35-minute headway turnouts have been built at each end of the rack division. Only three motor cars and one rack locomotive are required to carry out this schedule. The present equipment consists of three motor cars and two locomotives. The cars have single trucks, of 6.2 ft. (2.1 m) wheel base, and weigh 16,800 lbs. (8400 kg) each, without motors. The motors are of the direct-current series type, and are built somewhat larger than would otherwise be required, on account of heavy grades and warm climate. All cars are built in three sections, each of which has a separate side door. The seating capacity is eight passengers per section, with additional room for six passengers on the platform. The sides of the car are cut off halfway to the roof, but in stormy weather the openings may be



ELECTRICALLY DRIVEN RACK LOCOMOTIVE

closed by waterproof curtains. To provide for baggage, one of the three divisions is furnished with seats which may be turned up when necessary. The side walls of this compart-

ment are removable. The cars are equipped with bow trolleys.

Owing to the severe grades each car is furnished with two independent sets of braking apparatus. The first consists of a powerful spindle brake, furnished with eight brake-shoes, which can be operated from either platform. The second consists of an electric short-circuiting brake combined with an electromagnetic track brake. To overcome slippery rails two sanders are supplied at each end of the car. When the motor cars are used on the rack division they are pushed by the electric locomotive so that no brakes are required; the rack locomotive is equipped with four independent brakes, each of which is capable of controlling both locomotive and car.

The rack locomotive weighs about 20,800 lbs. (10,400 kg), and is capable of running at about 5 m. p. h. when propelling a load of 22,000 lbs. (11,000 kg) on a 25 per cent grade. It is equipped with two 80-hp shunt-wound motors, which run at 650 r. p. m. to 700 r. p. m., and operate the rack-driving wheels through gearing. The rack wheels are made of crucible steel and weigh about 160 lbs. (80 kg) each. As the motors are shunt wound, current is returned to the line when the locomotive is running down grade.

CABLE RAILWAY

The old cable railway which will be kept in operation, but reconstructed as described below, is a monorailroad, with the supporting wheels in the center of the car. The supporting stringers, which are two in number, one for each track, rest on cross ties placed about 5 ft. (1.5 m) apart. These ties are stiffened by diagonal braces, and the entire construction is supported at intervals of 200 ft. to 400 ft. by masonry pillars. The top of each stringer carries a T-rail for the center wheels of the cable car. Each car is operated by two endless cables, one being placed on each side of the car. To each cable is attached a forked gripping device, held in position by springs, and connected with an automatic brake, which consists of two cogged eccentrics embracing the wooden stringer, and designed to hold the car in position in case the cable breaks or loses its tension. The cables are operated through gearing by a 40-hp steam engine, which is located at the lower end of the line,

BUILDING THE SUPPORTING WALL BENEATH THE TERRACE OF THE OBSERVATORY

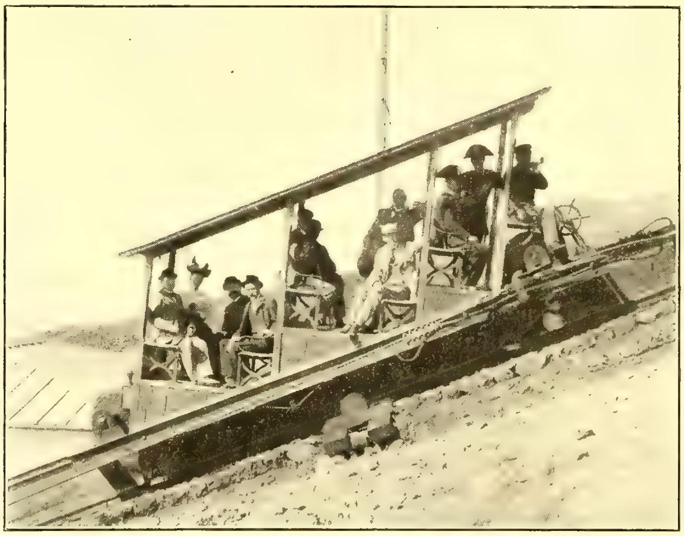
to minimize the danger from eruptions. The trip on this line takes about 8 minutes. This line has been in use since 1879, and during that time the roadbed has gradually sunk, so that whenever there is a severe wind storm loose ashes accumulate to such an extent that it often takes 100 men or more several days to remove the debris, and thereby allow the service to be resumed. This has caused the maintenance charges to be very high, and plans have been made for the building of another cable line. The new cable line is to be built about 10 ft. (3 m) above the grade of the present line. It will be of meter gage, and the rails will have conical heads to allow the use of special emergency brakes. The roadbed will be of dried mortar construction and the tiles laid in cement. Massive mortar pillars,

GROUP OF OFFICIALS AND ENGINEERS ON AN INSPECTION TOUR

several meters wide, will be erected at intervals of about 65 ft. (20 m). The new cars will seat twenty passengers, twice as many as the old ones. The cable will be driven by a 550-volt, 600-r. p. m. direct-current motor, which will be completely inclosed to protect it from injurious gases and lava dust.

POWER GENERATION AND TRANSMISSION.

The power station is furnished with two 67.5-kw, 550-volt direct-current generators, running at 700 r. p. m., and operated



PASSENGER CAR ON OLD CABLE RAILWAY

by belting from the fly-wheel of two 100-hp, 160-r. p. m. gas engines, using Dowson producer gas. The generators may be connected in parallel to a Tudor storage battery having 300 elements and a capacity of 256 amp-hours. These generators are wired according to the C. E. L. Brown system, which enables them to deliver current to the storage battery without the use of a booster. The full-load efficiency of each generator is 92 per cent and the half-load efficiency 89 per cent. There

are two gas producers, and as each is of 200-hp capacity only one is used at a time. There are also two boilers for these producers, one of which may also be held in reserve. The gas engines are started by compressed air, but can also be started by supplying the generators with battery current and momentarily operating the latter as motors.

The switchboard is furnished with five panels, one spare panel for a future generator and one battery panel. The switchboard is so arranged that one generator can be used to give current to the line while the other is feeding the storage battery. The feeder panel is connected to three outgoing circuits.

The power transmission line is divided into two sections by a section insulator, these divisions being respectively that from the power station to Pugliano, and from the power station to the cable railway. The third circuit leaving the switchboard was intended originally to be a feeder for the power house-cable railway division or to furnish current for the electric motor which is to operate the new cable railway. It has been found, however, that this feeder is unnecessary at present.

A circuit breaker has been placed at the upper end of the rack railway near the observatory, dividing the power house cable railway section into two parts. In case of an eruption it will be possible, therefore, to cut off all current from the electric railway division between the observatory and the cable railway. The power circuits are protected by Wurts lightning arresters, which are mounted on poles along the line at intervals of about .6 mile (1 km). The lightning arresters are grounded through the rails.

In addition to the power wires there are two telephone wires and one telegraph wire, used for despatching and other purposes. These wires are mounted on porcelain insulators but the power wires have insulators of hard rubber.

All of the electrical apparatus throughout the system was furnished by Brown, Boveri & Company, of Baden.

DEPRECIATION FUNDS IN EUROPE

One of the subjects to be discussed at the biennial meeting of the International Street Railway Association at Vienna, on September 11 to 15, is that of depreciation funds. In accordance with the practice of the Association, the different member companies of the organization have filed with the secretary of the Association a statement of their practice on the different topics to be discussed, and a digest of that relating to the subject of depreciation and sinking funds follows:

In Aachen the maintenance of a fund of this kind is required by law. This fund is credited with the sale of old apparatus, and annual payments are made to it as follows: 1½ per cent of the cost price of the track construction; 1 per cent of that of the overhead equipment; 4 per cent. of that of the power stations; 2½ per cent of the cost of the motor cars and 1¼ per cent of that of the other cars.

In Berlin the by-laws of the Grosse Berliner Strassenbahn require a payment to a fund of proportionate cost of the replacement of the material, depending on the wear. This amounted during 1902 to 2,850,430 marks or 4.23 pfs. per car km. (1.7 cents per car mile). The company does not own its power stations, but hires power.

The Berlin-Hohenschonhausen Strassenbahn charges off 1½ per cent. of the cost of the equipment, which amounted during last year to an average of 5.6 pfs. per car-kilometer (2.24 cents per car mile).

In Brussels the life of the track is estimated at twenty-five years, that of conduit lines at fifteen years and splice-bars at twelve years. The life of the cars is figured at twenty-five years and the power station for the same length of time. The overhead construction is figured at 25 years except trolley wire which is put at ten years. The company therefore charges off a proportion of its receipts to a sinking fund; this is independent of the maintenance which is paid out of operating expenses.

The municipal tramways of Cologne have not yet been in operation long enough to determine the amount to be charged off. The management at present is charging off 8 per cent of the cost of the rolling stock and 1 per cent of the cost of the buildings, and is investigating the subject of track wear.

The Crefelder Strassenbahn has a franchise which requires the payment of 6 per cent of its gross receipts to a fund of this kind.

The Czernowitz Railway charges 1½ per cent of the track construction, 3 per cent of the rolling stock, ¼ per cent of the buildings, 2½ per cent of the power station equipment, which amounts to 2.1 heller per kilowatt-hour; 1½ per cent of the feeder construction, and 2 per cent of the rest of the equipment.

The Dessauer Strassenbahn pays for power station depreciation 1.5 pfs. per kilowatt-hour, a total of 3¾ pfs. per car-kilometer (1.5 cents per car mile).

The municipal road in Frankfort charges 5 per cent of the track, 5 per cent of the overhead equipment and 6 per cent of the mechanical and electrical equipment, which amount to 3 pfs. per car-kilometer (1.2 cents per car mile). The company hires its power.

In Geneva the creation of a depreciation fund is required by law, and the company pays annually 1000 francs per kilometer ($320 per mile) of track.

The Glasgow municipal tramways charges off £450 per mile of single track per year, 7 1-3 per cent of the cost of the rolling stock; 2½ per cent of the buildings, 5 per cent of the power station equipment, 3 per cent of the underground cables, 7½ per cent of the bonds, 3 per cent of the poles and overhead construction, and 5 per cent of the section boxes, miscellaneous equipment 7½ per cent. For the year ending May 31, 1902, the total amount charged off was £127,555.

The Hamburg Street Railway Company charges off 1.4 pfs. per car-kilometer (0.56 cents per car mile) per year, that at Hamm 3.5 pfs. per car-kilometer (1.4 cents per car mile), and the Konigsberg municipal road charges off 1½ per cent of the capital.

The Leipziger Strassenbahn charges off 2 per cent of the track, 4 per cent of the overhead equipment, 8 per cent of the rolling stock, 1½ per cent of the buildings, and 8 per cent of the power station equipment. This amounted during the last year to 4.68 pfs. per car-kilometer (1.87 cents per car mile).

On the Leipziger Elektrische Strassenbahn the amount charged off was 3 pfs. per car-kilometer (1.2 cents per car mile).

The Linz-Urfahr Tramway Company charges off 5 per cent, and the Lyons Tramway Company 0.0386 francs per car-kilometer (1.24 cents per car mile).

In Mannheim the practice is to charge off for the track construction 5 per cent, motor cars 7 per cent, trail cars 5 per cent, buildings 1 per cent, feeders 1 per cent, pole line 3½ per cent, rest of the overhead equipment 8 per cent, amounting in all to 5.4 pf. per car-kilometer (2.16 cents per car mile).

In Munich 6 per cent of the receipts is charged off, and in Nordhausen 4 pfs. per car-kilometer (1.6 cents per car mile).

In Remscheid the proportion is track construction 2 per cent, rolling stock 10 per cent, power station equipment 6 per cent, conductor lines 3 per cent, other electrical apparatus 8 per cent. In Solingen the city system charged off 4.9 pfs. (1.96 cents), and the suburban system 4.3 pfs. per car-kilometer (1.72 cents per car mile).

In Würzburg the company provides for a charge of 1.6 per cent of the capital invested, which amounted during the last year to 2.5 pfs. per car-kilometer (1 cent per car mile). In Zurich the municipal system charges off 4.14 centimes per car-kilometer, or 1.32 cents per car mile.

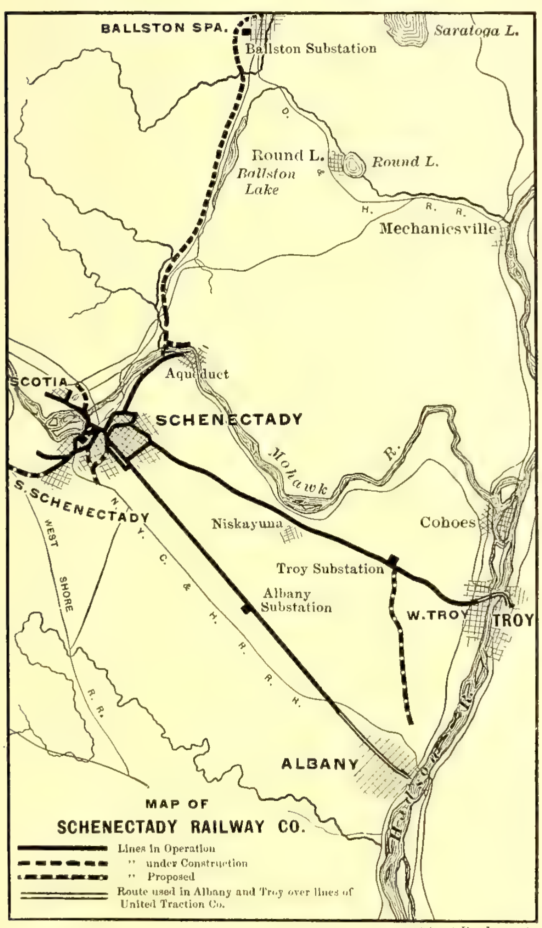
EXTENSION OF THE SCHENECTADY RAILWAY SYSTEM

BY ALTON D. ADAMS

Schenectady, N. Y., which is already connected with Albany and Troy, each about 15 miles distant, by fast electric lines, is soon to enjoy similar service to Ballston Spa. Connection with this last named place is now being completed by an extension of the tracks of the Schenectady Railway Company, which will unite the four cities. The extension from Schenectady to Ballston Spa is a double-track line, largely on private right of way, and 15.3 miles long. On this line the sharpest curve is 5 degs., with a radius of 146.3 ft., and the steepest grade is 1⅛ per cent. The private right of way on which the road is mostly located is 60 ft. wide. At the center of each track the gravel ballast has a maximum depth of 18 ins., and the estimated quantity is 5724 cu. yds. per mile.

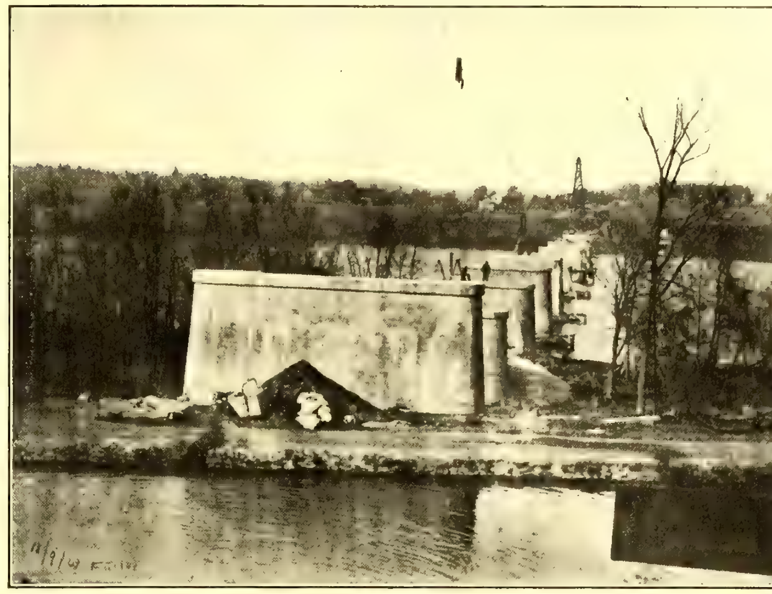
The tracks are laid with T-rails weighing 85 lbs. per yard, and mounted on 6-in. x 8-in. x 8-ft. ties. Between the centers of the double tracks the distance is 13 ft. In entering the city of Schenectady the Ballston division crosses the Mohawk River over a new steel bridge 1765.5 ft. long, built for the purpose. This bridge also crosses the Erie Canal, which runs close to the river at that point. This bridge is mounted on ten concrete piers. About a mile north of the bridge the electric line passes underneath the tracks of the Fitchburg Railroad through concrete masonry arches.

The trolley and feed wire poles are spaced 100 ft. apart, and are set in concrete to a depth of 8.25 ft. Each pole is octagonal in section, of yellow pine, conical at the top, 34 ft. long, 14 ins. in diameter at the butt and 7½ ins. in diameter below the cone at the top. A feature of the pole line is that iron steps are used, being 2 ft. apart, and the lowest step 7 ft. above the tops of rails.



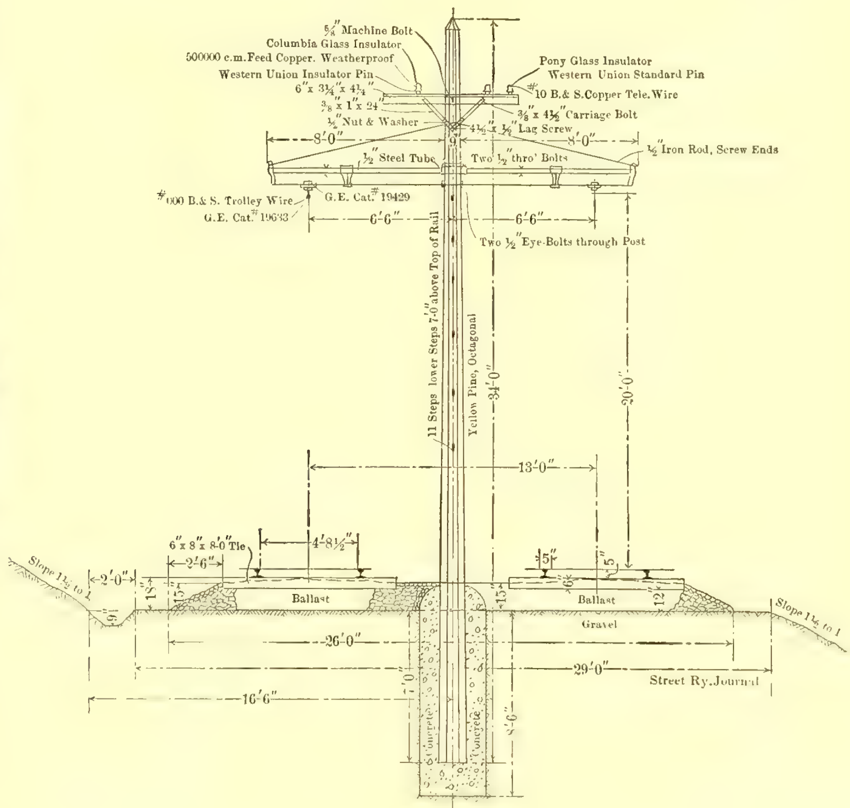
MAP OF THE SCHENECTADY RAILWAY COMPANY'S SYSTEM

The 500,000 circ. mil copper feeder runs the entire length of the Ballston line and is connected to the trolley wires once every 700 ft. for a distance of 3800 ft. from the Dock Street Station. while passing through the city of Schenectady the feeder for the Ballston line is laid underground in Camptile conduit. From the end of the underground cable a second copper feeder of 500,000 cm runs out onto the railway line to a distance of 30,000 feet and is then connected to the feeder that runs the entire length of the line.



BUILDING CONCRETE PIERS FOR STEEL BRIDGE NEAR SCHENECTADY

At the Dock Street sub-station, which furnishes current for the railway in Schenectady and parts of the Troy and Albany branches, as well as for the Ballston line, the capacity in rotary converters is 1800 kw, made up of two machines rated at 600 kw and two rated at 300 kw each. At the Ballston substation the capacity of the rotary converters to be installed at



DETAILS OF POLE SETTING AND FITTINGS

present is 900 kw in three machines of 300 kw rating each. The rotary converters at both of the sub-stations named are 40-cycle machines and operate at 600 volts on the direct-current side. On the Ballston line the new cars will weigh 40 tons each when loaded and are to have a maximum speed of 50 miles

CROSSING STEAM RAILROAD BELOW GRADE

per hour. Each of these cars will be equipped with 125 hp motors, with type M control.

Another moderate extension of about 5 miles would carry the new Ballston line on up to Saratoga Springs, and this would afford rapid electric transit between that city and Schenectady, Albany and Troy.

NEW SYSTEM OF CHECKING CAR SERVICE FOR DELAYS—BROOKLYN RAPID TRANSIT COMPANY

The operating department of the Brooklyn Rapid Transit Company has recently placed in commission a very complete and effective system of reporting car service, with special reference to the tracing of irregularities of headway. This system is the outgrowth of a series of experiments that have for some time been under way with the view of perfecting the service on all lines. In a recent issue of the STREET RAILWAY JOURNAL reference was made to the first step in this direction, in the adoption of a novel method of systematically reporting the service on the various lines by registering the times of passage by certain points of all cars of the system; this has been instrumental in leading up to the efficient system which is here described. The complete success of this system, as well as its simplicity and cheapness of operation, makes it worthy of the consideration of all street railway managers.

The method of registering the headways of the cars by recording the times of passage by certain points of the system, was described in the article on page 175 of the Jan. 30 issue. This was arranged to be accomplished by special clock registers, which were installed at two points of the system past which the two greater portions of the traffic of the city are directed. Each clock operates by rotating a large graduated circular record sheet of paper, upon which the records are made by means of electromagnetically-operated perforating needles. This circular sheet is divided off radially into 144 sectors, corresponding to every 5 minutes for a period of 12 hours, and is divided concentrically into twenty-four circles, to represent the various car lines; in operating, as a car on any particular line passes the clock station, a push button is touched to operate the perforating magnet, which makes the record by quickly pricking the sheet in one of the concentric circles which corresponds to this particular car line. The distances between indentations thus indicates the time that has elapsed between passages of cars.

In this way it may be seen that each car line is carefully traced, the intervals between cars being denoted by the distance between perforations in the circle representing the line; any irregularity of headway is at once shown graphically, and with very little trouble the amount of delay can be located. Two of these clocks are maintained in the city at points covering the greater density of traffic, the complete time of a man being required to operate either register. In addition to the duties of registering of the clock man he is thus enabled to make reports of the irregularity of headway upon each line separately, which he does whenever he notices an interval longer than usual between passages of cars on any particular line. If this interval is more than 5 minutes he is instructed to record the same upon the blank form, illustrated herewith as No. 435. This report is sent to the superintendent of surface lines, who may then make inquiry as to the delay if other explanation has not been given for the same, as will hereafter be referred to. This sample report, No. 435, which is shown, was made out by the clock man at the City Hall clock station, and shows the irregularities of headway on the Gates Avenue line for Saturday, April 16—a busy day.

Similar records showing irregularity of service are also kept upon the lines which do not pass the clock registers; these are easily taken care of by the starters, who, in such cases, have sufficient time to do so without serious addition to their other duties. The starter at each end of every line, from his knowledge of the time-table of his line, keeps careful record of this kind upon the same blank form as shown under No. 435, so that

THE B. H. R. R. CO. STARTERS' DAILY REPORT

April 16th, 1904.

SUPT. OF TRANSPORTATION

I give you below irregular headways on up rail at City Hall on above date

Gates																	
FROM	TO	HDY	FROM	TO	HDY	FROM	TO	HDY	FROM	TO	HDY	FROM	TO	HDY	FROM	TO	HDY
A. M						M			M			M			M		
9:19	9:28	9															
10:35	10:44	9															
10:56	11:05	9															
11:05	11:13	8															
12:31	12:38	7															
3:03	3:13	10															
3:32	3:39	7															
P. M.																	
7:12	7:22	10															
7:27	7:35	8															
9:48	9:56	8															
10:01	10:10	9															
10:27	10:36	9															
11:07	11:15	8															
12:00	12:10	10															

Day C. H. Burton — From 7:00 A. M to 7:00 P. M

Night G. A. Perinchief — From 7:00 P. M to 1:00 A. M

Starters

FORM NO. 435.

the records turned in by the starters at both terminals, and in many cases those furnished by the clock registers are checked up against each other for accuracy. In this way, at the end of each day, duplicate, and sometimes triplicate, records from different points, are turned into headquarters of the service upon a single line. Careful provision is made so that no line, whether running to ferry stations or across the Brooklyn Bridge, is without at least a double checking system of this nature.

In this way it may be seen that the clock records serve as a

valuable check upon the important records of irregularities of headway which are kept by the starters at all terminal points of lines. The intrinsic value of the clock register is that of presenting a graphical record of the headway of the various lines past an important center of the system, from which records the irregularities may be calculated; on account of the large number of cars passing City Hall Square it would be otherwise impossible to keep accurate records of the headway without employing a large force of men. The clock register enables this to be done with comparative ease by one man, which man can also make out from this recording system the required statement of irregularities.

In addition to the above-mentioned reports which are kept by the starters, another blank form is provided, upon which they are required to make statements of the reasons of all delays and irregularities which are known, or can be ascertained, by them. This form is shown as No. 434, one of which reports is made out to cover the service of every line from that terminal and is turned into headquarters daily. On it is recorded the reasons for each delay and irregularity upon that line which can be accounted for at that terminal.

With these reports of irregular headways and additional reports giving explanations at hand, the superintendent is enabled to locate at a glance the location of trouble if any, and can thus easily make inquiries to remedy the same, or if satisfactory explanation is not given he will know exactly where to make inquiry. For instance, if the more serious delays noticed upon the Gates Avenue line (see form No. 435), are not satisfactorily explained in the starter's daily reports, No. 434, inquiry is made of the division superintendent in charge of that

N. S. 434. O—42100

The B. H. R. R. Co. Starters' Daily Report

April 16th, 1904, 190

SUPT. OF SURFACE LINES:

I give you below irregular headways on Gates Avenue line, direction Park Row taken at New York Terminal on above date.

FROM	TO	HDY.	EXPLANATION
P. M.			
8:20	8:28	8	Car No. 3306, run 27, Motorman 1665. Sent to Fulton Ferry account being blocked by wagon at Gates and Nostrand.

Day J. B. Coffin Tour 12:00 M. to 12:00 M

Night ... " ... M.

Starters.

NOTE—This report is exclusively for irregular headways and same must be fully explained and not cover more than one line

FORM NO. 434

line, who can readily trace the trouble and make report of the same to headquarters, so that steps may be taken to remedy the difficulty. The valuable feature of this portion of the system is the provision for reports to show reasons for delays, which supplement the records of delays—this is of great assistance to the operating department and is of the greatest importance in providing for improvements to the service.

Another interesting report is now required by the operating department, which is of still further assistance in obtaining information as to the condition of the service. This is provided for upon the blank shown herewith as No. 312, the records for which are kept by the inspectors, being made out for a single line and turned in after every day's work. A glance at this report will indicate its usefulness. The questions to be answered with reference to the maintenance of the headway, to the sufficiency of the service at any hour, and to the general sanitary condition of the cars are valuable, while even more so, perhaps, is the statement as to whether the cars are running to proper terminals to accommodate the public.

A general monthly summing up of the condition of the service upon each line is to be had from the passenger record, which is made up in the form shown upon the large blank, No. 313. This record covers a month of operation, being made out in full for the four most important days of the week, namely, Sundays, Mondays, Wednesdays and Saturdays. These days represent the most important periods of traffic during the average week, as the records of the intervening days show up much lighter and are thus of less importance. As may be seen, a record is made of the condition of service for each half-hour

N. S. 312

Inspectors Daily Car Service Report

Date April 16th, 1904. 190

Tour from 5:00 P.M. to 6:00 A.M.

Gates Avenue Line

Is headway well maintained? Yes - outside of one gap (see below)

Are cars running to proper terminals to accommodate the public? Yes.

General condition of cars Good

Is there insufficient, or too much, service at any hour? The service was O.K. during my time.

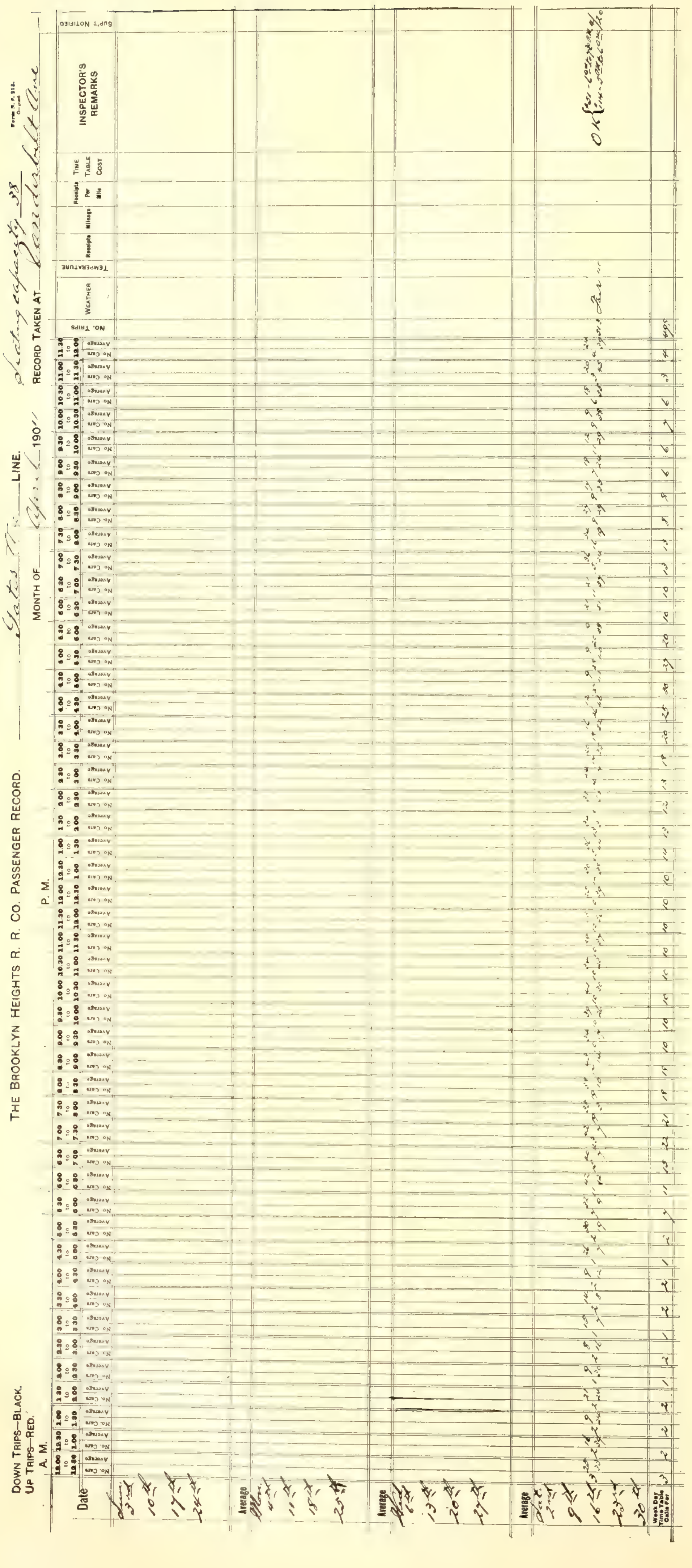
Delays, Cause? Gap of 10 minutes on up rail at Nostrand from 10:21 to 10:31 P.M. account being blocked by car which would not take switch at Fulton and Dekalb.

Sign J. H. Cordes No. 114

[Notice—This report must be made up accurately and turned in after day's work, and must not cover more than one line

FORM NO. 312

throughout the entire twenty-four hours of each of those days for the entire month. Under the heading, Number of Cars, is recorded the entire number of cars in operation upon the line during that half-hour; opposite this under the heading, Average, is recorded the average number of passengers upon a single car as counted at one of the busiest points of the line by the conductor, for both the up and down trips. In the actual keeping of this record the average numbers of passengers for both down and up trips are inserted in pairs opposite the number indicating the cars in service, in black ink for the down trips and in red ink for the up trips (the red ink numbers appear in black in the accompanying sample sheet, but may be distinguished readily from being the lower of the two average numbers). The average number of passengers riding upon a single car of the line during any half-hour is calculated from



PASSENGER RECORD. FORM NO. 313.

the reports turned in from all the cars upon the line during that half-hour.

The obtaining of these counted numbers of passengers in each car, from which to calculate the averages, presented at first a serious problem, but was solved in an interesting manner. At first slips were given the conductors in addition to their day cards upon which to record at some designated busy point of the line the actual number of passengers in the car at that time, the number of passengers being obtained by counting and not by reference to the register, as it is desired to provide for the maximum number of passengers riding on a car at the busiest point of the line, which cannot be obtained by reference to the register. The trouble encountered was that the conductors were continually losing their passenger report slips, and the records turned in were thus made indefinite. It was also an easy matter for a conductor not to receive the blank passenger slip, and, furthermore, it was an easy matter for him to purposely lose the slip if he had neglected to make out the report properly.

This was overcome in an effective manner by a rearrangement of the conductor's day card so that the passenger report blank is attached to its lower end, with perforations permitting it to be torn off and turned in separately at the end of the day's work. The form that was finally adopted is shown herewith as No. 137. This method effectively solved the difficulty, inasmuch as a conductor cannot now take out a car without receiving his day card, and with this arrangement the day card carries with it the passenger report blank.

The process of recording the average numbers of passengers is clearly indicated upon the passenger report blank which is attached to the day card as shown. Columns are provided for the car number, trip number, times of leaving, destination, average numbers of passengers of both down and up trips, and, finally, the busy point on the line at which the record was made. As shown in the accompanying sample report, the busy point on the Gates Avenue line is taken at Vanderbilt Avenue, and the number of passengers which the conductor counts at that point is recorded as shown. The real value of this report is that it shows whether the car service is made to provide carrying capacity for these average numbers of passengers and thus give adequate service.

Form No. 313 is of sufficient size to allow the records to be neatly and con-

STATEMENT OF CASH AND TICKETS TURNED IN

Date 190

.... Line

Run No. ....

.... Conductor

	Bills	Dollars (silver)	Halves (silver)	Quarters (silver)	Dimes (silver)	Nickels	Cents	Tickets at 5 cents each	Total
Cents									
Dollars									

A This Cash and Ticket Statement to remain attached to day sheet and turned in with cash in bag

CONDUCTOR'S DAILY PASSENGER REPORT

Date April 16th 1904

Gates Avenue Line

Run No. 26

Car No.	Trip No.	Left	Destination		Passengers		Taken At
		A.M.	From	To	Down	Up	
950	1	6.03	Ridge	N.Y.	59		Vanderbilt Ave
						23	"
	2	8.10	"	"	48		"
						16	"
	3	10.26	"	"	35		"
		P.M.				20	"
	4	1.20	"	"	37		"
						33	"
	5	3.40	"	City Hall	15		"
						46	"
	6	5.50	"	"	12		"
						58	"

SIGNED: Conductor John Jones No. 4206

Motorman P. Murphy No. 5907

NOTICE—When at point designated count passengers on car and show same on this report

DETACH AT PERFORATED LINE **A** AND TURN IN TO STARTER AT END OF DAY'S WORK

FORM NO. 137, USED AT FOOT OF DAY CARD

veniently made, and space is left at the right-hand end for further records which are of value in considering the service, namely, the total number of trips, the weather, the temperature, the total daily receipts of service upon the line, the mileage, the receipts per mile, and the time-table cost, or cost of labor, in operating the cars in service. This latter is important as, when taken in connection with the fourth column, it gives a basis upon which to figure directly the gross profit of operating the line. The inspector's remarks are recorded in the next to the last column, by making reference to his reports, while in the last column is indicated whether the superintendent has been notified of troubles, if any have occurred.

Another important feature of this record sheet is to be seen in the horizontal column at the bottom of the page, which shows what service the week-day time-table calls for. In this column is recorded the number of cars which ought to be in service upon the line during each half-hour of the day, and thus it may be seen, at a glance, by comparison of the recorded number of cars in service with this time-table number, whether the service is being maintained or not. It is important to note that in very many cases the service actually called for is considerably exceeded. Reference to the service record will show that at "rush-hour" periods of the mornings and evenings, and also at the theater hours of the evenings, the service called for is greatly exceeded, showing the attempt of the company to supply adequate service for all demands. The actual amount of extra service ordinarily to be required can in no other way be ascertained than by frequent study of the records obtained from this system.

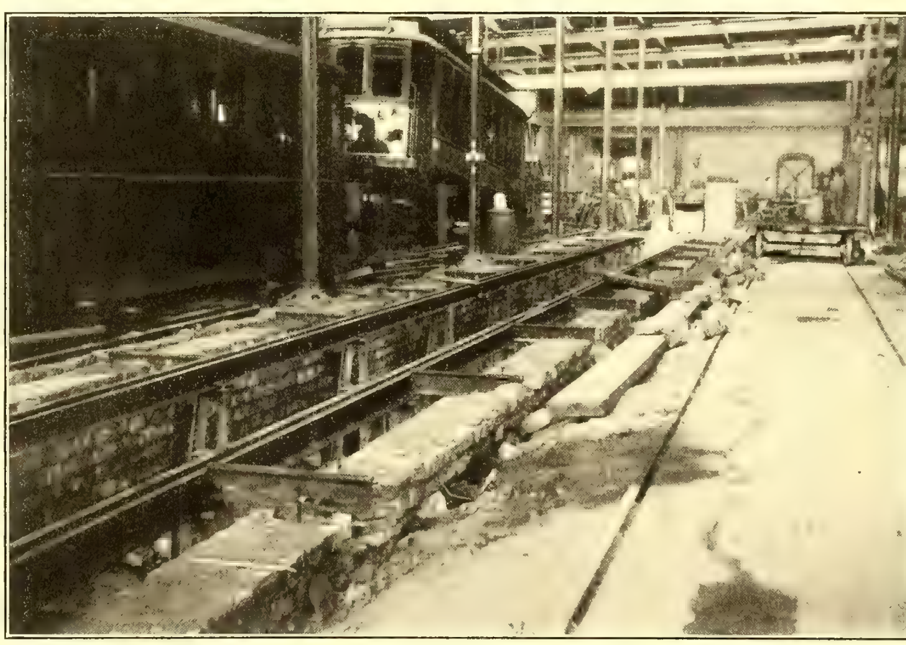
This reporting system has been worked out under the direction of Mr. Graham, superintendent of surface lines of the Brooklyn Rapid Transit Company, who has devoted a great deal of work to its development.

STORAGE AIR BRAKE SYSTEM IN CHARLEROI

The electric railway system in Charleroi, Belgium, owned by the Société Nationale des Chemins de fer Vicinaux, has recently been equipped with the Westinghouse storage air brake system. The line is about 16 miles in length and is equipped with thirty-nine motor cars and the same number of trail cars. The power station is about the center of the system and the air compressors are located at that point. They are two in number and driven by a 17-hp motor. The company has one auxiliary compressing station, which is also equipped with two electric compressors. The motor cars are fitted with two compressed air reservoirs, with a total capacity of 750 liters. The trail cars are equipped with brake cylinders and rigging, but not with reservoirs.

REPAIR TRACK PITS AT KANSAS CITY

The accompanying engraving is from a photograph taken during the construction of some new repair pit tracks in the shops of the Metropolitan Street Railway Company, of Kansas City, of which G. J. Smith is master mechanic. It will be noticed that these pits differ from the ordinary, being wider than the tracks under which they are located. The tracks are supported on cast-iron columns, and these columns are braced laterally by T-rails, which are tied into the masonry wall. The photograph was taken just before these tie-rails were embedded in the masonry. The material used in walling up these pits was granite block, as the company happened to have a large stock of these on hand, recently taken from streets where the track had been relaid in asphalt paving. The object of the pit is, of course, to enable repair work to be done on the journal boxes and other parts by a man in the pit or seated on the edge of the pit. The man in the pit can easily get at either the inside or the outside of the truck without going to the end of the truck and crawling out of the pit onto the floor. The pits being wider than usual are more convenient for the repair men. This pit construction combines some of the advantages of ordinary pit construction with some of the advantages found in repair shops where certain repair tracks are elevated in place of having pits under them.



WIDE REPAIR PITS IN KANSAS CITY, WITH TRACKS SUPPORTED ON CAST-IRON COLUMNS

THE NEW PARKVILLE CONCRETE SUB-STATION OF THE BROOKLYN RAPID TRANSIT COMPANY

In line with their general policy of improvement of service, the Brooklyn Rapid Transit Company is now adding another link to its very extensive power distribution system by the installation of the Parkville sub-station, which was sometime ago proposed for use in connection with the new Third Avenue power station, now being completed. This sub-station is located upon the Brighton Beach line, near the intersection of East Fifteenth Street and Avenue H, and close to the crossing of that line with the Long Island Railroad. It is intended to furnish power to the district now supplied by the Thirty-Ninth Street power station of the system, which includes many of the important lines leading to the ocean resorts.

This sub-station is of unusual interest, as it involves a departure from usual methods of construction for such purposes. Work is progressing rapidly upon the construction, although the side-wall foundations and those for the rotary converters only are as yet in place. It has been so badly delayed during the late winter by bad weather that it is proposed to temporarily erect two of the machines for assisting in the service of carrying the heavy traffic on the ocean lines in the coming summer, although the structure will not be entirely completed until fall. The machines installed will be protected by a temporary shed covering, which will permit of their operation, yet not interfere with the construction of the remainder of the sub-station building. This step is being taken in order to relieve the present power stations which have been carrying heavy overloads during the past summer seasons in handling the enormous summer traffic of the system, and particularly as the company intends this coming summer to increase the service considerably beyond anything previously attempted. This sub-station will greatly facilitate the operation of these lines and will permit the desired additional improvement over the greatly improved service of last summer.

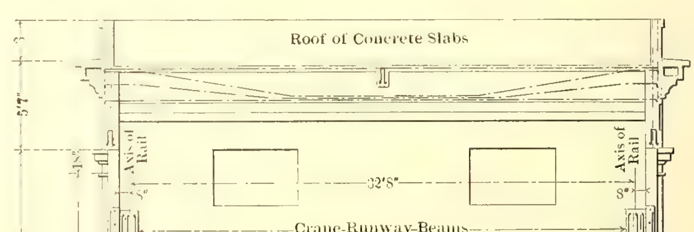
This station is designed to provide for five rotary converters of 1000-kw capacity each, although at present only two machines will be installed. The equipment of the sub-station is to conform with the standards that are in use at the other sub-stations of the city distribution system for interchangeability. The three-phase current from the main Third Avenue power plant is received at 6600 volts, but is transformed in static "step-down" transformers to a convenient working potential for the rotary converters; these machines will operate in synchronism, at the frequency of 25 cycles, to deliver the direct-current supply to the line feeders at 550 volts potential.

The static transformers are of the air-cooled type, and are to be delta-connected to the leading-in feeders through the necessary equipment of motor-operated oil switches. They are to be mounted in groups of three upon the raised platform at one side of the sub-station floor, as shown in the accompanying cross-section drawing; this arrangement makes convenient the necessary air-blast connections from beneath, as well as also facilitates the wiring connections which will be made from the basement. The oil switches to be used will be the standard type-C switches of the Westinghouse Electric Company, who is furnishing the complete electrical equipment of this plant, including the rotaries, static transformers and switchboard apparatus. The station is fed by two separate feeders from the main power plant, which are carried underground part of the way, and on overhead lines the remainder of the distance.

The interesting and important feature of this sub-station is that it is constructed throughout exclusively of reinforced concrete, including all the necessary beams and girders. This is something of a departure for sub-station construction, and the success of the system will be watched with interest by those having to do with power distribution problems. Many novel features are involved in this installation, including that of a concrete slab roof, concrete roof beams of 34-ft. span, concrete crane running girders to carry a hand traveling crane of 20 tons capacity, and reinforced floor construction of a capacity of 400 lbs. per square foot.

EXTERIOR ELEVATIONS OF THE NEW PARKVILLE SUB-STATION BUILDING

The accompanying drawings well illustrate the details of construction of this structure. The exterior is designed for an artistic effect, with rows of pilasters placed externally to represent columns, thus enhancing the otherwise plain effect of the concrete construction. Two rows of windows are provided for, and a large double door in the south end, as shown, will permit of easy handling of parts of machinery into the building.



CROSS SECTION OF CONCRETE SUB-STATION

A spacious basement is provided for carrying the wiring connections.

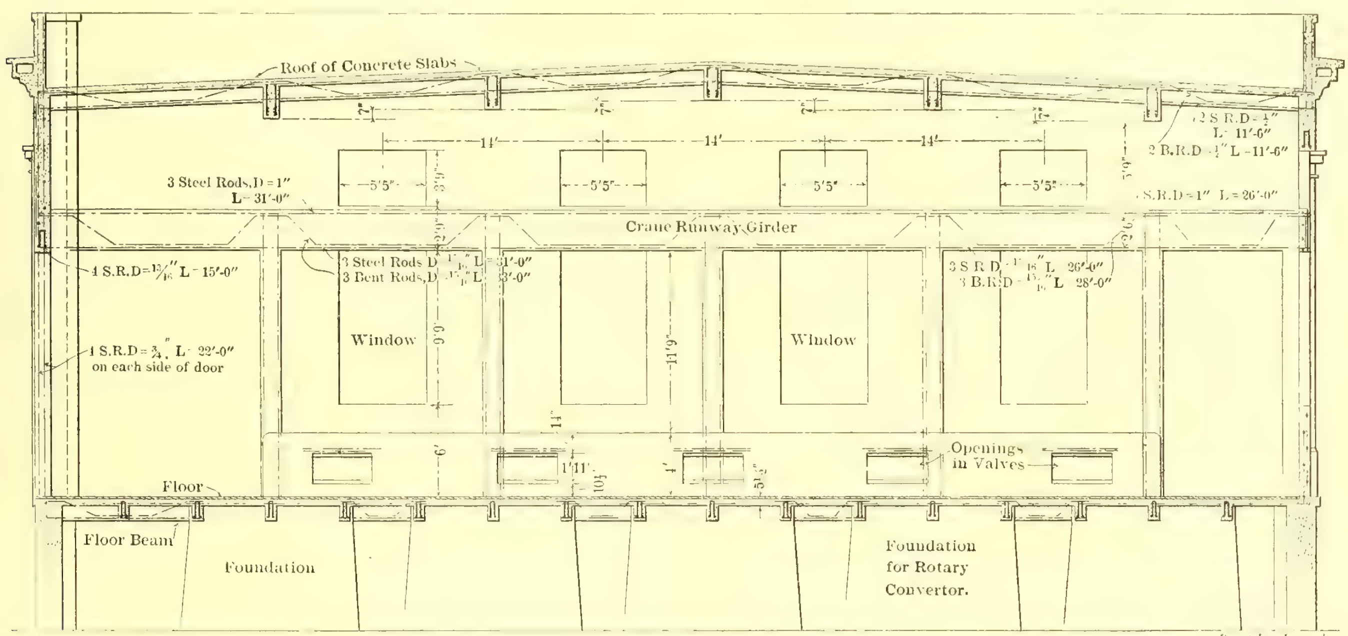
The longitudinal and cross sections illustrate the arrangement of the wall and rotary converter foundations, and also of the transformer platform at one side of the building. Five foundations are provided for the rotaries, surrounding which are open spaces in the basement, which has a clear height underneath floor beams of 6 ft. A spacious vault is formed under the transformer platform, occupying the west side of the basement, which provides easy access to the air blast pipes for cooling the transformers. The concrete crane girders are supported by pilaster columns rising between windows, upon which the runway is built up as a solid member. The roof is constructed similarly, being supported by five cross beams and stiffened by one longitudinal beam, all of which are of a construction similar to that used in the floor beams. The roof covering consist of sections of concrete slabs, which are reinforced by double rows of ⅜-in. steel rods, as indicated.

The details of this beam construction are made clear in the engravings. Each beam, whether for floor, roof, or crane-runway support, is built up with two or more rows of round steel rods extending longitudinally through the lower side of the beam and with corresponding bent rods extending downward from the upper sides of the ends, as shown; this effectual location of the steel reinforcing rods in the lower part of the beam enables the tension at the middle point under load to be fully taken care of by them. The shearing effect of the load upon the beam is taken care of by a carefully designed arrangement of stirrups of round steel rods, of smaller diameters, which are woven between the main longitudinal reinforcing rods, as shown, being necessarily closer together at the ends of the beams where the shear is greatest.

The cross section view shows some of the beams in detail and well illustrates this construction. In the floor beams reinforcing rods are placed in the lower side only, while in the crane girders and in some of the roof beams additional stiffening is provided by reinforcing rods in the upper sides also. In most of the beams two rows of straight and bent longitudinal rods are used, but in the crane girders three rows were used for obvious reasons.

The important feature of this system of concrete construction lies in the fact that all the steel members and even the section, location and spacing of the stirrup members, are carefully calculated for the loads which are to be imposed upon them. By actual destructive tests it has been found that with this system definite results can be provided for with the exactness which enters into steel-beam construction. It is believed by the contractors that this is the only system wherein shearing stresses in the beams are calculated for and suitably taken care of by the actual distribution of the reinforcing steel members. The main object of the contractors in the use of this system is to establish a system of concrete steel construction, which, while taking into consideration all theoretical principles, will also provide for the practical features of the work necessary for definite results; the theoretical requirements are well known, and have been much discussed, but they assert that sufficient consideration has not been given to the practical features, as required to make an exact application of the theory to the practice.

One of the defects of a good many systems of concrete steel construction, it is claimed by them, lies in the difficulty in the placing of the so-called stirrups in their proper positions in relation to the main reinforcing rods; while their theoretically



LONGITUDINAL SECTION OF SUB-STATION, SHOWING REINFORCED CONCRETE CONSTRUCTION FOR FLOOR, ROOF AND CRANE RUNWAY GIRDERS

proper locations are carefully indicated upon drawings, their practical placing in the beam is left to the ability of laborers or of foremen to space them after the longitudinal reinforcing rods are located in the moulds, thus creating a fruitful source of error. In this system this difficulty is obviated by the building up of the longitudinal reinforcing members and the vertical stirrups together into a framework, by tying with thin wire, before inserting into the moulds. It is then an easy matter to lower these frames, or trusses, into the moulds and locate them rigidly at the proper distances from the centering in order that the steel may be entirely embedded in the concrete, which is the condition required in order that the construction may be absolutely fireproof. The contractors believe that this will be the first concrete structure in which the reinforcing steel work is located definitely and exactly as called for by the plans.

Considerable care is used in the selection of material. In regard to the reinforcing steel, which is one of the most important features, nothing but steel rods of round section are used. The use of flat steel bars was found to offer the disadvantage that when the concrete is poured around it, air bubbles are formed upon its lower face, thus rendering a good part of its surface useless for adhesion; the patent twisted or corrugated rods which are used in many systems for the purpose of increasing the adhesion of the concrete to the steel, are thought to be absolutely unnecessary, inasmuch as the adhesion of con-

crete to a steel surface is equal to the shearing resistance of concrete. In some tests recently made on concrete beams it was noticed that in those merely reinforced with a patented type of reinforcing rods, the concrete almost in every case sheared off longitudinally along the rods near the stirrups where the shear is maximum, thus leaving the rods entirely exposed; in destructive tests of some beams of the system used for this sub-station, it was found that they failed in a manner similar to that in which steel or wooden beams usually break, that is, by breaking at the middle; this goes to show that the plain round rods, as here used, have many advantages for this work.

The other materials used are of the best quality. The broken stone is carefully screened to run in sizes of from ¼ in. to ¾ in., and is carefully washed. The sand is also screened and washed. The concrete is mixed wet in proportion of one part of cement to two of sand and four of broken stone, Atlas Portland cement being used for this structure. Wet concrete is used on account of having been found best for this work, owing to its property of more thoroughly covering and adhering to the steel frame work than the more dry rammed concrete. Some of the features of this system, as carried out, would seem to make the work rather expensive, but with the numerous labor-saving appliances that have been introduced for the construction, are said to render it a very economical system.

A building constructed in accordance with this system, the entire design and construction of which was supervised by R. L. Bertin, is in use in Long Island City for a large paper mill, and has been for some time subjected to the extreme test of daily service under heavy machinery-opearting conditions. The complete success of that building induced the Brooklyn Rapid Transit Company to investigate this system for the sub-station building, and, no doubt, its unquestionable success will do much to influence future work of this kind. The saving in first cost over that of former methods of construction is sufficient to warrant its being given careful attention by street railway managers.

The estimated cost of this structure, as erected by the Bertin system of reinforced concrete, will be $10,000—a material saving over what it would have cost with ordinary methods of construction. The materials and labor for its erection are being furnished by the Brooklyn Rapid Transit Company, the Bertin Engineering & Contracting Company, of Brooklyn, having contracted the engineering and supervision of the erection upon a percentage basis, with a bonus agreement for any reduction of cost below that estimated, and rebate for increased cost. The calculation and design of this structure was carried out by R. L. Bertin, of the Bertin Company, who was ably assisted in the designing work by its consulting engineer, E. P. Goodrich, formerly connected with the United States Navy.

The first electric railway in Peru was formally opened to the public at Lima, Feb. 17, with ample ceremony and great rejoicing by the populace. The road connects Miraflores, Barranco and Chorillos, summer resorts, with Lima, and is 8 miles long. It really was built in record time. The company applied to the Government for a charter to build the road Dec. 9, 1902; the concession was granted Jan. 20, 1903; work began June 11, of that year; the road was completed Jan. 18, 1904, and inaugurated Feb. 17. President Manuel Candamo of the Peruvian Republic, who is the formal sponsor of the road, replied to the address delivered by its president, Jose Payan, and Archbishop of Lima, Manuel Tovar, invoked divine aid and pronounced the benediction upon the new enterprise. Manuel T. Marca, chief engineer of the city railroads of Lima, is engineer for the new road. W. McLimont is electrical engineer, and Emilio Godoy, manager. All cars are of American manufacture, and are equipped with Christensen straight air brakes.

FINANCIAL RESULTS OF ELECTRIC RAILWAY OPERATIONS IN GERMANY

BY A GERMAN ENGINEER

Although the street railways in Germany were electrified at a later date than those in America, practically all the lines have now been equipped for electric traction for a sufficient length of time to demonstrate the results of the transformation from animal to electric power. The returns show that while most of the privately owned railways have continued to pay the customary dividends, the results obtained by the adoption of modern traction methods have been much less favorable than was anticipated. It is true that some of the railways operating in cities exceeding 125,000 inhabitants are paying over 6 per cent dividends, but they are few in number. In general the companies are satisfied if they can pay 4 per cent or 5 per cent on their stock. This is not a very encouraging fact. If an industrial undertaking, which is subject to ruinous competition at any time should return only 4 per cent on the cash investment, it would be considered a failure. The difference between the estimated and the actual net receipts of the electric railway enterprises lies in the operating expenses. In fact, so great has this difference proved that had not other unlooked for, but favorable, factors appeared, the larger part of the capital invested in electric railway enterprises in Germany might as well have been considered lost. If the reader asks what items in the original estimates were erroneous, the reply must be, "almost all."

Consider first the cost of power from the standpoints of both generation and use. Although two or three of the largest central stations produce power for about 1.25 cents (5 pfs.) actual cost (including station repairs) per kilowatt-hour, in the greater number the cost is at least 2.25 cents to 2.5 cents (9 pfs. to 10 pfs.); medium sized installations, 3 cents to 3.75 cents (12 pfs. to 15 pfs.), and smaller stations up to 10 cents (40 pfs.) per kilowatt-hour. To this must be added the cost of cables and other material, provision always made for sinking and renewal funds, etc. In the early days, tests made under most favorable conditions showed that the power consumption per car averaged 350 watt-hours per car-kilometer, but in practical operation the power consumption has risen to from 450 watt-hours to 600 watt-hours per kilometer, while on many city railways operating on good level streets the power consumption sometimes reaches 700 watt-hours per kilometer (1170 watt-hours per mile). These figures are based on the standard common in Germany, namely, a single truck car carrying two motors of about the same capacity as the G. E. 800 or G. E. 52 motor, and weighing from 7 tons to 8 tons.

Naturally, the deterioration of the equipment and track has increased in the same ratio. To-day it is considered remarkable if a gear runs 40,000 car-kilometers (24,000 car miles). The life of track in cities of 150,000 to 200,000 population was formerly assumed to be fifteen to twenty years. Now it is known, even if not always admitted, that expensive special track work, such as is used at points of heavy traffic, becomes so worn within three years that the wheel flanges run on the bottom of the grooves, and that in general railways in cities with heavy vehicular traffic must renew their entire track every ten years.

The cost for paving has proved enormously higher than was expected, as the companies are subjected to the most exacting requirements. The increasing use of asphalt is responsible for a great part of this expense, as asphalt pavements constantly need repairs. It can be safely asserted that wherever a company is obliged to maintain an asphalt pavement the maintenance charges will swallow all operating profits unless the passenger business is very dense.

The labor cost is in some cases more than double the amount

paid under horse-car conditions. The motormen, or rather the labor unions, suddenly discovered that there is a great difference between a motorman and a horse-car driver, although the former is not obliged to handle heavy reins and a whip while driving one or more horses and keeping a sharp lookout. This discovery resulted in wage increases and reductions in working hours from 12 or 13 hours to 8 or 9 hours. Of course, the conductors had to be treated likewise, but in their case the working time was reduced until they themselves protested. This anomaly is due to the fact that it is customary in many cities in Germany for the conductors to receive tips from passengers in return for information. As these tips sometimes equal if not exceed the wages paid by their employers, conductors on crowded lines are not likely to be short-hour enthusiasts.

The greater number of the employees have been accorded the benefits mentioned, as the companies were obliged to treat the other employees likewise, so that to-day the wages cost per car-kilometer is about one and a half times as much as it was eight or nine years ago.

Accident insurance is another item whose cost has proved to be far greater than was originally estimated, because the insurance companies grew tired of paying heavy damages out of their own pockets. Where formerly a company could secure personal injury insurance by paying 3 per cent or 4 per cent of its gross earnings, now as much as 20 per cent is demanded, and even then the railway company runs the risk of having its policy canceled by the insurance company at any moment.

Besides the old hand brakes power brakes have long been installed on most of the railways, not only in compliance with the demands made by municipal authorities and accident insurance companies, but also because of the desire of the railway companies themselves to secure safety in operation. The maintenance of this additional equipment, of course, involves still another heavy charge.

The one favorable condition that has tended to offset all of the additional charges named is the entirely unexpected increase in traffic. It can hardly be claimed that this increase has been caused by any one prominent characteristic of electric traction. It cannot be attributed to the change in speed alone, for in many cases this has increased on an average from only 9.5 km to 10 km (5.7 miles to 6 miles) an hour, or in some cases to 12 km (7.2 miles) an hour, possibly reaching 13 km (7.8 miles) an hour in suburban towns. Nor is this additional traffic due entirely to either more attractive cars or to lower fares, but more probably in principal measure to quicker and more regular headway and the introduction of transfers. Only all of these factors combined could cause an increase in traffic large enough to overbalance on a large number of lines the additional expenses brought on by the change to electric traction. Nevertheless, the very small city lines and the interurbans operating in thinly populated districts will be saddled with deficits for some time to come, or at best earn trifling dividends.

The profits of the municipal railways compare very poorly with the dividends paid by the companies under private ownership. This probably explains why the ardor for municipal ownership of tramways in Germany has cooled recently. It is true that in 1902 eight lines were added to the thirty-four municipal roads in operation at the end of 1901, but 1902 appears to have witnessed the maximum increase, for in 1903 only two were added. Not more than twelve of these roads can show earnings reaching or exceeding 4 per cent. To be sure, some of them are very profitable, for instance, Frankfurt-on-Main, which operates only 40 km (24 miles) of track for a population of 300,000, and Cologne, where high fares are charged. The other systems either pay very small dividends or show deficits.

The German street railways at the end of 1902 covered a total street length of 3176 km (1906 miles), an increase of 5.7 per cent over the preceding year. Of this amount, 576 km (346 miles), or 18 per cent, are under public ownership. It must be noted, however, that of this number only 470 km (282 miles) are operated directly by the municipalities, the balance being leased to individuals. This method is employed in Berlin, Halle, Münster, Elberfelde, Solingen, Aachen and Freiberg. On the other hand, there is only one privately owned railway operated by a municipality, namely, Bad Pyrmont, a 3-km (1.8 mile) horse-car line. The largest four municipal lines are Cologne (67 km, or 40.2 miles) München (48 km, or 28.8 miles), Frankfurt (44 km, or 26.4 miles), and Düsseldorf (42 km, or 25.2 miles).

Another symptom of the decline of the municipal ownership idea is the fact that several municipalities, Barmen, for example, are considering the advisability of leasing their lines to individual companies.

Of the 3176 km (1906 miles) above mentioned 80 km (48 miles), or 3 per cent, are horse railways. There are twenty-two in all of the latter, Mainz, Brandenburg, Rostock and Potsdam having the most important systems. Steam lines comprise 175 km (105 miles). The principal installations are at Strassburg, Mülhausen (Alsatia), Bonn and Gera. There is also one gasoline line, 7 km (4.2 miles) long at Nördsee-Bad Juist.

The few horse-car lines have remained in existence because the traffic did not justify their electrification, or in consequence of the excessive demands made by municipalities to permit such change. The remaining steam lines have held their own owing to their connection with the steam trunk lines, which enables them to deliver freight to factories in town. While there is little profit in this business it appears to be better suited for steam power than for the electric lines. A few of the electric roads are doing a little freight business, but with small success. In all, there were in 1902 twenty-eight street railways, operating 665 km (400 miles), handling freight, but the length of line fell to 540 km (324 miles) in 1903—a certain sign of poor business. Hanover, with 160 km (96 miles) and thirty electric locomotives, stands at the head of the electric lines handling freight. The number of freight-car kilometers run in Hanover last year was 1,475,000 (885,000 car miles), and the tonnage carried 176,000, giving only 1100 metric tonnes per kilometer (1936 tons per mile) of track.

The largest street railway system is the Grosse Berliner Strassenbahn (including the Western and Southern Berliner Vorortbahn & Charlottenburger Strassenbahn), covering 332 km (200 miles). The annual income of this company for 240 km (144 miles), exclusive of controlled lines, is 28,100,000 marks ($7,025,000), the number of passengers carried 295,000,000, and car-kilometers run 67,400,000 (40,440,000 car miles). The Hanover system, with 160 km (96 miles), is next in length, but the Hamburg lines, though 6 km (3.6 miles) shorter, have an annual income of 10,900,000 marks ($2,725,000), which is second only to Berlin.

The most profitable line is that owned by the Hamburg-Altonaer Centralbahn. It is 9 km (5.4 miles) long, and consists of a single straight line, joining the business and amusement centers of Hamburg and Altona. It is distinguished from all other German lines in selling no commutation tickets. A uniform fare is charged, viz., 10 pfs. (2½ cents). It holds the record with about 150,000 marks per kilometer ($62,500 per mile), followed by Frankfurt with 115,000 marks per kilometer ($47,916 per mile), and Berlin with 112,000 marks per kilometer ($46,666 per mile). The Hamburger Strassenbahn receives 75,000 marks per kilometer ($31,250 per mile), while the gross income of the Hanover company is barely 17,000 marks per kilometer ($7,083 per mile). At first the Hamburg-Altonaer Centralbahn paid 30 per cent, but is now paying 19 per cent on its capital of 2,000,000 marks ($500,000).

A review of the fares charged throughout the country may be of interest. Up to 1902 the cost of transportation was

lowered either by reducing the fares or giving a longer ride for the same charge. Most of the railways, in compliance with the urgent demands of the public, introduced a unit of 10 pfs. (2½ cents), and even lower commutation rates which often amounted to less than one-half of the usual fares, and this for distances up to 15 km.

Of course, low fares are conducive to heavier traffic, and every railway company should endeavor to reduce its transportation charges as much as is possible, but only within reason. Many of the railways found that they had gone too far and began to seek means for relief. This, however, could be obtained only by the municipal lines, because the private companies were bound by contracts with their respective municipalities, who, of course, would not be likely to abrogate agreements which would make their citizens pay higher fares. So, while the private companies were obliged to stand by the low rates, nearly all of the municipal lines abolished the 10 pfg. (2½ cents) uniform fare. It is a fact that in most of the large cities having municipal lines the fares are appreciably higher than in cities of corresponding size having privately owned railways—another sign of the times which has done much to dampen the ardor for public ownership. A good example of this is Nürnberg, where the private railway charged 10 pfs. (2½ cents) for many years. In May, 1903, the city acquired this line, and two months later a zone system was inaugurated which increased the average fare. The city explained this action by stating that additional income was necessary to build extensions.

The following table shows the average fare per passenger in some of the large cities:

	1902		1901	
	Pfg.	Cents	Pfg.	Cents
Breslau	8.3	2.075	8.3	2.075
Frankfurt	8.9	2.225	8.8	2.2
Deutsche Strassenbahn Dresden	9.0	2.25	9.0	2.25
München	9.1	2.275	9.2	2.3
Berlin	9.2	2.3	9.4	2.35
Leipzig	9.4	2.35	9.2	2.3
Magdeburg	9.5	2.375	9.1	2.275
Düsseldorf	10.2	2.55	9.1	2.275
Cöln	10.3	2.575	10.3	2.575
Hamburg	10.5	2.625	10.9	2.725
Hanover	10.8	2.7	10.8	2.7

Most of the lines showing an increased average accomplished this result by increasing the commutation rates, and in one case by raising the regular fare. Where a decrease is shown in the average fare the cause is due chiefly to reductions in commutation rates; but not a single company reduced its regular fares in 1902. The serious losses suffered in 1902 by many suburban lines operating in industrial districts were in most cases recovered the following year, when the industrial depression began to disappear, and up to the present time this betterment has continued. It is significant, however, that there is a general tendency to pay lower dividends than heretofore, and use the difference for the benefit of depreciation and maintenance funds and for contingencies.

In 1903 several of the railways began paying to the municipalities the percentages of net earnings stipulated in their charters, thus adding another item to the many exactions already required. Clauses regarding net earnings are worded somewhat like the following:

> Besides the payments hereinbefore mentioned, the railway is to pay, beginning with the year ...., a portion of the surplus remaining after disbursing a 5 per cent or 6 per cent dividend, this part to equal 35 per cent of the surplus remaining after a 6½ per cent dividend has been paid and rising to 50 per cent of the surplus remaining after the payment of an 8 per cent or 9 per cent dividend.

The only good feature about this method of taxation is that it tends to make a municipality cautious about granting concessions to a competing company, because with two companies in the field there would be far less likelihood of its receiving such additional payments.

In conclusion, it may be interesting to note the capital invested in street railways in Germany. The total amount invested is 745,000,000 marks ($186,250,000), of which 395,000,000 marks ($98,750,000) is invested in standard gage lines, and the balance in other gages (mostly meter gage). The average cost per kilometer is 240,000 marks ($96,000 per mile). The total income for passengers in 1902 was 123,800,000 marks ($30,950,000), against 118,300,000 marks ($29,575,000) in 1901. The freight and mail business amounted to 1,140,000 marks ($285,000). The actual operating expenses in all Germany were 72,000,000 marks ($18,000,000) in 1902, against 71,200,000 marks ($17,800,000) in 1901.

The cost to the companies for the workmen's insurance required by law was 2,270,000 marks ($567,000), and for taxes and special payments 7,300,000 marks ($1,825,000). It must be remembered that the latter amount, although very large, represents only a small part of the total sum paid to the municipalities by the companies, particularly in paving costs, the obligation in many cases to purchase current at high prices from municipal power stations and other heavy expenses. The total amount paid in dividends was only 15,800,000 marks ($3,950,000), or hardly more than twice the amount paid for taxes and special payments.

Great interest has been created by the question whether municipalities have the right to grant franchises to new companies on streets already given to another company. In all the cases which have been tried hitherto the highest court has decided that where one surface railway occupies a street a second franchise cannot be given to another surface railway for the same street. However, all of these cases were based upon specific agreements, and no general ruling has yet been rendered.

The present case concerns the city of Berlin and the Grosse Berliner Strassenbahn. The railway company seeking a franchise is not a street railway, but an underground railway, nor is it a new line but a continuation of an old one. The Grosse Berliner Strassenbahn has informed the city that it objects to having the other company receive a franchise, and the city has, therefore, appealed to the courts to make the railway company acknowledge its right to grant the franchise. The local court has placed the value of the concession at 37,000,000 marks ($9,250,000), and before the case is finally decided the legal expenses will probably amount to 1,500,000 marks ($375,000).

Naturally, the public is far from pleased to have the development of traffic facilities thus interfered with, but the Grosse Berliner Srassenbahn is simply defending its rights in objecting to the granting of franchises that will injure its best lines. Without question, this company has done much for the rapid development of Berlin, often building and operating lines which remained unprofitable for a long time. Now, when it is in position to gather the fruit of many years' work, another steps forward to enjoy the privilege without even being obliged to make the many payments under which the old company has labored for years.

RACE SEPARATION IN SAN ANTONIO, TEX.

The San Antonio Street Car Company, of San Antonio, Tex., has proposed a new plan for race separation on its cars which promises a solution of the problem. As the ordinance which governs the separation of the races now stands, certain seats are arbitrarily set apart for blacks, and the whites are not permitted to occupy them. Under the plan proposed, the conductors of the cars will seat the whites in the upper ends of the cars, and the blacks in the lower end, the two races gradually filling up the space between without any mixing. When only the center seats are not occupied, the first passenger aboard to take one of them will determine the color which is to prevail for that seat.

CONSTRUCTION DETAILS OF TORONTO CONVERTIBLE CAR

The general features of the convertible cars built by the Convertible Car Company, of Toronto, Ont., were described in the Street Railway Journal of March 12, but as the construction details present many interesting points, further data regarding these cars will, no doubt, prove interesting. As mentioned in the first article, they have been thoroughly and successfully tried out on the lines of the Toronto Railway Company, where many are in service.

The four platform sills of this car are faced with strongly bolted steel plates, which are of the same length as the sills. The bumper is also faced with sheet-steel, giving adequate strength for all ordinary usage.

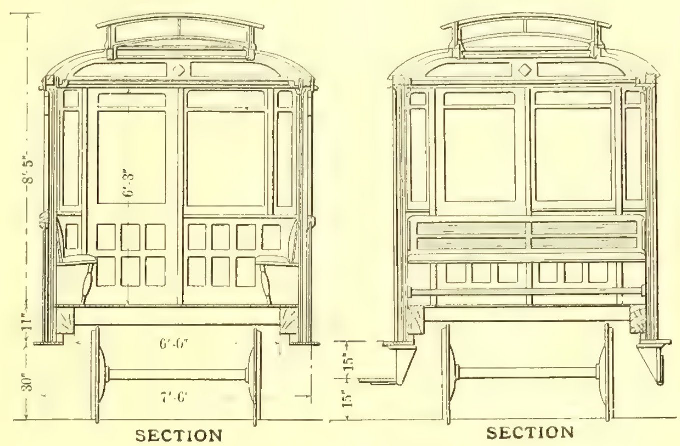
The platform is 4 ft. 7 ins. long, and 6 ft. 4½ ins. wide; height from platform to roof inside, 8 ft. 1½ ins.; height from platform to roof doorway, 7 ft. 1 in.; doorway to vestibule, 2 ft. 7 ins. wide; doorway sill entrance to car from platform, 7 ft. ¼ in. high.

The vestibule is sufficiently large to enable the motorman to have free access to all appliances, but is not large enough to permit passengers to remain in it to interfere with the motorman's work. It is of pleasing design, and has shown itself capable of standing great hardship from collisions and other contact. It is circular in form, all mouldings and belt rails being bent before ironing off. This type has been adopted as standard by several railways after thorough test. The top step or running board, when the car is closed, acts as a guard to prevent the car sides from being damaged by coming in contact with other vehicles. It forms also a permanent rest for the removable sections. The side posts are securely bolted from below this running board by a steel plate, which acts as a washer as well as a support underneath the running board. A steel plate is also bolted at the outside end to this step and bolted to the sill underneath.

This top step is 8¼ ins. wide, and is 1 ft. from the flooring. It is rounded off by a malleable iron stripping, which protects it against wear and contacts. The projection of this running board when the car is closed is 4¼ ins. from the car body. A moulding is screwed on to the step when the panels are on for closed car conversion, thus preventing the panels from becoming loose or rattling. At the same time this moulding gives a finished appearance to the closed car.

a very stiff and rigid car body, prevents all racking, and may be utilized either as a brace or seat support whether the car is open or closed. The posts are constructed so as to permit the curtain to rise or lower inside the hand rails, whether the car is closed or open.

On top of the car posts are steel plates of unusual depth halved into the car posts and forming the top or outside panel, thus making a very stiff construction. Steel plates are used on the face of the car sills, on which are securely fitted malleable

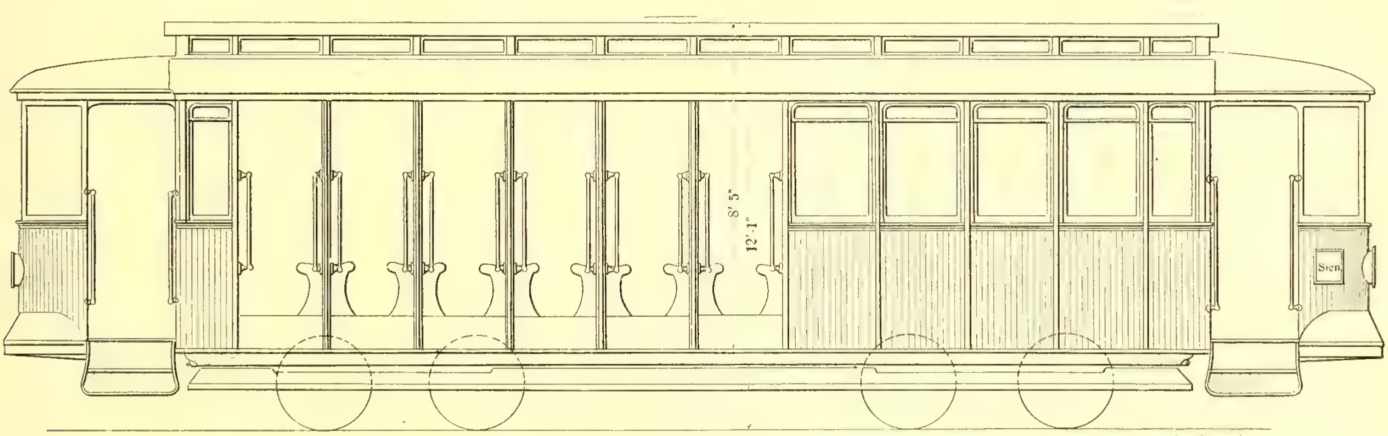


SECTIONS OF CONVERTIBLE CAR

cast-iron panels, bolted through the car sills. On the face of these panels is a rim which forms a slot into which the car posts pass. These being bolted to the upright panel, pass down to the bottom of the car sill and are securely bolted through the face of the same. They are also notched into the running board or top step, making the base extremely rigid.

The outlet of the eave trough runs through a specially devised flow through the corner post of the car body by means of a galvanized iron pipe passing inside or sunk in the same.

The following are the principal dimensions of the standard type of this car: Car body, 30 ft. from end sill to end sill; length over all, 40 ft.; car body, 8 ft. 4¼ ins. wide over all; top step or running board, 8¼ ins. x 1⅜ ins.; top step or running board, 3 5-16 ins. drop from sill inner side; stripping on closed side, 2 ft. 8 ins.; stripping on convertible side, 3 ft.;



SIDE ELEVATION, SHOWING CAR WITH SOME OF THE PANELS IN POSITION

The posts which sustain the panels may be of any well-seasoned wood, preferably white ash. The panels, or removable sections, are simply and strongly constructed of any good, solid, well-seasoned wood as may be selected. Where the posts meet the first step or running board they are bolted from below as well as being notched into the running board. The upright panel which sustains the transverse seats when the car is open is bolted to the car post and at the sill. This construction makes

width of removable section or panel, 2 ft. 6 ins.; top step or running board, when car is closed, 4¼ ins. wide; door entrance, 6 ft. 1 in. high, 2 ft. 7 ins. wide; corner posts, 5 ins. x 5 ins. x 7 ft. x 4½ ins.; side of car, running board from roof sill, 7 ft.

The weight of the car body equipped complete without trucks, motors and other material, is 5 tons. The weight of car equipment and trucks, motors and overhead material complete, ready for commission, is 15 tons.

AN INTERESTING SEMI-CONVERTIBLE CAR

Among the cars built by the J. G. Brill Company for exhibiting at the Louisiana Purchase Exposition is a particularly interesting suburban type of semi-convertible, with body 30 ft. ½ in. in length. It may be considered that this car is the fullest expression of the builder's idea of what a car for suburban service should be. The roof storage window system is too familiar to require description. It may be stated, however, that

INTERIOR OF EXPOSITION CAR

the top of the window sill is 25 ins. from the floor. This height has been adopted lately as the standard practice in this type. It necessitates the use of an arm rest, as the window sill is too low for that purpose. An arm rest has been devised, therefore, which is bracketed to the side lining, and is an addition to the comfort and appearance of the seats without interfering with the window lifts. The seats are 36 ins. long, have step-over backs, tilting cushions and are upholstered in figured plush. They are of a new design, and arranged so that the levers extend but seven-eighths of an inch beyond the cushion at either end. They are placed so that they do not come in contact with seated passengers, whose bodies may extend over them, and thus maximum seating space is obtained without encroaching upon the aisle.

Single sliding doors of the semi-accelerator type are used in the ends. These are set at the side close to the platform entrance, and, therefore, room is obtained for a seat for three passengers at either end of the car with the back against the end. The platforms are of the vestibuled "Detroit" type with entrance at one side, so that in whatever direction the car is running passengers must enter and leave at the rear. The platforms, which are 5 ft. 4 ins. from the end panels over the vestibules, are divided by brass railings, with room for passengers to move around the ends. The folding doors at the entrances are controlled in their movement by an ingenious device for which application for patent has been made. It consists of a vertically placed metal roller on top and at the end of the outer leaf of the door, and moves behind a rail or track extending across the inside of the lintel.

In the side of the vestibule opposite the door is a large window, arranged to drop into a pocket in a new and interesting manner. It is composed of two sashes, the lower of which on being raised engages the upper, then both are "walked over," and by means of trunions at the sash corners are guided down a second runway into the pocket. A patent on this device has also been applied for. The windows at the front of the vestibules have pockets in the wainscoting, the central has steps for holding it at any desired point.

The interior of the car and the platforms is finished in vermilion, richly ornamented with parquetry, and the ceilings are of painted veneer handsomely decorated with gold. Brake handles, sand-boxes, draw-bars, angle-iron bumpers, track scrapers, platform and conductors' gongs are some of the builder's specialties with which the car is equipped. The trucks are Brill 27-G-E-1.

SEMI-CONVERTIBLE CAR FOR LOUISIANA PURCHASE EXPOSITION

BLOCK SIGNAL SYSTEM

An automatic block signal system, which possesses a number of novel features, has been brought out recently by the Bradley Railway Signal & Supply Company, of Providence, R. I. In this system a block consists of two signal boxes and two contact boxes. The contact boxes serve to operate the signal boxes, and are secured in position on the trolley wire near the intersection of the turn-out and single track, while the signal boxes are placed on poles, one at each end of a stretch of single track at a distance of about 100 ft. from the contact boxes. The system is connected by three insulated galvanized iron wires.

The signal boxes contain two openings, one of 8 ins. and another of 4 ins., protected by heavy transparent glass discs, which are placed on the side toward the turn-out and facing the entering car. Within each box is a large transparent red semaphore, which is held away from the larger opening and thus concealed from view by a continuous current on a closed circuit. Within each opening there are also incandescent lamps which are for illumination only, as the operation of the system is not dependent upon them. When there is no car in the block the signal boxes at each end will show two clear openings.

The operation of the system is as follows:

When a south bound car leaves the first turn-out and enters the single track with the intention of meeting and passing a north bound car on the second turn-out, its trolley wheel in passing the first contact box breaks the circuit, thus allowing the red transparent semaphore in the signal box at the other end to fall by gravity to danger position, covering the larger opening in the box. This danger signal will thus be set in front of the waiting north bound car at the second turn-out and prevent it from coming into the block.

As the red danger semaphore falls by gravity in this signal box, it sets a green signal in the signal box near the south bound car. This green signal is absolutely dependent upon the danger signal being set in the other box, for if from any cause the danger signal fails to be set, no green signal will appear in the signal box near the south bound car. The green signal is a permissive signal, for it tells the entering car at the first turn-out that the danger signal is set at the second turn-out, and thus gives the car setting the signal the right to proceed.

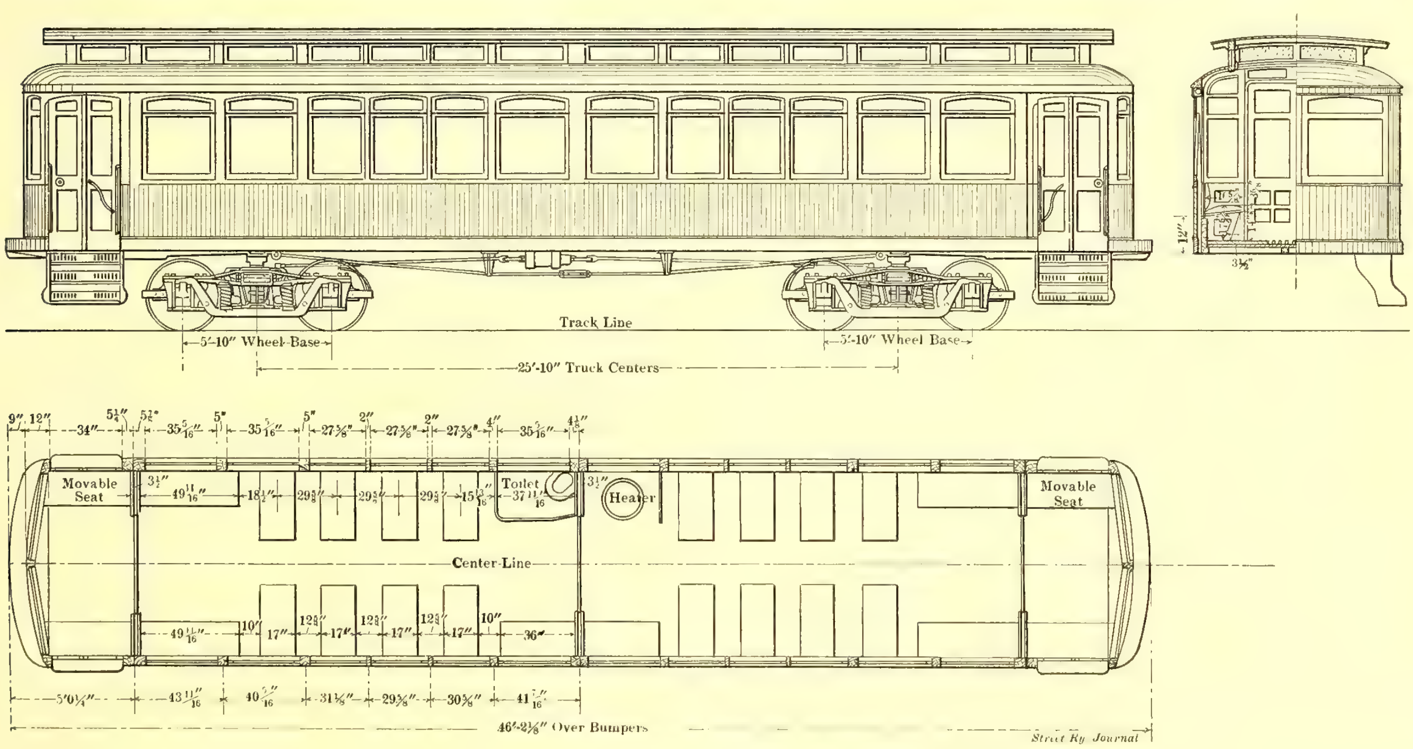
When the south bound car reaches the second turn-out and is about to leave the block, the trolley wheel passing the second contact re-establishes the circuit, thus raising the danger semaphore in the signal box at that end to safety, which in turn clears the green signal in the signal box in the rear at the first turn-out. There is now no car in the block, the single track is clear and the signals at both ends of the block are at safety and show a clear light. The car upon the second turn-out going north now has the right to proceed, and it repeats the operation, reversed, of the south bound car.

If there is one car on the second turn-out going north and three cars on the first turn-out going south, with orders to meet and pass the north bound car at the second turn-out, the first car to leave the first turn-out going south will set the danger signal at the second turn-out and get a green permissive signal. When the second south bound car following is about to enter the block it will see the green permissive signal, showing that there is a car in the block ahead going in the same direction. The passing of the trolley of the second following car at the first contact box will lock again the danger signal in the signal box at the other end of the block. This will be indicated to the car by a second operation of the green signal in the signal box at its end. The third following car will lock the danger signal a third time, which will be indicated as before by another green permissive signal. The north bound car waiting at the second turn-out will see nothing but a danger signal and will have no means of knowing how many cars are approaching, but as the first southbound car passes out of the block and is about to enter the second turn-out, the trolley wheel in passing the second contact box will simply unlock the signal once in the second signal box, which will stay at danger, as the two following cars must unlock it each in turn before it can go to safety. When the third or last south bound car passes out of the block, the danger signal will return to safety and the green permissive signal in the box at the other end will go to clear, and the north bound car on the second turn-out will be at liberty to proceed. The operation will be the same of course for any desired number of cars going in either direction.

It is plain from the foregoing description that no two cars can enter a block from opposite directions and meet on a single track, whether the system is in working order or not, unless the crew should go blindly against a danger signal.

INTERURBAN TRAILER CARS FOR MILWAUKEE

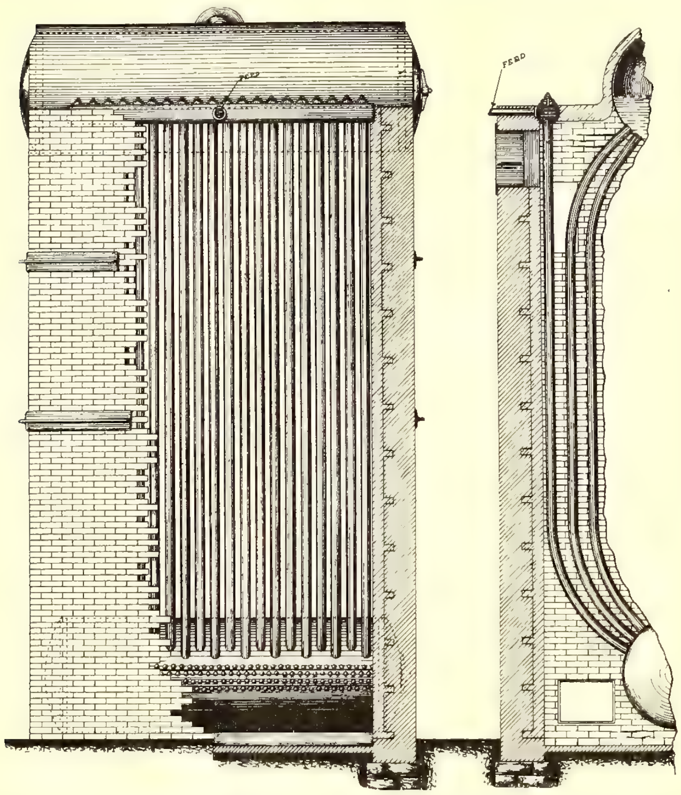
In the STREET RAILWAY JOURNAL of Sept. 5, 1903, the new interurban motor cars of the Milwaukee Electric Railway & Light Company, of a radically new design, were described. For attachment to these motor cars as trailer cars during times of unusually heavy traffic, the Milwaukee Electric Railway & Light Company is now having built at the St. Louis Car Company's shops a car, the design of which is shown by the accompanying drawings. This car, as can be seen, has the vestibule platforms with a movable seat over the steps, so that the front vestibule can be used for seating purposes when the car is in the country and as an entrance when in the city. In this respect it is similar to the motor cars previously described. The arrangement of windows makes the rear of the car about as near an observation car as can be obtained. The car is divided in the center for a smoking compartment.



PLAN AND ELEVATIONS OF MILWAUKEE TRAILER CAR

WATER TUBE BOILER AND SUPERHEATER

The accompanying cuts present two views of the Milne water-tube boiler, designed and built by the Milne Boiler Company, of New York. This boiler is a simple combination of four parts, namely, an upper and lower drum, a number of sections of staggered 4-in. seamless drawn steel tubes connecting them, and an independent feed-water section composed of a single staggered row of tubes coupled to the drums. Not an ounce of superfluous material, nor any of the numerous parts and complications so prevalent in steam boiler practice are to be found in this type, the whole having been designed to generate steam at the highest efficiency with the most perfect fuel economy.



REAR VIEW OF WATER-TUBE BOILER, SHOWING FEED-WATER SECTION

The drums are set one above the other and connected by a number of rows of 4-in. tubes, all joints being expanded. The tubes are all curved to a 5-ft. radius. There are but five different bends in a complete set of tubes, the front and back rows being interchangeable. The tubes are spaced and arranged so that any of them can be removed and replaced without disturbing the brick work or the tubes adjoining.

The feed-water section is composed of a single staggered row of 4-in. tubes extending completely across the back of the boiler. The upper ends of the tubes are expanded into an independent header (not connected with the upper drum) which receives the feed water. Feed water is not admitted to the upper steam and water drum. This feed-water section takes up considerable heat heretofore wasted, as it presents a cool surface to the escaping gases, and adds another element of safety in protecting the drum plates from the influence of the feed water, particularly in case of low water. Much drier steam is produced, as fluctuations in temperature, due to variable feed supply, are very unlikely.

The furnace design and heating surface situation will, with intelligent firing, produce the most perfect combustion, because the fire-brick arch covering the furnace maintains the high temperature required to ignite and burn the fuel gases. As the heating surface is situated at the back of the furnace and bridge wall, the highest furnace temperature is maintained, and the temperature of the fuel gases not reduced until combustion is completed.

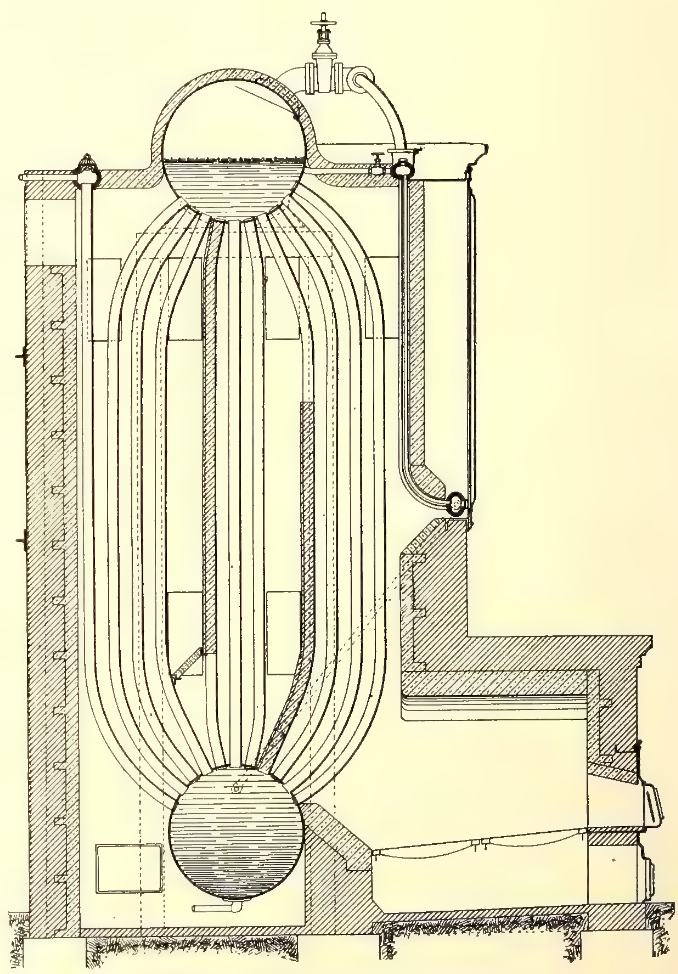
The boiler is constructed of wrought steel material throughout. It contains no flat, stayed or inaccessible surfaces. All surfaces are cylindrical, of moderate diameters, and accessible in the most direct manner for every purpose.

The vertical position of the tubes prevents the collection of dust and ashes, thereby insuring a rapid and uniform transmission of heat, and as the gases of combustion travel about 70 ft. over the heating surface, and finally over the feed-water section before escaping, higher fuel economies are insured than heretofore possible in steam boiler practice.

The tubes can be cleaned with greater ease and less expense than straight tubes; scaffolding or other structures are not needed, and there are no hand-hole plates to remove and replace. One manhole gives access to every tube in the boiler, and any of the mechanical rotary cleaners, now so extensively used, will clean them in the most direct manner.

The Milne steam superheater is of the most simple form, being composed of an upper and lower steel header, having each end of the superheating tubes expanded therein, the flexibility of this form amply providing for expansion and contraction. Being situated in the front of the boiler it is directly accessible for any purpose, and in case of serious derangement can be removed entirely while the boiler is under pressure.

The simple nature of the connections permits instantaneous flooding, accompanied by a perfect circulation of the water in the boiler, and, what is equally important, the degree of superheat can be varied to suit all practical working conditions.



SECTION OF WATER-TUBE BOILER

The simplicity of the complete boiler and superheater guarantees the greatest ease and efficiency in operation and the lowest cost for maintenance. They are constructed in sizes up to 1000 hp, and for any steam pressure, the design permitting ample grate area for capacities far in excess of the rating.

1500-KW ALTERNATOR FOR ST. LOUIS

The following is a description of the large alternating-current generator to be installed by the National Electric Company at the central power station of the Louisiana Purchase Exposition at St. Louis. This alternator will be direct connected to a 2250-hp Hamilton-Corliss vertical cross-compound engine. The rated output is 1500 kw, 25 cycles, 6600 volts, running at 83 r. p. m.

Like all of the standard alternators built by the National Electric Company, it is of the revolving field type, leaving the armature stationary and easily accessible. The difficulty of properly insulating the armature coils is eliminated, as the windings are not subject to any mechanical strains whatever. The revolving field is of large diameter, giving additional flywheel effect to the engine. The construction of the field coils is such as to make them practically indestructible. All parts are accessible, and the method of ventilation insures low temperatures.

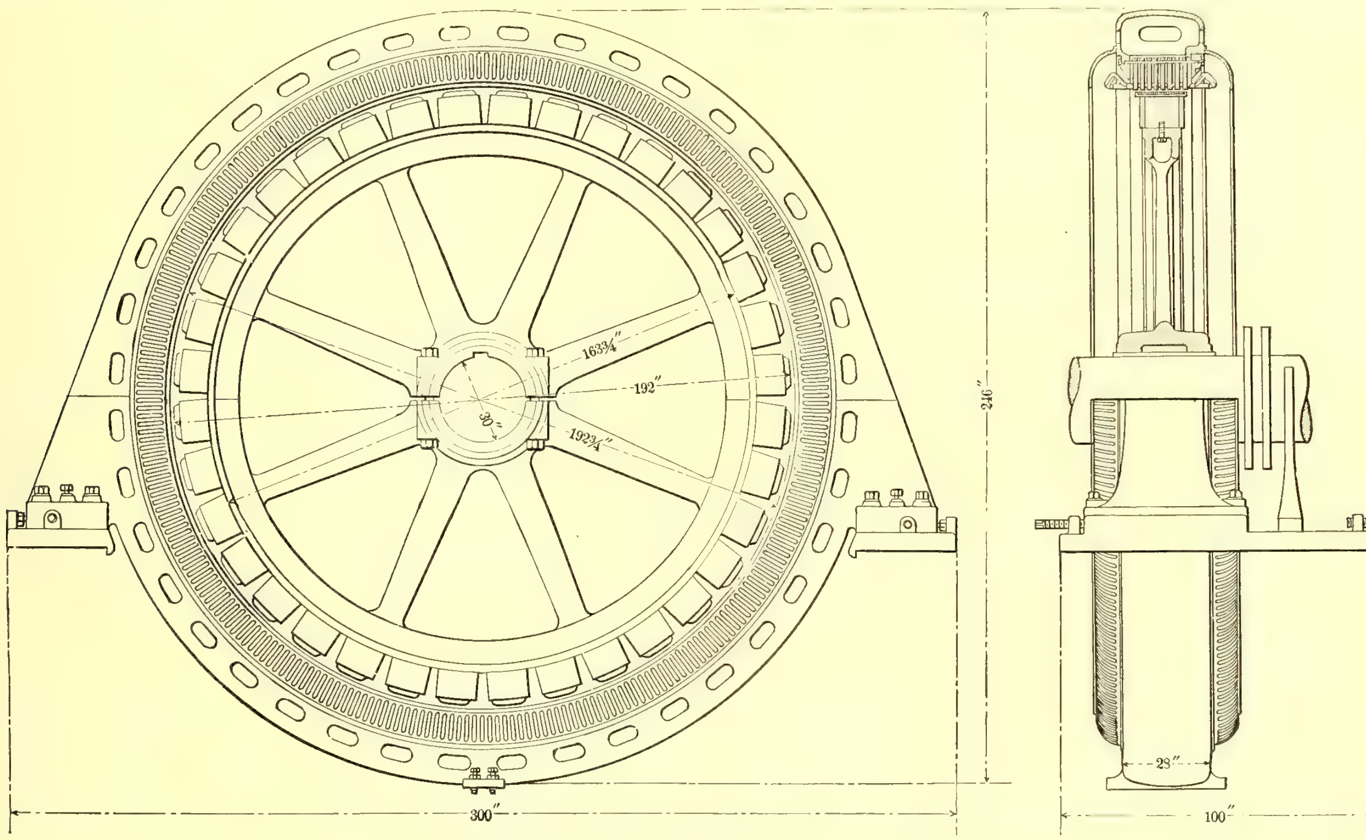
The revolving field is made of cast-steel in halves, which are bolted and secured together by shrunk links. The rim of the wheel is in channel cross-section, to which the cast-steel pole pieces are bolted. The field coils comprise sixty-five turns of 1½-in. x ⅛-in. copper strap, wound on edge and thoroughly insulated, the outer edge of the coil being exposed to the atmosphere for cooling. Laminated pole shoes are secured to the ends of the pole pieces, and serve to hold the field coils in position. These shoes cover a large polar arc, distributing the magnetic flux evenly.

The field coils are insulated from the pole pieces by fullerboards, and from the pole shoes and spider ring by heavy fiber. The revolving field is 16 ft. in diameter, and weighs approximately 50,000 lbs.

The frame is a circular cast-iron housing into which laminated punchings with inwardly projecting teeth are assembled for the reception of the armature windings. The frame is extremely heavy and stiff, not requiring any external support. It is divided horizontally, the halves being bolted and keyed together. Bolts and keys are contained entirely within the cross-section, obviating the use of side lugs. Large open spaces are provided in the sides of the frames, allowing a free passage of air from the ventilating ducts in the core.

The armature core is built up of laminated soft steel punchings, annealed and japanned before assembling. Ventilating space blocks are inserted at suitable intervals, providing openings extending around the circumference and allowing free passage for the heat generated in the windings. There are six slots per hole, 2½ ins. deep by 1½ ins. wide, each being wound with fourteen conductors of .37-in. x .28-in. compressed copper strand. The internal diameter of the armature is 16 ft. ¾ in., and the width of the core 16 ins.

Cast-iron collector rings and carbon brushes are used, enabling the machine to be operated with a minimum amount of attention, and at the same time providing a collector gear which will carry a heavy temporary overload.



SIDE AND END ELEVATIONS OF 1500-KW ALTERNATOR

The net weight of this alternator is 135,000 lbs. The efficiency guarantees are as follows: One and one-quarter load, 95.5 per cent; full load, 95.5 per cent; one-half load, 94.75 per cent. The regulation is 5.5 per cent on power-factor unity, and 22 per cent on power-factor zero.

The temperature will not exceed 30 degs. C. on armature and magnets on a continuous run at full load, and 40 degs. C. on the armature and magnets on a continuous run at 25 per cent overload.

The announcement was recently made in the Street Railway Journal that the Western Ohio Railway and the Dayton & Troy Electric Railway had completed arrangements for operating limited cars between Lima and Dayton, charging $1.40, as compared with $2.20, the fare over the same route made by the parallel steam road. Now the Cincinnati, Hamilton & Dayton Railway (steam) announces that it will meet the rate of the electric lines and inaugurate additional train service should the competition become active. It is stated also that the present conditions will continue if the electric roads abandon their plan of limited service.

SECOND MEETING OF THE OHIO INTERURBAN RAILWAY ASSOCIATION

The second meeting of the Ohio Interurban Railway Association was held at the Hollenden Hotel, Cleveland, April 28. About sixty operating railway men and supply men were present, including representatives from a number of roads in Northern Ohio that were not represented at the previous meeting. Practically the entire session was given up to the discussion of a plan for handling the form of coupon book adopted at the previous meeting, and for adjusting settlements between the various companies using the coupon book. This matter has been left to the transportation committee of the association with power to act. As stated in the last issue of this paper the transportation committee met at Fostoria, Ohio, April 16, and formulated a plan of agreement. However, the committee decided that this agreement was quite an important matter, and declined to take final action, and, instead, recommended its plan to the association for adoption.

In the meantime, H. C. Lang, of the Western Ohio Railway Company, had formulated a plan of agreement between the companies, patterned after the contract existing between the companies in the Central Traffic Association of steam roads. Mr. Lang presented his plan before the meeting, and the discussion which followed took up the greater part of the time set apart for the session. Many of those present favored Mr. Lang's plan, while others thought it too cumbersome. It was finally decided to send typewritten copies of both plans to the various roads in the association, together with a return postal card giving an opinion on the subject. One of the plans will then be adopted at the next meeting.

The plan proposed by the transportation committee was, in brief, as follows:

Coupon books to be issued by the various companies and to be purchased in bulk through the secretary of the association, who would have them printed, thus insuring uniformity. Books to be numbered in consecutive order and charged to a company as sent out. Settlements to be made between the various auditors not later than the tenth of the month, in which coupons were collected. Settlements to be made on a basis of 83 1-3 per cent of the face value of the coupons and settlements to be made by payment of balances. Each road to keep a daily record of serial numbers collected, to be made basis of settlement in case of loss or surrender of book and to indemnify issuing railway against lost coupons being presented for payment. Unused coupons to be redeemed at option of issuing company within eighteen months, full face value to be computed for all coupons used and remainder to be redeemed in cash. New companies to be bulletined by secretary. The agreement to be for one year from May 1, 1904, any company to be permitted to withdraw from the agreement upon sixty days' notice, providing all adjustments with other companies have been made. But companies withdrawing from the agreement must continue to honor books of other roads that were issued prior to the date of withdrawal from the agreement. Violation of rules to be brought before the association for action. Rules to be amended by two-thirds vote of companies in the agreement; thirty days' notice to be given to all companies of such changes. The decision of the transportation committee to be final in all disputes.

The plan proposed by Mr. Lang contemplates the formation of a bureau, to be composed of all roads parties to the coupon book agreement. This would take the matter of coupon books out of the hands of the association, and all matters pertaining to same would be controlled only by those who are parties to the agreement. It is proposed to have an executive committee composed of three members, selected by the various roads, the action of this executive committee to be final in all discussions arising between the various roads parties to the agreement. It is proposed to change the form of the book somewhat, and attach the contract with the purchaser to the auditor's check, to be retained by the selling agent and forwarded to his company. Coupons to have a perforated line through the center, each section of each coupon to have the initial of the issuing road and the number of the contract. One section of each strip is to be retained by the company collecting and the other to be mailed to the road that issued the book.

The secretary of the association to be the secretary of the bureau. All books to be ordered through the secretary, who will order them from the official printer, bill to be rendered to the company ordering. New roads desiring to become parties to arrangement must be approved by the executive committee of the bureau. Each company party to the agreement to give a bond of $10,000. Expenses of bureau to be provided for by an assessment, based on 25 cents per single track mileage. Settlements on coupons to be made monthly by balances between the various auditors. Redemption of coupons to be on a basis of cash fare for the portion used. Meetings of the bureau to be called by executive committee. Members of bureau may be fined $1 for failure to have representatives present at meetings. Members may be represented by proxy. Instructions to agents and conductors to be uniform, as prescribed.

These rules provide among other things that the signature of purchaser must be made in presence of agent. Baggage to be checked in accordance with the rule of the road over which book is being used. In case a loss of book is reported to agent, the agent must send a written notice to his auditor, who will notify other roads to take up the book. Owner of the book must agree that in case he finds the book he will not attempt to use it until he has notified the company from whom he purchased it. Expired books will not be redeemed. A joint agent must ascertain over which road a passenger desires to travel first and sell a book for that road. Coupons will be accepted for local fares outside of corporations. On the back of each coupon strip the conductor must write the name of the station at which the passenger boarded the train, his destination and the train number.

F. J. J. Sloat, general manager of the Cincinnati, Dayton & Toledo Traction Company, brought up for discussion the subject of uniform rates for interurban cars operating over the tracks of other interurban roads. Mr. Sloat stated that during the past year or two all of the seven interurban roads radiating from Dayton had sent special cars over the Cincinnati, Dayton & Toledo, and that his road has sent cars over all the other roads. This interchange of traffic has been considered complimentary, and no attempt had been made at an equitable adjustment. He stated that he believed that this interchange of business was bound to grow, and that particularly in view of the agitation on the subject of operating through limited cars over several roads, he thought that some equitable basis should be arrived at for the division of receipts. He stated that a scale of prices for such interchange of business would be difficult to arrive at, because of the great difference in the equipments and weights of cars, the capacity, gear ratio, etc., the idea being that a heavy car with large seating capacity, heavy motors and high gear, costs more to handle than a lighter car having smaller motors and lower speed. Mr. Sloat presented a tabulated statement of the various sizes of motors used in the operation of interurban cars, ranging from 125 hp to 500 hp, the gear ratio, the maximum and minimum weights of cars, and the operating charge per car mile, based upon the kilowatt-hour consumption, including bond interest charge. These figures ranged from 15 cents to 28 cents per car mile. Mr. Sloat proposed that a committee be appointed to prepare a tabulated statement of the cost of operating various types of cars, and that the matter of adopting such a schedule be discussed at the next meeting.

Taking as a concrete case, Mr. Sloat spoke of a special party

going from Piqua to Cincinnati, over the Dayton & Troy and the Cincinnati, Dayton & Toledo. In the division of receipts both companies should consider the dead mileage as well as the live mileage. The special car on the Dayton & Troy would run from the car house at Troy to Piqua, then down to Dayton and back to Troy on the return trip, a total of 60 miles over the Dayton & Troy. On the Cincinnati, Dayton & Toledo the round trip from Dayton to Cincinnati and return would be 110 miles. At 50 cents, the Dayton & Troy fare, and 95 cents, the Cincinnati, Dayton & Toledo fare, the single trip rate would be $1.45, or $58 for forty passengers. The Dayton & Troy cars are 200-hp cars, with proportionately heavy equipment, which, according to Mr. Sloat's schedule, should be charged at the rate of 23 cents per mile. The operating charge on the 110 miles would thus be $25.30. The Dayton & Troy regular fare would be $20, and deducting this together with Mr. Sloat's cost charge from the $58, would leave a balance of $12.70, which Mr. Sloat stated would be his profit for handling the car over his track.

Some one took exceptions to this last item on the ground that as the Dayton & Troy would furnish the crew while the Cincinnati, Dayton & Toledo would simply furnish the pilot, the Dayton & Troy should enjoy part of the profit while the car was on the Cincinnati, Dayton & Toledo tracks. One manager remarked that he would not permit a foreign crew to operate over his tracks, even though the car was in charge of a pilot, while another manager was equally positive that he would not care to have strange crews handling his cars. The question of liability to cars and passengers while on foreign roads entered into the discussion, and it was obvious that a wide range of ideas would have to be thrashed out before a schedule of charges, such as proposed by Mr. Sloat, could become operative but at the same time it was recognized as a subject which is of considerable importance in a district where interurban lines are being connected up as they are in Ohio.

Warren Bicknell, chairman of the committee on legislation, presented a report of the work accomplished by his committee before the recent State Legislature. As outlined in the last issue of the Street Railway Journal, the committee put through several measures of considerable moment to electric railways, and killed several others that were considered detrimental to the best interests of the properties.

Walter H. Abbott, of the Roberts-Abbott Company, gave a "chalk talk" on steam turbines. In a very entertaining manner he described the principles, make up, advantages and disadvantages of the three leading forms of turbines used in this country, and presented figures showing the economies claimed for the various types as compared with reciprocating engines. Mr. Abbott referred particularly to the De Laval turbine installed at the power station of the Ohio Central Traction Company, and the Parsons turbines now in operation at the Cleveland & Southwestern Traction Company's station, both of which were installed under Mr. Abbott's direction. He stated that both of these installations were proving out most satisfactorily.

Thursday evening the delegates took a special car over the Cleveland & Southwestern line to Elyria, where they had an opportunity of inspecting the Parsons turbines described by Mr. Abbott. The return was by way of Lorain, and the party took a special car on the Lake Shore Electric Railway to the Beach Park power station, in which has just been installed a 1500-kw, 16,500-volt A. C. generating set. The run to Cleveland was made in one of the "limited" type of cars at a speed which was commented upon.

Invitations to inspect the plants of the Sherwin-Williams Paint Company, the Kuhlman Car Company and the National Carbon Company were read at the meeting, and some of the delegates availed themselves of the invitations.

The Dayton contingent made an "all trolley" trip from Dayton to Cleveland by way of Toledo. They left Dayton at 9 a. m. and reached Cleveland at 10:30 p. m., covering nearly 300 miles.

The next meeing of the Ohio Interurban Railway Association will be at the Chittenden Hotel, Columbus, the last week in May.

Seventeen companies have promised to become parties to the coupon book agreement as soon as the plan is formulated.

NEW MEMBERS ADMITTED AT THE CLEVELAND MEETING

Thos. F. Clohesey, Stanley Electric & Mfg. Co., Cincinnati, Ohio.
J. A. Rutherford, Tuscarawas Traction Co., New Philadelphia, O.
J. O. Wilson, Cleveland & Southwestern Trac. Co., Cleveland, O.
A. J. Reynolds, The National Ticket Company, Cleveland, Ohio.
Geo. S. Davis, Street Railway Journal, Cleveland, Ohio.
Daniel Royse, Street Railway Review, Chicago, Ill.
E. R. Larter, Dayton & Troy Traction Co., Tippecanoe City, O.
F. W. Stewart, Climax Stock Guard Co., Chicago, Ill.
A. R. Dittrick, Dittrick & Jordan Elec. Co., Cleveland, Ohio.
Wm. H. Stafford, Central Union Tel. Co., Indianapolis, Ind.
W. R. McKown, Indianapolis & Eastern Ry. Co., Greenfield, Ind.
Milton C. Stern, Egry Autographic Register Co., Dayton, Ohio.
James F. Mahoney, H. W. Johns-Manville Co., Cleveland, Ohio.
E. F. Schneider, Cleve. & Southwestern Trac. Co., Cleveland, O.
A. E. Akins, Cleve. & Southwestern Traction Co., Cleveland, O.
Frank Hoffman, Jas. V. Howell & Co., Cincinnati, Cleveland, O.
L. M. Wolf, Ohio Central Traction Co., Cleveland, Ohio.
Valentine Winters, Dayton & Troy Traction Co., Dayton & Troy Electric Railway Co., Dayton, Ohio.
Ambrose Petry, Ambrose Petry Co., Dayton, Ohio.
Clinton E. Palmer, Cincinnati, Dayton & Toledo Traction Co., Middletown, Ohio.
William Akins, Ohio Central Traction Co., Galion, Ohio.
J. A. Bendure, Lima Electric Railway & Light Co., Lima, Ohio.
Frederick V. Green, Westinghouse Traction Brake Co., Cleveland, Ohio.
John McGeorge, McGeorge & Sons, Cleveland, Ohio.
Francis B. Morgan, Eastern Construction Co., Cleveland, Ohio.
Geo. H. Pomeroy, Cleve. & Sharon Traction Co., Cleveland, O.
O. M. Carter, Western Electrician, Cleveland, Ohio.
L. C. Thompson, Taylor Manufacturing Co., Cleveland, Ohio.
F. W. Coen, Lake Shore Electric, Cleveland, Ohio.
S. T. Dodd, Stanley Electric Mfg. Co., Pittsfield, Mass.
Edward M. Williams, Sherwin-Williams Co., Cleveland, Ohio.
Geo. B. Dusinberre, Westinghouse Electric & Manufacturing Co., Cleveland, Ohio.
Warren Bicknell, Lake Shore Electric Ry. Co., Cleveland, O.
F. W. Bliss, Buckeye Electric Co., Cleveland, Ohio.
W. E. Ludlow, Ludlow Supply Co., Cleveland, Ohio.
R. H. Mickey, National Carbon Co., Cleveland, Ohio.
W. S. Hammond, Jr., Consolidated Car Heating Co., Chicago, Ill.
Robert K. Fast, Trolley Supply Co., Canton, Ohio.

BROOKLYN RAPID TRANSIT COMPANY MAKES CONTRACT FOR REMOVAL OF SOIL FROM SUBWAY

The endeavor on the part of the Brooklyn Rapid Transit Company to develop new phases of business as auxiliaries to its purely street railway field is evidenced again in the execution of a contract with Messrs. Cranford & McNamee, contractors for one of the sections of the Rapid Transit Subway to be built in Brooklyn. The company proposes to dispose of the excavation. The section of the subway in question extends along Flatbush Avenue from Fulton Street, where there are elevated railways, and the work of constructing the subway will require supporting both the surface tracks and the elevated structure without interfering with the regular traffic operation of the roads. The contractors will be allowed to close off one side of the street, and the Brooklyn Rapid Transit Company is now at work laying a third surface track as a siding, long enough for perhaps five cars. At a point between the siding and the adjacent main track, will be located a hoisting derrick which will lift the excavated material in buckets from the subway and dump into gondola cars.

PROMINENT EXHIBITS AT THE ST. LOUIS EXPOSITION

The opening of the Louisiana Purchase Exposition at St. Louis on April 30 makes a review of the exhibits in the transportation line to be shown there of interest. Owing to the condition of the grounds and buildings, as described elsewhere in this issue, it is impossible to present yet any satisfactory views of the street railway exhibits, which are divided between Electricity Building and Transportation Building. Through the courtesy of different manufacturers, however, it has been possible to present a brief statement of certain of the exhibits to be made at the Fair. Further information, with views, will be published in early issues of this paper.

EXHIBITS AT THE ST. LOUIS FAIR

The exhibit of the J. G. Brill Company occupies 300 linear feet on aisle D of the Transportation Building, and consists in the main of a suburban type of the patented semi-convertible car, a double-truck convertible, and a thirteen-bench "Narragansett" car; three sizes of the high-speed truck No. 27-E, one size each of the single-truck No. 21-E, the "Eureka" maximum traction, and the suburban truck No. 27-G. An exceedingly attractive office is in a section of a car with windows of the semi-convertible style, and finished in solid mahogany rich in parquetry. The cars are handsomely finished in rich woods inlaid, and include details which make them singularly complete, and are equipped with the well-known Brill patented specialties.

William Wharton, Jr. & Co., Inc., of Philadelphia, will have an exhibit at the St. Louis Exposition in the Transportation Building, aisle C, posts 8, 9 and 10. It will comprise parts of special track work, such as switches, frogs, crossings, etc., both for steam railroad use and for street railway use. Particular stress is laid by this company, as is well known, on the introduction of manganese steel into track work in general, and the great value of this is to be illustrated by some samples giving evidence of the long life imparted to track work by the use of manganese steel. Some specialties are also to be shown, like the Wharton improved unbroken main line switch, for steam railroads, and the Wharton unbroken main line switch for street railways, the Wharton manganese steel frog for steam railroads, the guard rail with manganese steel reinforcement for steam railroads, and the manganese steel hard center work for street railway girder rail track, also solid manganese steel work for T-rail track. The entire exhibit will present the most modern and advanced constructions and all parts of special track work as supplied by the company. It will be in charge of Arthur S. Partridge, of St. Louis.

The Standard Steel Works, of Philadelphia, Pa., will have an exhibit in the Transportation Building. The articles to be shown are steel tired wheels of various types, solid rolled steel wheels, steel tires for locomotive and car wheels, steel castings for locomotives and steel springs for locomotives, coaches and freight cars. The company will make a special feature of wheels mounted on axles for electric railway equipment.

The Alberger Condenser Company, of New York, will have two large exhibits at St. Louis. There will be an Alberger barometric condenser equipment in connection with the 5000-hp Allis-Chalmers engine in the first space at main entrance of Machinery Hall, and also an Alberger surface condenser equipment, in the adjoining space, used in connection with several engines furnishing power for the intramural railway system. The barometric condenser equipment consists of an Alberger barometric condenser, air cooler and tail pipe, with a vertical Corliss combination engine and vacuum pump, operating in connection with a rotary circulating pump. The surface condenser equipment consists of a 5000 sq. ft. Alberger surface condenser, horizontal Corliss dry vacuum pump and a centrifugal circulating pump and engine.

The American Locomotive Sander Company, of Philadelphia, will have examples of its style "A" and style "E" sanders in actual operation at St. Louis, together, of course, with various details of its sanding devices shown in section, and in fact everything possible to show the construction and operation of the company's sanding devices. This exhibit will be located in the Transportation Building.

The United States Electric Signal Company, of West Newton, Mass., will occupy space No. 167 in the Electricity Building at the St. Louis Exposition. It will show its latest block signal system for electric railway service. C. V. Turner, of the company's works, will install the plant and probably remain at St. Louis during the month of May, and may be followed by J. H. Nickerson, treasurer, in June.

The exhibit of the Wyckoff Pipe & Creosoting Company, Inc., of Stamford, Conn., will be in the Electricity Building, under the Court Colonnade. It will consist of Wyckoff creosoted conduits for underground wires, showing method of laying; creosoted cross-arms, poles, cross-ties and paving blocks; two sections of piling, one creosoted and one uncreosoted, the one creosoted showing the penetration of the oil into the very heart of the pile, and the uncreosoted section showing the effects of the teredo in a very short time. The company will also have on exhibition several pieces of creosoted Wyckoff conduit, laid in Philadephia fifteen years ago, and removed by the Bell Telephone Company of Philadelphia last fall on account of the building of a subway in that city. These pieces show no signs of decay whatever, and are just as good as the day they were laid.

The Leonhardt Wagon Manufacturing Company, of Baltimore, will have one of its tower wagons on exhibition at St. Louis in the Transportation Building, Department of Electricity, in connection with the Electric Railway Equipment Company, of Cincinnati, Ohio, which will exhibit its tools, etc., in connection with the Leonhardt wagon.

E. Imhauser & Company, of New York, have arranged to have a working exhibit of their improved watchman's time detectors in the Fish, Game and Forestry Buildings at the St. Louis Exposition, and will also probably have them in some twenty to thirty other concessions where they can be seen in operation.

The Locke Insulator Manufacturing Company, of Victor, N. Y., will have an exhibit of porcelain and glass insulators, both high and low tension, in the Electricity Building at St. Louis.

The Richardson Scale Company, of New York, will exhibit at the St. Louis Exposition an automatic coal scale, working in conjunction with the Robins conveyor, referred to elsewhere, also two or three automatic grain scales of its usual type. This coal scale is operated entirely by gravity and is of the beam type. The coal to be weighed is delivered from the conveyor to the weighing hopper of the scale, which is suspended on one end of the beam and balanced on the other by a weight box in which ordinary dead weights are deposited. The material is admitted into the weighing hopper by means of a double swinging gate, or cut-off, which at the beginning of the weighing operation is open. When the charge is nearly completed the first cut-off, or gate, actuated by the increased weight of the weighing hopper, closes and thus reduces the stream of material to a mere dribble—the second cut-off or gate being only partially open. When the exact weight has been passed into the hopper the cut-off completely closes and the exact balance is reached. A lever, connected with the cut-off mentioned, acting upon the lever attached to the hopper, sets in motion the mechanism which opens the bottom of the hopper, and, as soon as the charge has been dumped, closes it and locks it. In closing the bottom of the hopper the dumping mechanism in turn strikes the lever connected with the cut-off, or gates, thereby causing the same to open and allowing a new charge to flow into the weighing hopper. The whole action is entirely automatic—the only power required being the momentum of the falling material, except where bituminous coal is used, when some slight power is needed to drive the feeding apparatus fitted above the scale. The drip, or column of material, which is in the air at the time the feed is automatically cut off, is compensated for by a novel contrivance which works automatically and without manipulation of any of the working parts. The machine is fitted with a self-registering device which records and totalizes the weighing. The exhibit will be at stand No. 1 in the Machinery Hall.

The Harrison Safety Boiler Works, of Philadelphia, will be well represented at St. Louis by a large number of their specialties. These will be described later in connection with a more complete article on the steam specialties. A number of these are now in service in the pre-Exposition power plant and will later be transferred to exhibitors' power plant. They consist of one No. 118 Sorge-Cochrane system and three 6-in. horizontal receivers. In addition, the Westinghouse, Church, Kerr Company is using at the Fair one No. 14 1½ heater, and the company has installed in the Intramural power plant one 10-in. vertical receiver, one 8-in. vertical receiver, one 8-in. horizontal receiver, one 40-in. vacuum oil separator, one No. 11 ½-heater, one No. 110 Sorge-Cochrane system, one 14-in. horizontal receiver, two 6-in. horizontal oil ammonia receivers, one No. 7½-heater and one No. 9 heater.

The Wheel Truing Brake Shoe Company, of Detroit, Mich., will show shoes of various sizes and designs adapted for different uses. Some are designed for removing flats from chilled iron wheels of electric cars, some are for dressing down flattened wheels of locomotive driver wheels, and still others are especially designed for dressing down tread-worn or grooved tires of locomotive drivers.

The Winton Motor Carriage Company, of Cleveland, Ohio, will have on exhibition one chassis, one Winton touring car in Winton red and one Winton touring car in Brewster green.

The Buckeye Engine Company, of Salem, Ohio, will exhibit one of its standard cross-compound engines, with the following cylin-

der dimensions: High pressure is 26½ ins.; low pressure, 50 ins.; both 48-in. stroke. The wheel is 15 ft. in diameter and weighs 40,000 lbs. The total shipping weight of the engine was a little over 300,000 lbs. The engine has governors upon both the high and low pressure sides, connected together in such a manner that both move an equal distance under any given change in load. The engine is well equipped with oil guards and with a self-contained central oiling system, piped to all the principal bearings and regulated by needle valves. There is a pump for returning the waste oil to the filter. The engine is of the company's heavy-duty or rolling mill bed-plate type, and there are no extras of any description furnished, it being the company's intention to exhibit such an engine as is ordinarily supplied in filling orders.

The Standard Underground Cable Company, of Pittsburg, Pa., and the McRoy Clay Works have installed a joint exhibit in Section 3, immediately adjoining the northwest entrance of the Electricity Building. The exhibit shows a cross section of an actual conduit consisting of 72 ducts with a manhole at either end, one manhole being complete with a cover, the other being open. A trench 7 ft. deep and 5 ft. wide extends the entire length of this conduit, enabling close inspection of the method of laying conduits, including the wrapping, concrete base and top, and the general construction of the manholes, showing hangers, pipes to holes, etc. At one end in the manhole is a capstan rigged up for drawing in cables and connected to a cable which is mounted on a reel at the other manhole; the cable is thus shown being drawn through the ducts and part of the ducts are split so as to show the method of fastening cables to rope, etc. From the various manholes, cables go to distributing poles to illustrate the method of distribution to aerial cables for telephone, electric light and street railway work, with various terminals used to protect the ends of the cable in such work. The McRoy Clay Works show piles of clay as it is dug from the ground and the various processes through which the material goes to produce the finished duct. The Standard Underground Cable Company will also exhibit samples in handsome cases of all the various cables and appliances made by the company. An examination of this system will present in very complete detail the method of installing conduits and drawing cables into completed conduits.

The International Steam Pump Company will be represented in a large number of departments and in various capacities at the St. Louis Exposition. The central compressing power plant will be equipped largely with this company's apparatus, including a cross-compound, two-stage Cincinnati-gear compressor, and a cross-compound, two-stage Meyer-gear compressor. The first machine is to supply the general exhibits of the Exposition and the second is to supply the transportation exhibits. The Grand Cascade, which will probably be the largest artificial waterfall ever exhibited, will be equipped with two 3500-gal. Worthington 36-in. single-stage turbines, each operating against a head of 159 ft. and driven by a direct-connected 2000-hp Westinghouse induction motor. The fire protection of the Exposition will be furnished by twelve 1000-gal. Worthington underwriter fire pumps, and the sewage pumps will also be supplied by the company. Elsewhere the company will be represented in the C. H. Bradley & Company exhibit, with Westinghouse, Church,.Kerr & Company and with with the General Electric Company.

The Lunkenheimer Company, of Cincinnati, will have an exhibit in Machinery Hall, location 5-G Block 26. The company will show a comprehensive display of the high-grade specialties which it manufactures.

The Peter Smith Heater Company, of Detroit, Mich., will exhibit at the St. Louis Exposition one of its No. 2 heaters, nickeled in the most improved style, and placed on the private car of John I. Beggs, general manager of the Milwaukee Electric Railway & Light Company, which is being built by the St. Louis Car Company.

The Electric Storage Battery Company, of Philadelphia, has at the St. Louis Exposition the most extensive and comprehensive exhibit that has ever been made of storage batteries and auxiliaries. It is located in Block 20, Electricity Building. A conspicuous feature is a map about 30 ft. in height by 45 ft. in length which, by an ingenious arrangement, shows the distribution of "Chloride Accumulator" installations throughout the United States. Illuminated glass jewels designate the locations and characters of the installations, whether for railway, central station, isolated lighting and power service, yacht plants, telephone installations, etc. There is set up in a model battery house a complete operating installation of chloride accumulators for railway service. Specimens of chloride accumulators ranging in size from a 61-H type of cell to the smallest laboratory cells, are also shown, together with a complete exhibit of the Exide battery, used for electric automobile work. In another section of the exhibit there are five types of storage battery switchboards, together with end-cell switches, storage battery recording instruments, etc.

The apparatus of the Hartman Circuit Breaker Company, of Mansfield, Ohio, will be exhibited by its Western selling agent, The Wesco Supply Company, of St. Louis, and will be found in the Electricity Building. The exhibit will consist of high-tension oil switches and circuit breakers, and also oil circuit breakers for direct current. The apparatus will be mounted on a switchboard and it will all be shown under actual operating conditions. The company will also have an exhibit in connection with that of the Bullock Electric Manufacturing Company, consisting of a three-pole, 6600-volt oil switch, which will be used in controlling current for the large rotary converter which the Bullock Electric Manufacturing Company will have on exhibition.

The Harrisburg Foundry & Machine Works will show at the St. Louis Exposition one Fleming 4-valve tandem compound self-oiling automatic engine, of 600-hp capacity, directly connected to and driving a 400-kw Crocker-Wheeler generator, furnishing power for the electric railway system within the Exposition grounds. In addition to this, there is a small engine of 8-hp direct connected to 4½-kw Crocker-Wheeler generator for lighting the exhibit, speed 450 r. p. m. This exhibit is located in Machinery Hall.

The Brown Hoisting Machinery Company, of Cleveland, Ohio, will make an exhibit of hoisting machinery, etc., jointly with the Yale & Towne Manufacturing Company, sales agent for the Brown Company for trolleys, tramrail equipment, and crabs and winches. The exhibit will be in the Machinery Building, and will comprise one of the Brown standard 10-ton and 15-ton locomotive cranes, a complete line of safety crabs and winches, a full line of tram rail equipment and trolleys up to 10 tons capacity, plain, geared and electric, a stationary hand bridge crane, a small overhead traveler, and a very complete line of Yale & Towne triplex chain blocks.

The International Register Company, of Chicago, expects to have a large display, including a full line of International and New Haven registers, mounted on mahogany boards. One of the boards will be the one the company has shown at street railway conventions, and which has attracted wide attention there. Some of the New Haven registers, however, will be mounted on posts. There will be polished oak boards containing a full line of the various pulleys, brackets, etc., manufactured by this company, a mahogany case with plate glass doors, in which will be shown punches, Heeren badges, and articles of that type, coils of pulley rope, bell cord, etc. Some of the registers will be shown with their dials removed so that the working parts will be exposed. The company is located in the Transportation Building, aisle C, near post 30, right opposite the exhibit of the St. Louis Car Company, and will be represented at the convention constantly by A. N. Loper, for many years connected with the New Haven Car Register Company.

Stombaugh guy anchors will be shown at St. Louis in the Electrical Building with the display of the Wesco Supply Company, which is in Section 8. The exhibit will also include wrenches of all sizes.

The Egry Automatic Register Company, of Dayton, Ohio, will have an exhibit in the Varied Industries Building, the exact location being Block B-4, which is close to the British Exposition. Here the company has fitted up a handsome booth occupying a space 15 ft. x 15 ft., where will be shown the many styles and sizes of the Egry registers. Particular attention will be paid, however, to the company's train dispatching system, which has been described in this paper, and the company will show a system in operation, through the connection of telephones located at opposite corners of the booth. A No. 101 dispatching register in the pole box, accompanied by a telephone, will represent a turn-out station, while the opposite corner will be fitted up like a chief distpatcher's station, with a telephone, dispatching register, etc.

The Burt Manufacturing Company, of Akron, Ohio, will have no regular exhibit at the St. Louis Exposition, but will be represented by a No. 3 oil filter in the 30,000-hp station which is used by the Exposition authorities in their pre-power plant. A No. 3 oil filter will also be used by C. H. Bradley, Jr. Company, of Pittsburg, a No. 3 American filter by the Buckeye Engine Company, of Salem, Ohio, and a No. 3 American filter by the De Laval Steam Turbine Company.

N. A. Christensen, of Milwaukee, Wis., will have no individual exhibit of his apparatus at the St. Louis Exposition, but has made arrangements with a number of concerns who will require compressed air to install one of his compressors with their exhibit. Thus the Standard Railway Equipment Company will use his compressor in connection with its pneumatic tools, the Pneumatic Signal Company will employ one in demonstrating the operation of its signal system, and the Weber Gas & Gasoline Engine Company one for use in starting up gas engines.

The W. T. Van Dorn Company, of Chicago, will not have any regular exhibit at the St. Louis Exposition, but will be repre-

sented by the couplings in use on all the intramural cars that run through the Fair grounds. These cars will probably bear a placard stating that they are equipped with the Van Dorn automatic couplings No. 11.

The exhibit of the American Brake Shoe & Foundry Company, of Mahwah, N. J., will be in the Transportation Building, and will present an illustration of the development of the railway brake-shoe for car and engine service from the time the plain cast iron shoe was adopted up to the present date. This will include samples of the various patented brake-shoes which have come into successful use as standards on the various railroads during this period, and will show not only the development of the wearing face of the brake-shoe to secure durability and beneficial action on the wheel tread, but will also emphasize the various improvements which have taken place in the way of reinforcing the brake-shoe in order to continue it in service when the body metal cracks. The company will also be represented by the brake-shoes on many of the engines, cars and coaches on exhibition throughout the grounds. In the Baltimore & Ohio Railroad industrial exhibit the company will also have full-sized illustrations showing the development of the railway brake-shoe as indicated in its own exhibit with reference to both the wearing qualities and staying qualities of the brake-shoe. The company will also illustrate various small steel castings made by its Tropenas process, covering tools, oil cups, motor and gear castings, and representing its product as supplied by the Chicago Heights steel plant.

B. E. Tilden Company, of Chicago, manufacturers of car and locomotive replacing frogs and motor car replacers, will have several pairs of its steam railway replacing frogs on exhibition. These steam railway replacing frogs are, of course, also adapted to the replacing of motor cars on interurban roads, but not for replacing cars on paved streets. This exhibit will be in the Transportation Building. The company will probably not exhibit at the St. Louis Exposition motor frogs for replacing street railway rolling stock on paved streets.

The Crane Company, of Chicago, will have two exhibits, one in Machinery Hall, Block 26, aisle H-4, the other in Transportation Building, west end aisle H, near aisle 4. The company's exhibit in Machinery Hall will consist of a full line of steam, gas, water and engine supplies, including pop safety valve, electrically operated gate valves, pipe bends and special flanged connections. That in the Transportation Building will comprise a full line of valves and fittings for locomotive and marine use, including all types of brass and iron pop safety valves for locomotive and marine use.

W. W. Lindsay & Company, engineers and contractors, of Philadelphia, will be represented at the St. Louis Exposition by a model electric storage battery house, 20 ft. long, 12 ft. 9 ins. wide, and 12 ft. 6 ins. high, which they constructed for the Electric Storage Battery Company, of Philadelphia, as part of the exhibit of that company in the Palace of Electricity. The building is of steel and concrete throughout, and is an exact reproduction of a design for a large modern storage battery house. The columns and trusses are built of structural steel. The chief feature of the building is the roof and walls, which are built of ferro-inclave. This is a somewhat new building material and is manufactured by the Brown Hoisting Machinery Company, of Cleveland, Ohio, for whom W. W. Lindsay & Company are agents, and whose shops in Cleveland are constructed entirely of it. The ferro-inclave is covered on the inside as well as the outside with cement plaster, forming an interior finish and completely incasing all the structural steel, thus protecting the columns and trusses from the battery fumes. Ferro-inclave, it might be added, is fire-proof, waterproof, practically indestructible and light in weight, making it particularly adapted to storage battery houses, power houses, car houses, etc.

The Joseph Lay Company, of Ridgeville, Ind., has arranged for an exhibit in the Manufacturers' Building at the St. Louis Exposition, and will there present a full line of its brooms, including those manufactured especially for street railway service. The different samples of brooms for this work will be arranged on a large board tastefully designed, and descriptive circulars will be prepared fully explaining the advantages of these brooms over the old-style broom.

The Baldwin Locomotive Works, of Philadelphia, will have an exhibit at the Louisiana Purchase Exposition consisting of thirteen steam locomotives in the Palace of Transportation, two of which will be placed on pedestals at the entrance and the others in aisles G and H, west of the center of the building. The company will also have three electric locomotives and four electric trucks in the Palace of Electricity, Block 3, aisles A, B and S. One of the electric locomotives is designed for surface haulage, the other two for mine haulage. The electric trucks are designed to illustrate: (1) The heavy construction shown by the type built for the Interborough Rapid Transit Company, of New York. This truck weighs 12,500 lbs., without motors, and is designed to carry a weight on the center pin of 25,000 lbs. (2) The medium-heavy construction is shown by the type built for the Central Illinois Construction Company. This truck weighs 11,000 lbs., without motors, and is designed to carry a weight on the center pin of 26,500 lbs. (3) The light construction for interurban service shown by the type recently supplied by the company to the Twin City Rapid Transit Company. This truck weighs 6300 lbs., and is designed to carry a weight of 18,000 lbs. (4) The light construction for street railway service. The weight of this truck is 5300 lbs., and it carries a weight of 14,000 lbs.

The Elliot Frog & Switch Company, of East St. Louis, Ill., will have an exhibit in the Transportation Building devoted entirely to new designs of frogs, switches and switch stands.

The Heine Safety Boiler Company, of St. Louis, Mo., has erected in the main power station eight boilers of its single shell type, rated at 400 hp each, set in four batteries of two boilers each. Each boiler consists of a single drum 48 ins. diameter, with 176 18-ft. tubes and is designed for a safe working pressure of 175 lbs. per sq. in. They are connected by means of an overhead horizontal breeching to an induced draft apparatus. Each boiler is provided with a Green traveling chain grate, the fuel for which is fed from overhead coal bunkers which are kept filled from a central distributing bunker by means of overhead conveyors. The ashes are discharged into an ash pit which opens into a tunnel in the space in front of the boilers, thus permitting the removal of the ashes without inconvenience. Besides the eight boilers in this main power house there are three Heine 250-hp boilers of the double shell type in the power plant of Ferris wheel and also 210-hp boilers of the single shell type in the fuel testing plant of the Outside Mining Exhibit. These latter two plants will be equipped with ordinary flat grates and the usual high stack. The Heine Safety Boiler Company will also have an exhibit space in the extreme northwest corner of Machinery Building, in which will be exhibited portions of Heine boilers, illustrating methods of construction, and also samples illustrating the quality of material used in construction of the boilers. A portion of this space will be utilized as an office and resting place for visiting engineers.

The Walter A. Zelnicker Supply Company, of St. Louis, has secured a large space in the Transportation Building, where it will exhibit a few of its specialties, among them being the Zelnicker "double-clutch" car mover, which has been of great assistance to the railroad companies at the Fair grounds in placing their large and heavy dead locomotives in position. The exhibit will also include the company's new 60-ton hydraulic wheel press, which represents several years of experiments, and is designed so that a maximum result is obtained on a minimum of weight. The company is also expecting to show its well known rail bender and a large variety of track tools and other machinery.

The Robins Conveying Belt Company, of New York, will be located at St. Louis in Block 1, Section 1, Machinery Hall. Its exhibit will consist of three 16-inch belt conveyors, with the company's patent automatic distributing tripper and a Richardson automatic scale to weigh the material as it passes from one conveyor to another.

The Duff Manufacturing Company, of Allegheny, Pa., will have two or three exhibits at the World's Fair, including a complete exhibit of all jacks in the Transportation Building, and also one in the Machinery Building. The company is further exhibiting the Barrett pipe forcing jack, in the Liberal Arts Building, in connection with the Western Gas Association exhibit. In all the company will show between forty and fifty different sizes of Barrett lifting jacks of various capacities, among them the new No. 30 Barrett geared ratchet-lever jack of 30 tons lifting capacity, which will be on exhibition for the first time; the Barrett motor armature lift, which will be shown in the Transportation Building, a full line of Barrett differential screw jacks, the Barrett automobile jack, which will be shown in connection with the general automobile supply exhibit and also in the company's regular exhibit; also a complete line of track jacks, car jacks, car house jacks, journal jacks, bridge jacks and screw jacks.

The Atlas Railway Supply Company, of Chicago, Ill., will have an exhibit containing a full line of samples of its straight, compromise, insulated, raised and standard joints for T and girder rails, also braces and tie plates, and the Atlas primer and surfacer for priming and surfacing cars of street and steam railways. This exhibit will be located in the Transportation Building, aisle C, post 28.

The Weston Electrical Instrument Company, of Waverly Park, Newark, N. J., will have a particularly attractive booth in Electricity Building, space No. 25, immediately opposite the entrance.

It will contain a full line of the electrical measuring instruments for which this company is famous.

The space which has been allotted to the Western Electric Company in the Louisiana Purchase Exposition, St. Louis, is Block No. 17, located near the southwestern corner of the Electricity Building. Immediately adjoining on the south is the space which has been allotted to the American Telephone & Telegraph Company. In the center of the Western Electric Company's space a motor generator equipment will be installed, consisting of two L-5, 100-kw frames, the motor side taking current at 500 volts and the generator side delivering current at 220 volts. This unit will operate in conjunction with a 15-kw compensator, thus permitting the use of 110, 220 and 500-volt current. This same space will also contain two switchboards, one for controlling the operation of the apparatus receiving current from the motor generator, and upon this board will be mounted all the necessary switches, circuit-breakers, ammeters, etc. The other board will be for display purposes only, and will contain a line of knife switches, circuit-breakers, voltmeter switches and kindred apparatus. In the extreme northeast corner of the space a small machine shop will be installed where the company will exhibit in actual operation some of the modern machine tools driven by Western Electric motors on the three-wire multi-voltage system. The company will also show in this space a line of new emery grinding machines manufactured by it. West of the machine shop will be exhibited a few of type "L" direct-connected and belt-driven generators, also a number of Cornish cycle engines direct connected to Western Electric generators, these sets being for marine use especially. In the northwestern corner of the space will be shown a line of power motors arranged in the form of a pyramid, the smallest ones at the top. In the southwest corner of the space will be shown a series alternating arc light equipment, consisting of a full line of transformers, regulators and switchboards. Opposite this, in the extreme southeast corner, will be exhibited ornamental arc lamp stands, from which will be suspended the various types of arc lamps which the company manufacture, also a number of sewing machine motors in actual operation. Fan motors and ceiling fans will be distributed throughout the space, suspended from overhead, and a number of boards containing supplies manufactured by the leading companies throughout the country.

The Continuous Rail Joint Company of America, of Newark, N. J., is located on aisle C, between posts 9 and 10 in the Transportation Building. The company will show samples of its type of T and girder rail joints and step joints, also insulated and special electric bonding joints, with numerous photographs and pictures of its works at Troy, N. Y. The exhibit will be a very attractive one, and will be in charge of E. A. Condit, Jr.

The Brown Corliss Engine Company, of Corliss, Wis., is erecting at the World's Fair two of its vertical cross compound Corliss engines. They are built for high speed, running 135 r. p. m., and each unit will at that speed develop 750 hp at its most economical rating, with 150 lbs. steam at throttle. The cylinders, which are 18 ins. and 36 ins. x 36 ins., are made double ported so as to give quick opening for steam and at the same time give less throw to valve gear parts and reduce momentum of moving parts on gear. All wearing parts are made large, and the oiling system is most modern and complete. These engines are located at the right-hand entrance of the Machinery Hall, Block 45.

The Eureka Tempered Copper Works, of North East, Pa., are located in space 19, Electricity Building. The exhibit will consist of a very attractive display of commutators, trolley wheels, commutator bars, copper, bronze and brass castings, together with other articles which the company manufactures and which are too numerous to mention here.

The Maltby Lumber Company, of Bay City, Mich., will have no booth of its own at the Exposition, but will be represented by a number of excellent photographs of trainloads of ties and poles, and of the company's tie and pole concentrating yards, in the Michigan Building, under the head of Forest Products from the Southern Peninsula.

The American Car & Foundry Company, of St. Louis, Mo., will have a very extensive exhibit of passenger and freight cars. The street railway portion of the exhibit will include a vestibuled electric motor coach with smoking compartment, one of a lot built at the Wilmington plant for the Scioto Valley Traction Company, as part of a contract with W. E. Baker & Co., engineers, of New York. As the car is intended for interurban service, with an attainable speed of possibly 75 miles per hour, it is very strongly and substantially built, with composite steel and wood bottom longitudinals running through to platform end sills, and is equipped with four General Electric 150-hp motors and Westinghouse Traction Brake Company's latest standard electric brake, both installed by these respective companies. The car is of the American Car & Foundry Company's design and the trucks are its high-speed standard, with all contact parts machined. The painting is Pullman color. The decoration is in gold and lettered "S. V. T. Co., Valley Route," and numbered "111." It will be exhibited on the electric test track. The main dimensions of this car are as follows: Length over buffers, 60 ft.; length over vestibules, 58 ft. 2½ ins.; length of car body, 49 ft. 2½ ins.; length of ladies' compartment, inside, 37 ft. 6 ins.; length of smoking compartment, inside, 10 ft. 10 ins.; width over sheathing, 8 ft. 4 ins.; distance between center of trucks, 37 ft. 4 ins.; wheel base, each truck, 6 ft. 6 ins.; seating capacity, ladies' compartment, 54; seating capacity, smoking compartment, 16; windows, 18 each side, arranged in pairs with upper and lower sash; roof, monitor; hood, steam type; weight in running order, 86,900 lbs.; vestibule finish, not like street cars, but in quartered oak and similar to steam car practice, with both compartments in mahogany or Prima Vera, with marqueterie and inlay lines; ceiling, 3-ply poplar veneer, decorated in gold; seats, Hale & Kilburn special high-back walkover, upholstered in green pluch in the ladies' compartment, and in leather in the smoking compartment; trimmings, such as basket racks, door locks, etc., in scratch brass; window guards, bronze; curtains, silk-faced pantasote; glass, crystal plate; saloons, one; tool box with the usual tools; fire extinguishers; lighting, General Electric; heating, Consolidated Car Company's system; headlights, movable arc; center plates, basic steel; signal whistles and gongs. The car was moved to St. Louis on its own wheels, which are Standard Company's steel tired 36-in. diameter M. C. B. flange, 3¾-in. tread, on steel axles. For movement to the Exposition it was equipped with Smilie couplers, but these will be eventually removed and Van Dorn No. 3 automatic couplers will be substituted.

The Crocker-Wheeler Company, of Ampere, N. J., will have two exhibits at the Fair, one being the power plant for the Intramural Railway and the other a number of motor driven machine tools operating under the multiple-voltage system of speed control. The intramural plant is described elsewhere in this issue. The motor exhibit will consist in the drive of a number of machine tools, some of which are located on the company's own exhibit, and others in the official machine shop, which is located in Block 21 of Machinery Hall. All these tools will exhibit the latest progress in the application of electric drive to lathes, drill presses, etc.

The Consolidated Car Heating Company's exhibit at the St. Louis Exposition is located in aisle E of the Transportation Building, and is arranged in a space representing an interurban railway car, but somewhat larger. A most interesting feature is the McElroy electric lighting system for railroad cars, employing an axle-driven dynamo, an automatic rheostat and one storage battery. This system is shown in operation. The various types of Consolidated standard electric heaters, including new types of cross-seat heaters, and special sizes of panel heaters, are shown on a panel, and on a second panel are shown several types of regulating switches and one of the switchboards the company is now building for the new elevated cars of the Brooklyn Heights Railroad. A row of electric heaters of the truss plank type is shown at one side of the exhibit, the cases of these heaters being finished in copper bronze. At one end of the exhibit is a new hot-water system for electric railway cars, with which special fittings are used similar to those furnished with Consolidated equipments for railroad cars. The following equipments for railroad cars are also shown: two-pipe and three-pipe direct steam heating equipments, with thermostatic traps, special train pipe and valves, and steam valves on turnstiles; hot water drum equipment complete, with special parts in section; coupler rack showing twenty-four different styles and sizes of steam couplers, many of them fitted with a new automatic locking device, and couplers so arranged that any two may be coupled together; a turnstile showing four differert styles of thermostatic traps, all in section. There is also shown a locomotive equipment in section; a panel with pipe fittings, and a panel with photographs of the company's various plants and offices, and of a few special cars and locomotives recently equipped with its apparatus.

The booth of the Photoscope Company, of New York, is located in Liberal Arts Building, where the company has secured a space 10 ft. x 16 ft. The front of the booth is constructed of staff, with two very artistic female figures representing the pillars, holding up a cross-piece of attractive design, which bears the letters "Photoscope" standing out in old gold. The company will have two photoscopes in operation, also a model in a glass case, so that the complete mechanism is exposed to view, showing the simplicity of the machinery. Around the Exposition grounds the company will have 200 machines in operation. The company will also have an assorted lot of brooch pins and lockets, souvenirs of World's Fair, St. Louis, which will hold small photo-

graphs, making a valuable token to take home or give friends.

The Ingersoll Construction Company, of Pittsburg, Pa., expects to exhibit at the Fair at St. Louis its figure 8 roller coaster, which will have a number of improvements; the Ingersoll laughing gallery, and a new feature called "Wonder World." It is not possible at the present time to give a full description of this new feature, but it will be published in a later issue. It is said, however, to be entirely new and promises to be one of the leading park amusements.

The Miniature Railway Company, of New York, is to operate thirty miniature railway equipments for 15 ins. and 22 ins. gage, to be used as feeders for the intramural railway. Each outfit will consist of locomotive, tender and five canopy-top cars, giving a total seating capacity of 100 adults or 150 children. Each locomotive weighs 3500 lbs., and is trimmed in brass.

The Western Wheeled Scraper Company, of Aurora, Ill., is exhibiting in the Transportation Building a line of dump cars consisting of ten side dump cars of capacities ranging from 1¼ to 10 yards, and four rotary and end dump cars of from 1¼ to 3 yards, also two styles of bottom dump cars for use in ballasting electric and steam railways, with a capacity of from 5 to 10 yards. The company will also show a number of novel devices particularly adapted to the work of constructing and repairing railways. This company is also exhibiting in the Liberal Arts Building, dump cars, also scrapers, plows, road machines and elevating graders for grading public roads as well as railroads. In that exhibit the miniature machines will be shown in the grading operations.

The Bellamy Vestlette Manufacturing Company, of Cleveland, Ohio, will have an exhibit of its conductors, collectors, milkmen and drivers' vestlettes. It will probably be in the Ohio Building.

The American Blower Company, of Detroit, Mich., is not making an exhibit at St. Louis, but will be represented at the Fair by apparatus furnished in connection with a number of exhibits. Among them are two 60-in. full housed top vertical discharge steel plate fans, and a 30-in. exhaust fan supplied the Westinghouse Electric & Manufacturing Company, and which will be attached to suitable motors; also a 60-in. full housed top horizontal discharge steel plate fan with a Westinghouse motor direct-connected for the Bureau of Standards, Department of Commerce and Labor exhibit. The American Blower Company also furnished to the Northern Electrical Manufacturing Company, of Madison, Wis., a disc ventilating fan, to which that company will attach one of its motors.

The Magnetic Equipment Company, of Chicago, will have an exhibit at St. Louis, which will be nearly the same as that shown last fall at the Street Railway Convention at Saratoga. It will consist of a small model electric car equipped with the company's device, and will probably be in the transportation department of the Electrical Building. The company also proposes taking its large 200-hp double-truck car to the Fair and at some time during the season placing it before the Electric Railway Test Commission for their expert opinion upon it.

The exhibit of the Buda Foundry & Manufacturing Company and Paige Iron Works will be found in the Transportation Building of the Louisiana Purchase Exposition. It will occupy a space of about 35 ft. in length, and will contain a number of articles of interest, both in goods of standard manufacture and in new devices. Among them is the Buda oscillating cattle guard, which is constructed of slats fastened on to a hanger, which in turn is supported by a number of iron plates from one tie to the next. The motion is free, so that when an animal approaches and places its foot on the guard it slides and swings so easily that it is impossible for the animal to obtain a foothold, and, as is well-known, animals will not step where there is an unsecure surface beneath their feet. The company will also show the Buda derailing device, designed to prevent cars or engines from passing to side or main track, except when the main track switch is properly set. The derail is located on the side track and placed approximately 125 ft. from the main track switch stand and operated from that switch stand by pipe line connection. Other devices to be shown are a switch stand with tower and semaphore attachment, the Ramapo automatic switch stand, a large variety of track levels and gages, Jim Crow and roller rail benders of various sizes, a new line of ratchet and friction jacks for track and other work, a Buda standard hand-car with pressed steel wheels, as well as a variety of sizes of wheels. These wheels have the reinforced flange with the straight web, carrying the load of the car direct through the web to the top of the rail. Paulus, Buda and Wilson track drills will also be shown as applied to the track for bonding and signal purposes, as well as some of the products of the company's frog and switch department, such as points and mates, spring frogs, forged work, etc.

The Bullock Electric Manufacturing Company, of Cincinnati, Ohio, will be located in the Electricity Building, Block 15, and will occupy a space 104 ft. x 54 ft. In the center of this space will be an ornamental pavilion, the interior of which will be decorated and the walls hung with interesting photographs of Bullock installations and apparatus. Visitors may sit here and refresh themselves. Among the most interesting part of this exhibit will be a complete multiple-voltage outfit, including a three-wire balancer and motors driving a number of machine tools, and controllers. This outfit will show the practical operation of the Bullock (patented) multiple-voltage system. The company will also show four street car motors mounted on trucks, which will be turning over. They will be furnished current from a 500-kw rotary, which in turn receives its current from three 150-kw transformers which are reducing a voltage of 6600 down to 500 volts. There will also be a number of alternators ranging from 50 to 350 kw. Some of these machines will be partly finished to show their construction, and there will also be a complete line of type "N" motors, which are particularly adapted for driving machine tools, and also a line of "B" motors, which have been successfully applied for driving nearly every kind of machinery. The entire Bullock exhibit will represent a modern testing floor with its accessories of instruments, testing tables, etc., and the company will have in constant attendance a number of engineers from the factory who will look after the operation of all the machinery and will explain in detail to all interested the claims made for Bullock apparatus.

The Fairbanks-Morse exhibit in the Transportation Building will show the various articles which this company manufactures, among them its latest type of motor car. This car is of the No. 10 size, has a seating capacity of about six passengers, and is fitted out with an independent engine and special transmission gear of novel design and construction. It is arranged with three speeds, making it adaptable to almost any system of road. On the slow speeds, of course, very steep grades can be mounted. The company will also have in position within the next few days one of its extra large motor cars, constructed very much on the same line as that above, but large enough to carry a gang of men with tools useful for construction work. Their exhibit will also include the usual run of track tools, such as shovels, picks, bars, gages, levels, a complete line of track jacks, and a number of styles of automatic lowering-jacks and trip jacks. A new feature in jacks which will probably attract attention is a special gear jack, which is constructed for lifting large loads with the least possible effort or power. This jack works about seven times quicker than the old-style screw jack, and has the advantage of the pump motion, instead of that necessary with the old-style screw jack. Several sizes of these jacks will be exhibited. Several types of platform as well as hand-cars will be shown, also a complete line of gas engines, which are manufactured by the company.

The St. Louis Car Wheel Company, of St. Louis, Mo., will have a large exhibit of wheels, showing wheels loose on stands, holding them in upright position and wheels on axles, which will embrace all styles of chilled cast-iron wheels used for steam railroad service, as well as the St. Louis Car Wheel Company's improved spoke Twentieth Century street car design of pattern. None of the wheels will be polished nor painted in any manner, the intention being to show them in their original state after coming from the foundry. Each wheel being perpendicular and supported in a manner to afford easy access for careful examination, will give opportunity for those most interested to examine the chill and quality of the metal, as well as the mechanical form of the designs. The street car wheels on axles are shown in two forms of equipment. Those for interurban electric railroading weigh 550 lbs. each and were designed especially for such service on the lines of the Milwaukee Electric Railway & Light Company. The lighter weight wheels are such as are furnished for city street car service. A double-plate car wheel will also be shown with a section cut out to show the depth and quality of the chill, and to give means of making a minute inspection of the quality of the iron. The display is to be a joint exhibit of the St. Louis Car Wheel Company, St. Louis; the Decatur Car Wheel and Manufacturing Company, Birmingham, Ala., and the Atlanta Car Wheel & Manufacturing Company, Atlanta, Ga.

The Mica Insulator Company, of New York City, has incorporated the exhibit of its well-known specialty, Micanite, with that of the State of North Carolina, in the Mines and Metallurgy Building. The exhibit is an interesting object lesson, showing to what utility and extent mica can be put in the ever-expanding field of electrical insulation. Micanite in all kinds of shapes and forms is shown. Flat sheets of various thicknesses, generator and motor commutator segments, and rings, of many of the standard types. Micanite tubes from ⅛-in. in diameter to the immense tubes entering into the construction of X-ray induction coils.

LONDON LETTER.

[*From Our Regular Correspondent.*]

Since the publication of the items contained in the Street Railway Journal of April 2 and April 9, further details have come to hand of the tender of Bruce Peebles & Company, of Edinburgh, amounting to £42,250, which has been accepted by the Canadian Electric Traction Company, London, St. Thomas & Port Stanley Railway. This order comprises a 1000-hp power station equipment, three-phase transformers, ten 250-hp three-phase motor cars, etc. This is probably the first electric railway to run in Canada with plant entirely of British manufacture. The railway passes through an agricultural district, the first portion of which—30 miles—runs from London, Ont., through the city of St. Thomas to Port Stanley, on Lake Erie. As soon as this line is energized the remaining portion, from London to Hamilton, will be electrified on the same system, making a total distance of 160 miles. The Ganz system has been adopted as the guaranteed figures in comparing continuous current, single-phase and three-phase estimates show a saving of 30 per cent both in first cost and in running costs in the Ganz three-phase system. The power will be transmitted at 10,000 volts, 25 cycles, and will be transformed to 1000 volts for the motor cars, each of which is designed to run at 30 m. p. h. on the level and 15 m. p. h. up to grades of 1 in 25. Each car holds fifty passengers, and is capable of hauling either freight or passenger trailer in addition. The line is built partly across private right of way and partly across public roads, as is the case with interurban railways in Canada and the United States, and considerable interest will await results in practice. The line is under contract to be completed in six months from date. The whole of the electrical portion of the plant will be built at Bruce Peebles & Company's works in Edinburgh.

The London County Council is now proceeding rapidly with the electrification of the old cable tramways between Kennington and Streatham, J. G. White & Company, Ltd., have secured the contract. In doing this work it has been decided best to stop completely the service of the cable cars, and this being so, special efforts will be made to complete the whole installation in about ten weeks, which will probably be a record for carrying out work of this kind. Some disappointment has been felt by J. G. White & Company's engineers, as the first plan projected was to use both cable cars and electric cars, and a special gripping device and junction box had been designed for this work. Electric cars, in fact, were run for some time up Brixton Hill, the electric car being attached to the cable by this special device, and being pulled up the hill by the cable in the same manner as the ordinary cable cars. The London County Council, however, found out afterwards that while the cable was amply large enough for pulling up its ordinary small cable cars it soon gave signs of failure when pulling up the much heavier electric cars equipped with electric motors, gearing, etc. At present there are about 2000 men engaged on the work, and whatever night work is possible is being done. The whole road will have to be lowered about a foot under the Brixton Railway bridge, and from Streatham Hill the whole of the roadway is to be widened.

The electrification of the Metropolitan Railway and the Metropolitan District Railway is proceeding apace, and some of the outlying branches entirely outside of the inner circle are practically ready for work. The Baker Street to Harrow and Uxbridge branch of the Metropolitan Railway is ready to be put in service, and is only waiting now for completion of the large generating station at Neasden, which will be capable of supplying from 14,000 hp to 17,000 hp. Under the guidance of A. C. Ellis, general manager of the company, a party of experts, journalists and others recently inspected a portion of the line, and a trial trip was made on a section which has been electrified, with the new type of first and second-class corridor cars. They are large, commodious and handsome vehicles of the open corridor class, each 52½ ft. long and 8 ft. 9 ins. wide, tastefully upholstered, well ventilated, and, when necessary, both lighted and warmed by electricity. It is intended to run trains wholly composed of these corridor carriages, with motor cars at each end, on the multiple-unit system. All of the carriages have been built in this country by the Metropolitan Amalgamated Carriage & Wagon Company, Ltd., of Birmingham, and the electrical equipment by the British Westinghouse Electric & Manufacturing Company. The Metropolitan Railway Company is itself undertaking the fitting of the line for electric traction, with T. Parker, of Wolverhampton, as consulting engineer, and C. Jones, formerly of the Liverpool Overhead Railway Company, as chief electrical engineer.

A parliamentary committee recently commenced its sittings in the High Court of Justiciary, Edinburgh, for the purpose of inquiring into the merits of a number of Scottish provisional orders sought to be passed. The first case heard was that in connection with an order promoted by the Town Council of Leith for power to purchase, electrify and work the tramways undertaking within the burgh of Leith. The cost of the work is estimated at £225,000. The passing of the order is objected to by the Edinburgh Town Council, and the question resolves itself into a fight between the cable and the electrical systems of traction.

Municipal tramway managers throughout the country have received a decided shock at the decision of a House of Lords' committee to grant to a company compulsory running powers over a municipal system. The Tyneside Tramways Company, working a small undertaking between Newcastle and Tynemouth, has obtained powers from the lords' committee to take its passengers over the extensive system of the Newcastle Corporation. This is the first time a parliamentary committee has granted such powers, and the municipalities throughout the country see in the decision a serious menace to the efficient development of their tramway enterprises. The chairmen of the Manchester and Glasgow committees have invited representatives of various public bodies to attend a conference in London, with the object of promoting united and strenuous opposition to the company's bill when it reaches the House of Commons. The position that the municipalities will take up in the matter will not be one of opposition to inter-communication. They contend that the arrangements made should be voluntary, after full consideration has been given to the local requirements, and not compulsory.

The annual dinner of the Tramways & Light Railways Association was held last month at Prince's Restaurant, under the presidency of Alfred Baker. Responding to the toast of the association, Mr. Atherley-Jones, K. C., M. P., said that they were to be congratulated on the accession of Mr. Baker to the presidency. The object of the association was to develop as far as possible the interests of the public by the promotion of cheap and facile locomotion. If they had not done much to obtain this result, it was not through want of effort, but through the innate conservatism which was one of the principal characteristics of the English people. Tramways formerly regarded railroads as competing bodies, but he did not agree with this, for tramways were the feeders of the railroads. In the same way he believed that the omnibus proprietors might be induced to regard the passage of tramways over Westminster Bridge as not destructive to the British constitution. (Laughter.) He was sure that the association would in the future increase the locomotive communication between the various centers of population and between the suburbs and the centers of cities. After the speeches, which were not of a particularly important character, an excellent musical programme, provided by Mr. Benedict, the secretary, to whom a special vote of thanks was accorded, was enjoyed by all who cared to linger.

The first electrical train of the Newcastle and Benton line of the North-Eastern Railway Company was started recently by Viscount Ridley (chairman of the company), in the presence of a large gathering, which included most of the other directors and chief officials of the railway. The run to Benton and back was performed easily within the scheduled time, and the public service commenced soon afterwards, over 200 passengers traveling by the train. A luncheon followed the opening ceremony, at which the authorities of the company, Mr. Merz, the consulting engineer, and the British Thomson-Houston Company, the contractors, were heartily congratulated on the complete success of the proceedings. Sir David Dale, who presided at the luncheon, said that it was expected that the whole of the electric service would be working on June 30.

In the description of the Great Northern & City Railway, published in the Street Railway Journal of March 5, a list was given of the gentlemen who had charge of the electrical engineering work. Reference should have been made at the time to the fact that all of the electrical apparatus used throughout the system was furnished by the British Thomson-Houston Company.

The Crewe Town Council some time ago decided to promote an electric tramway scheme of its own and withdrew its support from a private company. It had been arranged that the application should be made in May for an order, but on account of trade depression in the borough, the railway workmen being on short time, the committee has decided to abandon the scheme for the present.

Some alarmist reports have lately appeared in the daily papers about the discontinuation of the electric train service on the newly-opened electrified branch of the Lancashire & Yorkshire Railway from Liverpool to Southport. Doubtless nothing serious has happened, and probably by the time this appears in print the service will have been resumed. It is possible that too keen a zeal to be able to claim the first electrified main railway in England has led to a little trouble, as certainly the power house was hardly in condition to do itself justice when the railway was opened. A gradual commencement would probably have been better. A. C. S.

PARIS LETTER.

(From Our Regular Correspondent.)

The much-talked-of city loan has at last been issued by the municipal authorities. The amount is 170 millions of francs, and it is said that the issue was oversubscribed scores of times.

The authorities made a special feature in the loan and have thus made it popular with all classes. The nominal amount of the bond is 500 francs and the price was 440 francs. Interest at the rate of 2½ per cent is paid on 500 francs. The payment is to be made in instalments, running over three years, payable every six months. From an early hour on the eve of the issue the streets were thronged in the neighborhood of the banks and brokers' offices, and the subscribers in many cases waited all night in order to sign early for their bonds. The amount of the loan will be utilized for the new construction work of the Paris-Metropolitan Railway, especially for the No. 4 line, which runs north to south, and is considered as the backbone of the whole system as regards anticipated results in traffic. It serves the populous district of Les Halles, or Central Markets.

The last word regarding the great accident of Aug. 10 last has not yet been said. The motorman who drove the doomed train, the station master at whose station the 100 lives were lost and two other officials connected with the operation of the line are all to be charged early in May with manslaughter. It is thought that the trial will be somewhat of a farce. The traffic manager, considered by many to be as responsible as any for the accident, has not been indicted.

The traffic receipts on the two Metropolitan lines continue to increase in a most satisfactory manner. For the period between Jan. 1 and April 15, the returns give 35,000,000 passengers carried, an increase of over 20 per cent compared with the same period of 1903.

Some months ago it was stated in this monthly letter that an action had been started by the Compagnie Generale des Omnibus against the city authorities for breach of faith in respect to the monopoly granted them some fifty years ago for street conveyance. The action has dragged out before the courts, and it is anticipated that the final decision will not be favorable to the city. The new Municipal Council will, at its meeting in June, take up the question of the means of transport within the city, with the view of putting the affairs of the Cie Generale on a better basis. The monopoly of the company runs out in six years' time, but matters are being hastened to a conclusion owing to the impossibility of the Omnibus company competing successfully with the Metropolitan lines. The Compagnie Generale reports a decrease in receipts for 1903 of 1,353,420 francs, which, however, is converted into a net increase by reason of economies in management, running expenses, etc. The net products for 1903 were 2,162,600 francs, against a total of 469,981 francs less for the year 1902. The company was obliged to pay off some 13,800 debentures (3 per cent) amounting to 6,900,000 francs, leaving a deficiency of 4,737,399 francs, which sum was met by the issue of new debentures at 4½ per cent. Thus, the company's affairs are drifting from bad to worse every year.

The Cie des Tramways de Nice has just been mulcted in the sum of 95,000 francs damages given to the University of Paris, which body possesses an observatory at Mont Gras. The Nice Tramway Company extended its system of lines close to the observatory, with the result of interfering with the magnetic apparatus installed in the observatory. Hence, the damages to the Paris University, which received daily reports from the observatory before operations were stopped by the tramway company.

Algiers has a very efficient tramway system which is soon to be increased by the addition of several units. The new rolling stock includes G.E.-53 motors, and Type-B controllers, and the material will mostly come from the United States.

The year 1903 was a pretty favorable one for tramways in France. The larger companies are paying about 5 per cent, among which may be mentioned the Cie Generale Francaise de Tramways, owning a large system at Marseilles, the Havre Tramway Company, and the Thomson-Houston concern.

It will be remembered that about a year ago the Est-Parisi Tramways were granted a license to run their cars in the rue du 4 Septembre by means of overhead trolley, instead of the surface contact system in use. The reason for this was that the Est-Parisien made out that the new Metropolitan line (No. 3), which runs under the rue du 4 Septembre, interfered with the surface contact system. The No. 3 line is finished as regards construction work and the city authorities have called upon the Est-Parisien Company to remove the so-called unsightly trolley from the streets. The time granted expired at the end of last March, but the company has made no effort to comply with the request. The city will undoubtedly take immediate action, and the consequences are not difficult to foresee, in view of the parlous state of the finances of the Est-Parisien, which has never recovered from the disastrous strike which terminated about two months ago. The Est-Parisien system includes about 50 km of track, mostly outside the city boundaries.

The State Railway announce the putting into service of a new steam motor car, composed of motor (two small compound engines) baggage car and seating accommodation for forty passengers. The Northern Railway Company has already a number of these in service and the P.-L.-M. Railway is also experimenting in this direction. Coke is the fuel in general use on French railways, together with a certain proportion of briquette, or patent mixture, and this will be used on the new automobile car. The fuel feed is automatic as well as the water feed. The engine will only need one attendant. In appearance the trolley cars used for interurban service in America are very similar to the steam automobiles in use on French and British railways.

TWELFTH ANNUAL REPORT OF THE GENERAL ELECTRIC COMPANY

The annual report of the General Electric Company for the year ending Jan. 31, 1904, was made public last week, and shows that the profits of the company for the past year, including a profit of $138,644.06 upon securities sold, and $750,796.69 royalties, dividends, sundry profits, etc., after deducting all general and miscellaneous expenses, and allowances for depreciation, losses and writing off $553,773.01 from patent account, and $2,027,841.52 from factory plants and machinery were

from factory plants and machinery were	$7,865,376.89
Less interest on debentures	76,007.15
	$7,789,369.74
Less net debit to profit and loss in writing off the patents, etc., of the Stanley Electric Manufacturing Company, and other acquired interests, and balance due on all turbine patents acquired by the company, and in revaluing stocks and bonds owned	1,470,098.98
	$6,319,270.76
The amount of surplus at the end of the last fiscal year was	4,482,701.99
	$10,801,972.75
Paid in dividends during the year	3,508,284.00
Surplus Jan. 31, 1904	$7,293,688.75

The report states that disturbed financial and other unsatisfactory conditions of the past year have considerably affected the business, and the percentage of profit upon business done is smaller than for the previous year; the increased price of copper, higher priced and less effective labor, large expenses in developing steam turbines, and lower selling prices have also contributed to this result.

The total sales (amount billed to customers) during the past year were $41,699,617.

The orders received during the past year include: Generators, rotary converters and steam turbines, aggregate capacity about 900,000 hp; railway motors, more than 7000, aggregating over 300,000 hp capacity; transformers, over 650,000 hp capacity; stationary motors, more than 15,000, aggregating over 200,000 hp capacity; arc lamps, more than 75,000; meters, more than 110,000.

The equipment of the Manhattan Elevated Road in New York City has been completed, and has continued to operate with complete success, frequently carrying more than one million passengers per day. This road has now been operated electrically for about one year, and despite the early unfamiliarity of the operating men with electrical apparatus, and the enormous increase in traffic, not a single passenger in the elevated trains has met with a fatal accident that in any way, directly or indirectly, could be attributed to the electrical apparatus. This record is not only one of which the operating department may well be proud, but is also a strong testimonial to the reliability of the electrical apparatus. It is worthy of note that the popular apprehension of the "deadly third rail" is without foundation as regards danger to the public. There is not a recorded instance of a passenger being killed by the third rail.

Most of the equipment for the Interborough Rapid Transit Company, New York City, has been delivered, and many of its cars have been operated for months on the lines of the Manhattan division.

STEAM RAILROAD EQUIPMENTS

Considerable progress has been made during the year in the steam railroad branch of the business. The New York Central

Railroad has placed large orders with this company for electrical apparatus to operate its trains south of Croton (a distance of 34 miles from the Grand Central Station). The officers and engineers of many of the great railway systems are watching closely the progress of electric traction, and express themselves as ready to adopt electricity as soon as its economical operation has been demonstrated by the installations now in progress. The South Side and Lake Street Elevated Railways of Chicago, and the Manhattan Elevated Railway of New York City, are three roads which originally operated by steam and have since adopted electric traction. The South Side Elevated and Manhattan are equipped respectively with the Sprague and Sprague-General Electric multiple-unit control system, and all are equipped with General Electric Company's apparatus. A comparison of results obtained with steam and electricity is given below:

Year.	Gross Receipts.	Operating Expenses.	Net Earnings.	% Operating Exp. to Gross Receipts.
SOUTH SIDE ELEVATED, CHICAGO.				
Steam, 1895	$744,167	$573,704	$230,463	69.1
Elec., 1899	1,170,381	516,206	654,175	44.1
LAKE STREET, ELEVATED, CHICAGO.				
Steam, 1895	517,305	290,000	227,298	56.1
Elec., 1899	697,513	331,553	365,960	47.5
MANHATTAN ELEVATED, NEW YORK.				
Steam, 1901	9,416,888	5,253,230	4,163,658	55.8
Elec., 1903	12,208,337	5,460,793	6,747,544	44.7

The figures in the case of the Manhattan road are made more interesting by the fact that the number of passengers carried in 1903 was 246,587,022, as against 190,045,741 in 1901, while it will be noted that the operating expenses were only $207,564 more in 1903 than in 1901. The 1903 figures given above are for the year ending June 30, 1903. The results since that date are even more favorable to electric traction.

MULTIPLE UNIT CONTROL.

The Sprague General Electric control equipments on the Manhattan Elevated have continued to give satisfaction to its officials and engineers and by prolonged test have proved their strength, reliability and durability. The same is true of the Interborough equipments during the time that they have been in operation. During the past year the company secured the order for the complete equipment of the elevated road in Boston with the Sprague-General Electric system and orders for the same type of multiple unit control have been given by the Yerkes system of underground roads in London to the British Thomson-Houston Company, and by the Metropolitan Underground in Paris to the French Thomson-Houston Company. The Central Underground Railway of London has also equipped its entire system with the Sprague-General Electric control. The list of roads and number of cars equipped, or under contract, given in the last report aggregates now 53 roads and 2595 cars.

RAILWAY MOTORS

Since the organization of the company in 1892, it has sold 92,557 railway motors, having a total capacity of 3,420,537 hp. These motors are in operation in all parts of the world.

POWER TRANSMISSION PLANTS

One of the important enterprises completed during the year is a power transmission plant at Guanajuato, Mex. The power is transmitted at a continuous pressure of 60,000 volts. The transmission line is 101 miles long and the wires are carried on iron towers 48 ft. high and 440 ft. apart, instead of by the usual system of poles spaced at intervals of 100 ft. or 125 feet.

Including steam and water power plants, the company has installed and under contract to-day: 1,230,270 hp capacity in polyphase generators. Of this number, 514,919 hp capacity are being operated by water power. The company has now five large plants under construction employing 60,000 volts. The average size of the transformer used in such installations has increased from 100 kw to 1000 kw, and the maximum size from about 300 to 2500 kw.

The various installations mentioned in previous reports, in which electricity is transmitted long distances, have continued to be commercially successful, and many have been increased; for example, 5000 hp capacity in generators with the necessary transformers have been ordered by the government of Mysore for the Cauvery-Kolar plant. This nearly doubles its original capacity. The remaining 5000 hp generators for power station No. 2, at Niagara Falls, have been completed and there are now in operation at this station eleven machines of General Electric manufacture, making a total of 55,000 hp. The company has also shipped the first of the 10,000 hp generators intended for the Canadian development of Niagara Falls power, and the second and third machines of this same size are nearly completed. These generators are the largest in capacity that have yet been constructed.

The company's engineers have been engaged for several years in developing and perfecting a line of single-phase alternating-current motors suitable for use on railroads and tramways. While this motor and its control are both new, they are now based upon patents already owned by this company.

STEAM TURBINES

The past year has been marked by the successful introduction of the Curtis steam turbine. A large line of turbo-generators, varying in size from 1½ hp to 7500 hp, has been developed. The company has sold about 350,000 hp, of which 35,000 hp have been installed and are in successful operation.

BALANCE SHEET

The balance sheet follows:

ASSETS.

Cash			$3,289,445 18
Stocks and bonds		$14,665,346 27	
Real estate (other than factory plants)		424,082 74	
Notes and accounts receivable		15,207,480 74	
Work in progress		2,046,488 43	
		32,343,398 18	
MERCHANDISE INVENTORIES:			
At factories	$10,488,464 63		
At general and local offices	1,247,754 37		
Consignments	69,899 38		
		11,806,118 38	
			44,149,516 56
Factory plants		6,500,000 00	
Patents, franchises and good-will		2,000,000 00	
			8,500,000 00
			$55,938,961 74

LIABILITIES.

3½ per cent gold coupon debentures	$2,049,400 00	
5 per cent gold coupon debentures	82,000 00	
Accrued interest on debentures	683 33	
Accounts payable	1,810,664 54	
Unclaimed dividends	1,825 12	
		$3,944,572 99
Deferred liability on account of purchase of Curtis Turbine Patents, payable in installments to Feb. 1, 1906		834,000 00
Capital stock		43,866,700 00
Surplus		7,293,688 75
		$55,938,961 74

ACCIDENTS IN CHICAGO

The Civic Federation, of Chicago, Ill., has classified the cases of death or injury in Chicago from accidental causes which were reported by the Chicago police for the year 1903. The tabulation of the street railway accidents, giving their nature and number of victims, is given here:

STREET RAILWAY ACCIDENTS.

Alighting from car	331
Boarding car	217
Collisions	123
Arm or head out of window	9
Car jumping track	61
Car striking wagon	442
Falling or thrown off	198
Thrown off by conductor	18
Jerking of car	15
Run over	457
Hit by passing wagon	99
Knocked off by bridge	28
Crushed in tunnel	8
Slipping from car	16
Hitching on car	13
Total	2,035

UNION ENGINEERING BUILDING IN NEW YORK

The programme of competition for designs for the Union Engineering Building will be placed this week in the hands of the architects who are to compete for the design to be selected, and all drawings are to be in the hands of Prof. Hutton, secretary of the committee, by June 15. The building will occupy a space of 10,500 ft. on Thirty-Ninth Street, exclusive of the 15 ft. required by city ordinances, and will contain offices for the different societies, reception rooms, a library, audience halls, the largest of which will seat 1500 people, etc. The Engineers' Club, which will connect with the Engineering Building, will front on Fortieth Street and will be eleven and a half stories in height.

STATISTICS OF VIRGINIA COMPANIES

It is possible to give here only a summary of the statistical tables compiled by the State Corporation Commission of Virginia concerning the details of the capital stock, funded debt, cost of road and equipment, income account, earnings from operation, operating expenses, balance sheets, traffic and mileage statistics, mileage, equipment and average wages of and number and class of employees of the electric railways of the State. The total of outstanding common stock of the twenty-two companies reporting is $19,456,950, while the total of outstanding preferred stock is $5,925,000, making the total of stock issued per mile of road $32,748 for the companies able to report the amount of capital stock per mile. The total of bonds authorized is $37,949,000, of which $31,760,500 has been issued. The figure of $47,969, given in the table as the amount of bonded indebtedness per mile, represents the average of those companies which are able to report the amount of their funded debt. The total cost of road and equipment, as given in the report, is placed at $48,991,717. The figure of $86,991 given as the cost per mile of road represents only such companies as operate railway lines, it being impossible to ascertain the cost where lighting and other properties are included. The income account is shown in the following table:

INCOME ACCOUNT

NAME OF COMPANY	Income from Operation	Deficit from Operation	*a* Income from Other Sources	Total Income	Total Deficit.	*b* Deductions from Income	Net Surplus	Net Deficit.
	$	$	$	$	$	$	$	$
Bay Shore Terminal Co	--------	7,568.23	--------	--------	7,568.23	9,938.89	--------	17,507.12
Berkley Street Railway Co	2,303 80	--------	510.23	2,814.03	--------	28,875.77	--------	26,061.74
Charlottesville City & Suburban Railway Co	4,467.80	--------	--------	4,467.80	--------	7,000.07	--------	2,532.27
Chesapeake Transit Co	--------	5,318.60	754.09	--------	4,564.51	17,395.84	--------	21,960.35
Citizens' Railway, Light and Power Co	15,261.92	--------	42,142.39	57,404.31	--------	51,005.84	6,398.47	--------
Danville Railway and Electric Co	12,642.85	--------	6,206.46	18,849.31	--------	13,301.66	5,547.65	--------
Hampton Roads Railway & Electric Co *c*	--------	--------	--------	--------	--------	--------	--------	--------
Lynchburg Traction and Light Co	36,452.42	--------	44,597.51	81,049.93	--------	53,578.54	27,471.39	--------
Newport News and Old Point Railway and Electric Co	63,944.55	--------	87,753.59	151,698.14	--------	158,781.10	--------	7,083.02
Norfolk and Atlantic Terminal Co	3,415.96	--------	--------	3,415.96	--------	47 272.97	--------	43,857.01
Norfolk, Portsmouth and Newport News Co	9,542.16	--------	322.82	9,864.98	--------	10,509.21	--------	644.23
Norfolk Railway and Light Co	90,692.18	--------	119,448.48	210,140.66	--------	206,073.91	4,066.75	--------
Old Dominion Railway Co	5,688.48	--------	188.35	5,876.83	--------	30,897.48	--------	25,020.65
Radford Water Power Co	--------	3,613.02	13,003.34	9,390.32	--------	7,144.73	2,245.50	--------
Richmond Passenger and Power Co	121,546.30	--------	12,859.21	134,405.51	--------	226,856.89	--------	92,451.38
Richmond and Petersburg Electric Railway Co	19,614.32	--------	--------	19,614.32	--------	14,090.47	5,523.85	--------
Richmond Traction Co	53,039.06	--------	3,584.05	56,623.11	--------	57,437.60	--------	814.49
Roanoke Railway and Electric Co	32,395.18	--------	16,637.34	49,032.52	--------	26,695.39	22,337.13	--------
Tazewell Street Railway Co	505.10	--------	--------	505.10	--------	--------	505.10	--------
Virginia Passenger and Power Co	66,754.46	--------	258,946.88	325,701.34	--------	440,015.02	--------	114,313.68
Washington, Arlington & Mt. Vernon Railway Co	73,812.79	--------	4,234.60	78,047.39	--------	44,061 89	33,985.50	--------
Washington, Arlington and Falls Church Railway Co	2,974.83	--------	--------	2,974.83	--------	10,688.31	--------	7,713.48
Total	615,054.1[illegible]	16,499.85	611,189.34	1,221,876.39	12,132.74	1,461,621.64	108,081.43	359,959.42

a Advertising, light, power and ice plants, leases, hotels, ferries, amusements, interest and dividends on securities owned, etc. Total net deficit, $251,877.99. *b* Interest, dividends, rentals of leased lines, taxes, etc. *c* In hands of United States Circuit Court—no report made.

The earnings from operation are shown as passenger earnings, freight earnings, mail earnings, miscellaneous earnings, and total at $2,307,082, making earnings per mile of $8,134. The operating expenses are detailed as maintenance of way, maintenance of equipment, operation of power plant, operation of cars, and general expenses. The total of operating expenses is given as $1,708,527, making expenses per mile of $6,024. The total balance sheet shows the total of assets to be $71,406,710, while the total of liabilities is given as $71,406,710. The total number of passengers carried is given as 56,038,428, while the number of transfers is given as 8,819,870. The passenger car mileage is 13,385,688 and the rate of fare per passenger $.0392. The passenger earnings per mile of road are $7,858, while the passenger earnings per car-mile are $16.61. The total mileage, including main line, branches and side tracks, is given as 374.42. The total number of cars is 675, made up of 358 closed cars, 267 open cars, 1 express car, 31 freight cars, 13 service cars, 1 snow plow, 1 sprinkler, 3 sweepers. The wages of employees are given for general officers, general office clerks, conductors, motormen, drivers, starters, watchmen, etc. The general average for conductors is placed at $1.49 per day. The highest wage paid for this class of service is by the Chesapeake Transit Company, which pays $2.19, while the lowest rate is paid by the Tazewell Street Railway Company, which pays $1 a day. The average of wages of the motormen is $1.55 per day. The highest rate paid for this service is by the Washington, Arlington & Mount Vernon Railway Company, which pays $2.25, while the lowest wage is paid by the Charlottesville City & Suburban Railway Company, which pays $1.15. The total wages for all service averages $1.42 per day.

The Roberts & Abbott Company, of Cleveland, writes that the long double-truck cars recently purchased by the Northern Texas Traction Company are equipped with four 75-hp motors, and not four 50-hp motors, as stated in the description published April 23. The cars were built by the American Car Company, according to the specifications and under the inspection of, the Roberts & Abbott Company.

ANNUAL REPORT OF THE PITTSBURG RAILWAYS COMPANY

The annual report of the Pittsburg Railways Company, for the year ended March 31, 1904, was submitted to the stockholders on May 2. It was as follows:

During the year the following lines have been added to the system: the Pitcairn & Wilmerding Street Railway, extending from Wilmerding through Pitcairn to Trafford City, and the Wilkinsburg & Verona Street Railway, extending from Wilkinsburg to Verona and Oakmont. The East McKeesport Street Railway completed a connection in Wilmerding by a long viaduct over the tracks of the Pennsylvania Railroad Company to Airbrake Avenue in Wilmerding, thus affording a connection through the Turtle Creek Valley to McKeesport. The Pittsburg & Charleroi Street Railway completed the connection between Castle Shannon and Monongahela City. Through cars are now operated from the head of Pittsburg Incline in Pittsburg to Allenport, a distance of 31.89 miles. The results from the operation of this line during the fall and winter months indicate that this railway will eventually be profitable, and especially so when cars can be operated direct from Pittsburg through Mount Washington tunnel and by private right of way to Castle Shannon. On this line are ten double-truck closed cars, equipped with motors, controllers, etc., adopted for high speed interurban traffic. The tracks of the McKeesport & Reynoldton Street Railway have been extended to the southern limits of Glassport. The Howard & East Street Railway was constructed to the city limits of Allegheny and the tracks of the Bellevue & Perrysville Street Railway to West View. The results from the operation of these railways during the summer and fall were satisfactory.

The company during the year has constructed 34.53 miles of new track, and the total track now operated by the company is 445.56 miles.

The company purchased 200 cars during the past year, 100 being closed vestibule motor cars, and 100 closed trail cars.

The company during the year has maintained its tracks in good repair. Several of the heavy traffic lines of the system were thoroughly overhauled, cast-welded joints being used, rails straightened and new ties placed at joints. It is believed that the repairs, while involving a large expenditure, will add three or four years' service to these tracks.

The company has maintained its power plants, cars, buildings and equipment in thorough repair. The progress of construction of the power plant on Brunot's Island has been slow. Since April 1, 1904, however, the contractors have been pushing their work rapidly, and from present indications current will be supplied from this plant early in July.

During the year the Pennsylvania Company has completed the work of elevating its tracks on the main line in Allegheny, which practically removes all the grade crossings of the company in that city.

The gross receipts from the operations of the company up to January 1, 1904, show a satisfactory increase. The depression in general business and the closing down of many of the mills in this district has caused a slight decrease in receipts between Jan. 1, 1904, and March 31, 1904. The increase in gross receipts for the year is .0481 per cent, and a slight increase in net earnings.

The extremely severe weather during the winter has also affected

the receipts as well as increased the operating expenses. The principal item in the increase of expense is shown in the transportation department, and is owing to the increase in wages to all classes of workmen—especially to motormen and conductors—and to the advanced cost of coal, which was about 40 per cent over the preceding year, but owing to competition the company will be able to purchase its supply of coal at reduced prices for the coming year. The item of maintenance of way and structures also shows an increase, which was caused by the extensive repairs made upon the system.

Attached hereto will be found a statement of the operations of the company for the year ended March 31, 1904:

INCOME AND PROFIT AND LOSS ACCOUNT YEAR ENDED MARCH 31, 1904

Gross receipts from operations			$8,661,394.48
Operating expenses—			
General expense		$607,735.04	
Conducting transportation		2,922,431.99	
Maintenance of way and structures		405,393.48	
Maintenance of equipment		650,166.18	
Parks and Duquesne Garden expenses		60,612.35	
Total operating expenses		4,646,339.04	
Bridge tolls		118,217.73	
Taxes		422,325.11	
Total operating expenses and taxes			$5,186,881.88
Net earnings			$3,474,512.60
Other income—			
Advertising in cars		$37,711.91	
Dividends on stocks owned		62.50	
Rent of buildings and real estate		65,310.60	
Interest and discount		17,437.76	
Miscellaneous		17,133.67	
Total other income			137,656.44
Total income			$3,612,169.04
DEDUCTIONS FROM INCOME			
Rentals of leased companies—			
United Traction Co. of Pittsburg		$370,785.04	
Consolidated Traction Co		757,098.00	
Interest on current liabilities		150,996.76	
Tenement expenses		14,924.89	
Total deductions from income			$1,293,804.69
Net income			$2,318,364.35
FIXED CHARGES			
Interest on funded debt		$1,464,440.84	
Dividends on preferred stock—			
United Traction Co. of Pittsburg	$150,000.00		
Consolidated Traction Co	720,000.00	870,000.00	2,334,440.84
Deficit for year			$16,076.49
Surplus March 31, 1903			206,961.79
			$190,885.30
Bad accounts collected		$224.50	
Premium on bonds sold		8,353.63	8,578.13
Surplus March 31, 1904			$199,463.43

NOTE.—During the fiscal year ended March 31, 1904 the gross receipts from operation increased $384,829.40 over the same period for the preceding year.

Passengers carried	174,400,055
Car mileage	34,748,836 Miles
Earnings per car mile	$.2532
Expenses per car mile (including taxes)	.1492
Net earnings per car mile	.1040

IMPROVEMENTS AT CINCINNATI

The Cincinnati Traction Company is planning to make a number of improvements to its system during the summer. W. Kesley Schoepf, president of the company, is at present in the East discussing with his asociates the expenditure of about $500,000 in betterments for the property. At the Depot Street generating station there will be installed 2250 hp of additional boilers and engines and a 1500-kw generator. Plans are under way for the erection of a large fireproof car house on Walnut Hill to replace the one burned some time ago. Considerable new special work will be laid at crossings in the down-town district, and additional curves will be put in at a number of points which will enable both the city company and the Cincinnati, Newport & Covington Traction Company to operate additional cars over loop routes during rush hours.

SUBWAY EXTENSION REPORTED IN NEW YORK

The Plan and Scope Committee of the Rapid Transit Commission, of New York, on Thursday, April 28, reported favorably upon the subway plan, of which mention was made in the STREET RAILWAY JOURNAL of April 30. This, in general, is the plan proposed by the New York City Railway interests a few weeks ago, but differs from that plan in advocating the use of Seventh Avenue instead of Eighth Avenue up to Forty-Second Street. In brief, the line is to run down Lexington Avenue to Irving Place and Fourteenth Street, thence to Broadway and Chambers to William, through the financial district and around the Battery, through West and Houston Streets, up Seventh Avenue to Thirty-Fourth Street and thence east to Lexington Avenue. It would afford the loop system for the lower part of the city and connect with the Grand Central Station and the new Pennsylvania Station at Thirty-Seventh Street and Seventh Avenue. A public meeting will be held May 12, to consider the project.

As an incentive to competition in building the new subway, the committee suggests that the work be divided into sections in such a manner as to make it adaptable in practice to the plans of both the New York City Railway Company and the Interborough Rapid Transit Company. Notwithstanding this provision, the contract, offered wholly or in sections, will go to whichever bidder can offer the most attractive proposal in the matter of transfers. The Interborough Company has suggested the building of a lower west side route by extending the present subway from Forty-Second Street and Broadway to the Battery, and an upper east side route by an extension from Forty-Second Street and Fourth Avenue up Lexington Avenue into the Bronx. The Metropolitan interests recommend building an independent system running from the Bronx down the east side, thence around the Battery and continuing up the west side of the city to Thirty-Fourth Street, and thence across to the east side tunnel. This is the committee's recommendation:

The routes in Manhattan and the Bronx now proposed by your committee follow generally the line suggested by the Metropolitan interests on the east side, except that the terminus in the Bronx is moved northerly so as to connect with the present subway at One Hundred and Ninety-Fourth Street and Third Avenue. On the east side, instead of going up Hudson Street and Eighth Avenue, it is proposed to continue up West Broadway to Washington Square, thence under Washington Square and private property to Greenwich Avenue, thence under Greenwich and Seventh Avenues to Thirty-Fourth Street, and thence under Thirty-Fourth Street to a junction with the east side line at Lexington Avenue.

Three additions to the route thus outlined are proposed by your committee:

First—A short line to connect the Lexington Avenue line with the present subway at a point near Fortieth Street and Park Avenue.

Second—A line up Seventh Avenue from Thirty-Fourth Street, to connect with the present subway at Forty-Third Street.

Third—The line from Fort Hamilton, Brooklyn, already referred to, running under Fourth Avenue and Flatbush Avenue, as extended, and over the Manhattan Bridge to a point in Canal Street near Centre.

This large scheme of building, if approved, should not be offered to bidders as an entirety. On the contrary, it is the judgment of your committee that it would be essential to invite bids upon it in separate sections. One section would embrace the Brooklyn line, one section might embrace the east side line from One Hundred and Thirty-Eighth Street to Forty-Fifth Street, another the east side line south of Forty-Fifth Street, and another the west side line as far north as Thirty-Fourth Street. The four connecting links from One Hundred and Thirty-Eighth Street and Third Avenue to One Hundred and Forty-Ninth Street and Third Avenue, from Park Avenue and Fortieth Street to Lexington Avenue and Forty-Fifth Street, along Thirty-Fourth Street from Seventh to Lexington Avenue, and along Seventh Avenue from Thirty-Fourth to Forty-Third Street, would also each constitute a separate section. Bidders might be allowed to bid for one or more of the sections.

The board should reserve the right to award contracts for one or more sections, or suspend the construction of any section until such time as the increase of traffic might establish the necessity for an additional route. The invitation to contractors should also require them (as was done in the case of the Brooklyn-Manhattan Rapid Transit Railroad) to specify the maximum fare, not exceeding 5 cents, which would be charged, and also specify what transportation facilities over railways connecting or to connect with the new line each bidder would be able to assure the city. The transfers offered might be with or without change of cars, as the several bidders might be able to offer.

Bidders might also be called upon to specify what rental they would be willing to offer above the minimum provided by law. In this way the competition might be invited, not merely as to the expense of construction, but also as to the accommodations offered to the public and the rental to be paid to the city for the use of its streets.

CHICAGO TO ASK COMPANIES FOR TERMS

Mayor Harrison, of Chicago, has been authorized by the City C · ncil to invite the companies to enter into negotiations with the city officials for franchises. The resolution began by making the observation that the street railway question is still open and unsettled and the general pubic is still submitting to deplorable transportation facilities. The resolution then proceeds to authorize the Mayor to extend an invitation to all street railways of the city whose franchises expired July 30, 1903, and since that date, to negotiate with the proper officers of the city of Chicago as to what character of franchise they or any of them contemplate requesting from the city.

FERROSTEEL FLANGED FITTINGS

The practice of superheating high-pressure steam is becoming so general that the Crane Company has brought out a material called ferrosteel, for use in piping systems subject to the higher temperatures and increased expansion strains which the improved practice involves. This metal has an average tensile strength of 32,500 lbs. per sq. in. The weakest test bar in 31 heats was 30,135 lbs. per sq. in., and the majority of the bars were within 5 per cent of the average, showing a remarkable uniformity. Ferrosteel is more than 50 per cent stronger than the ordinary run of cast iron, which rarely exceeds 19,000 lbs. tensile strength, and quite frequently runs 14,000 lbs. to 16,000 lbs.

A property of this metal which makes it very desirable in heavy fittings, is that of maintaining the close character of the grain in large sections better than cast iron. The result of this is, that while a ferrosteel test bar 1 inch square is 50 per cent stronger than a cast iron test bar of the same size, a heavy ferrosteel fitting will probably be 60 per cent stronger than a cast iron fitting made from the same pattern. The company's extra heavy ferrosteel fittings for working pressures of 250 lbs. are made from the same patterns as the cast iron, so that the full benefit of the difference in strength is obtained.

Ferrosteel fittings of 12 ins. and smaller will be tested under 1500 lbs. hydraulic pressure per sq. in., and those of 14 ins. and larger under 1000 lbs. pressure. All fittings will have cast on them: "Crane F. S.," and when tested, will have stamped on them: "tested 1500 lbs.," or "tested 1000 lbs.," according to size. The difference in price between cast iron and ferrosteel is small.

THE PERSONNEL OF THE MEXICO ELECTRIC TRAMWAYS

W. W. Wheatley, formerly manager of the railway department of the Public Service Corporation of New Jersey, who, as previously announced in the Street Railway Journal, is now general manager of the Federal District Railway Company, which operates the extensive electric traction system in Mexico City, has issued the following circular:

In order that there may be a clear understanding among all employees, concerning the responsibility and jurisdiction of the heads of the respective departments, the following order will become effective immediately:

A. J. McDonald, with the title of traffic superintendent, will have charge of the operation of all the lines of the company, with such assistants as he may appoint.

J. L. McCreary, with the title of superintendent of maintenance of way and equipment, will have charge of the various shops and of the maintenance of track, rolling stock, roadway and buildings.

H. S. Bolton, with the title of electrical engineer, will have charge of the company's power plant, and of the transmission lines and overhead work. He will be consulted by the superintendent of maintenance of way and equipment in all matters relating to bonding of track.

C. A. Malau, with the title of consulting engineer, will perform such duties as may be assigned to him.

J. C. Jackson, with the title of storekeeper, will have charge of the company's stores.

It will be understood that the above departments cover all lines of the company, irrespective of the system of traction.

The heads of each of the above-mentioned departments will report directly to the general manager.

SINGLE-PHASE EQUIPMENT FOR A PACIFIC COAST LINE

The Vallejo, Napa & Benicia Electric Railway Company, of California, has closed a contract with the Westinghouse Electric & Manufacturing Company for the electrical equipment for a single-phase electric railway. The grading is progressing between Vallejo & Napa, and the road is expected to be finished in about six months.

NEW FACTORY OF CHASE-SHAWMUT COMPANY

The new factory which the Chase-Shawmut Company has recently equipped at Newburyport, Mass., is one of the most complete of its kind in the country. The plant covers about an acre and is located on the Merrimac River, far enough out of the city proper to give plenty of air and light to the 220-odd employees. Coal for the steam plant and all raw material used in the manufacture of the company's specialties can be taken from barges within 100 ft. from the main factory building. The steam plant consists of three Hodge boilers, having an aggregate capacity of about 300-hp. The power is supplied from one 150-hp horizontal Rollins engine. The lighting plant consists of two 30-kw direct current machines, also a 30-kw alternating-current machine, used for testing purposes.

The main factory building is a four-story structure separated by fire walls, and having a depth of 350 ft. On the ground floor is the switchboard, assembly room and the motor and generator repair department, together with the heavy stock room. The second floor is devoted largely to the manufacture of switchboard parts. On this floor are also the polishing, plating and dipping rooms. The third floor is used for the manufacture of the well-known "Shawmut" soldered rail bonds and "Shawmut" indicating enclosed fuses, the output of which has been increased more than 100 per cent since the advent of the company into its new quarters. The fourth floor is employed for the storage of finished product, kept ready for shipment in standard packages. In a separate part of the building on this floor is located the wire-drawing machinery used in the manufacture of the company's tested fuse wire, which is drawn through a series of sapphire dies. In the rear of the main building and on the water front, is located the foundry, where the company makes all its castings. There are also a number of other buildings adjoining the main building, including the pattern and cabinet shop, drafting rooms, photographing and blue print rooms, laboratory, and a storehouse for raw material.

The office buildings are pleasantly located, and were constructed to enable the work to be done in the simplest and best manner. The past experience of the company in its crowded quarters in Boston led it in selecting new quarters to secure as far as possible a plant where it would be possible to manufacture complete the different specialties which it puts on the market, and with the facilities at the new factory it is apparent that the company can carry a complete line of raw material, manufacture and assemble it without the necessity of buying a piece here and there to fill in on the details.

The company is now manufacturing all kinds of open and enclosed fuses and fuse metals, switches and switchboards, flexible soldered rail bonds, conduit boxes and fittings, and is constantly adding to its lines. In addition to this material, the "Boston" cable clip is manufactured by this company.

TWO-CENT FARE ORDINANCE IN CLEVELAND

An ordinance has been introduced in the City Council of Cleveland, which will, upon its passage, grant franchises for the construction of four 2-cent fare street railway lines. It will be remembered that some months ago the city advertised for bids for the construction of street railway lines over the following routes:

Dennison Avenue, from Rhodes Avenue to the city limits; Summit Street, between Erie and Seneca; Edgewater Boulevard, between Taylor and Lake Avenue; Doan Street, between Wade Park and Ansel Avenue. The city officials and railway people in general were mystified upon the bids made by Will Christy, of Akron, Ohio, to construct street railway lines over these routes and give a 2-cent fare. Mayor Johnson declared that it was only a straw bid, but despite this claim Mr. Christy deposited with the city the required $20,000. The city holds consents for the majority of frontage over three of the routes, and the city would be bound under its policy of securing low fare roads to turn these consents over to Mr. Christy. Mayor Johnson declares tnat the introduction of the present ordinance is a ruse to recover the $20,000. The ordinance

says nothing about the city having the right to buy the property at the expiration of the franchise, which is one of Mayor Johnson's pet hobbies. A change in the ordinance to embody this point would give Mr. Christy an opportunity to recover the forfeit money. A precedent on this point was made recently when the city returned a forfeit of $5,000 deposited by another promotor of a low fare line who claimed he was unable to secure consents of property owners. Mr. Christy continues to maintain a sphinx-like silence on the subject of his plans or how he expects to make one on a city line giving a 2-cent fare.

IMPORTANT FRANCHISE BILL IN NEW YORK

One of the latest bills passed by the New York State Legislature at its last session and signed by Governor Odell practically abolishes in second class cities the necessity of having auction sales of street railway franchises. When this bill was passed it was believed by its advocates that it would benefit the cities by securing for any franchise the maximum amount of return for any new franchise. It has been found, however, that there are many other considerations to the public than the money paid for a franchise, and the bill required in some cases the award of franchises to companies under conditions detrimental to the public interests, as well as to the interests of the railway companies themselves. For this reason several street railway managers, including representatives of the State Association, spoke at the hearing in favor of the change.

In this connection it is interesting to note that the State Association is increasing in membership. Among recent new members are the United Traction Company, of Albany, and the Kingston Consolidated Traction Company. Others have applied for membership.

NO STRIKE IN SAN FRANCISCO

Information to hand as the Street Railway Journal goes to press says the threatened strike of the employees of the United Railroad, of San Francisco, has been averted by the acceptance by the union of the terms of the company submitted through Mayor Schmitz. The basis of the settlement, however, is not even intimated.

PERSONAL MENTION

MR. M. O'BRIEN has resigned as master mechanic of the Chicago City Railway to take a similar position with the St. Louis Transit Company.

MR. CLINTON B. KIDDER has resigned as manager of the Savannah Electric Company, of Savannah, Ga. He will engage in mining at Bonanza, Yukon Territory.

RICHARD H. PIERCE, of Pierce, Richardson & Neiler, engineers of Chicago, has been appointed chief engineer to take complete charge of the power plant at the Louisiana Purchase Exposition. He was consulting engineer of the Columbian Exposition and later was consulting engineer for the Chicago City Railway Company. Mr. Pierce will be assisted by Mr. Charles S. Foster, of Chicago.

MR. R. L. CHILES, of New York, has been appointed superintendent of the street railway lines of the Norfolk, Portsmouth & Newport News Company, of Portsmouth, Va. He succeeds Mr. Randolph Peyton, who resigned from the company April 1 to accept another position. Mr. Chiles is a railway man of experience, and was formerly associated with Mr. E. C. Hathaway, general manager of the local company at Portsmouth.

THE ENGAGEMENT is announced of Mr. T. E. Mitten, general manager of the International Traction Company, of Buffalo, N. Y., and Miss Ruth Bissell, of Lockport, N. Y. Mr. Mitten is very well known in street railway circles. Before his connection with the International Company he was general superintendent of the Milwaukee Electric Railway & Light Company. Miss Bissell is a talented young woman, very pretty, and with excellent musical accomplishments, acquired by study in Paris. The date of the wedding is not yet announced.

MR. BION J. ARNOLD has been appointed consulting electrical and mechanical engineer for the Illinois Tunnel Company. This company has already completed some 21 miles of subway tunnels underneath the streets of the business district of Chicago, and has installed an extensive automatic telephone service in the same district, carrying its telephone wires in the tunnels. The problem which confronts Mr. Arnold is that of planning and installing a narrow gage electric freight railway in these tunnels and arranging connections to the business buildings, freight depots, river docks, etc. It is proposed to perform a general freight collecting and distributing business, thus obviating a large portion of the teaming now greatly congesting the streets above. The necessary power stations, type of equipment, signalling and switching system, and method of conducting this transportation are all interesting factors in the problem. Mr. Arnold, it will be remembered, as municipal traction expert, recently made an extended study of the transportation problem in the downtown district of Chicago, and his report to the City Council upon that question is being followed out as the basis of a general scheme for relieving the surface congestion.

MR. JOHN I. BEGGS, president of the Milwaukee Electric Railway & Light Company, of Milwaukee, Wis., was recently presented with a beautiful silver service by officers and directors of the company, assembled at a banquet at Hotel Pfister, Milwaukee. Sixteen guests were present at the dinner, which was an informal affair tendered to Mr. Beggs. The gift was presented by Dr. Charles H. Lemon. He paid a high tribute to Mr. Beggs' ability as a manager and to the success of his work with the company. The silver service is intended as part of the equipment of a private car for Mr. Beggs. This car is being built by the St. Louis Car Company after plans and designs by Mr. Beggs, and is to be part of the St. Louis Company's exhibit at the Louisiana Purchase Exposition. The car is for use on the Milwaukee Electric Railway & Light Company's system in Milwaukee and Wisconsin, and is designed so that it may be used for touring, being provided with sleeping compartments, dining-room, kitchen, etc., at the same time having large observation compartments at each end. In general design it is as fine a specimen of the art of car building as is to be found on any steam railroad.

THE ELECTRIFICATION of the Alexandria & Ramleh Railway, described in this issue, was successfully accomplished through the efforts of three gentlemen who, although of widely differing nationalities, worked together most harmoniously in carrying out this project. His Excellency Boghos Pacha Nubar, who is chairman of the Alexandria & Ramleh Railway, was for many years on the Council of Direction of the Egyptian State Railways Administration, where he gained considerable experience in railway work. He is the son of the late Nubar Pacha Nubar, who was for many years Premier of Egypt. Mr. J. Lumbroso, who had charge of much of the routine work of the executive portion of the undertaking, proved himself eminently capable of coping with the many intricate problems which he was compelled to solve. Mr. Lumbroso is well known in Europe as a large cot-


Boghos Pacha Nubar


Nelson Graburn


J. Lumbroso

PROMINENT EGYPTIAN ELECTRIC RAILWAY OFFICIALS

ton merchant and financier. The general manager and chief engineer of the Alexandria & Ramleh Railway Company and the Alexandria Tramway Company is Mr. Nelson Graburn, M. I. E. E. He is the son of the late Captain Marmaduke Graburn, R. N., of Melton Hall, Barnaby, Lincolnshire, England. He was appointed to his present position in November, 1901, to carry out the transformation of the Alexandria & Ramleh Railway and to reorganize the Tramway Company. Mr. Graburn served an apprenticeship with the Canadian Pacific Railway as a mechanical engineer from 1881 to 1887, when he joined the Edison Illuminating Company, of Brooklyn, where he secured a practical training in electric lighting. He remained with that company until 1889, when he went to the Thomson-Houston works at Lynn, Mass., to take a student's course in electric railway work. After completing this course he was sent to Canada in the spring by the General Electric Company to look after contracts. Mr. Graburn resigned this position to join the Montreal Street Railway Company as assistant electrical engineer. In 1894 he was promoted to the position of electrical engineer and assistant superintendent. He resigned from this company in 1899 to accept a position as consulting engineer of the Compagnie Générale de Traction, of Paris.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Mar. '04	62,110	36,617	25,493	22,467	3,026
	1 " " '03	61,609	35,361	26,248	21,083	5,164
	3 " " '04	178,601	107,869	70,732	67,601	3,131
	3 " " '03	175,097	102,618	72,479	64,275	8,204
AURORA, ILL. Elgin, Aurora & Southern Traction Co.	1 m., Mar. '04	34,544	23,239	11,304	9,133	2,171
	1 " " '03	32,824	19,973	12,850	9,216	3,635
	9 " " '04	344,630	207,578	137,052	82,641	54,411
	9 " " '05	319,978	185,903	134,076	81,946	52,129
BINGHAMTON, N. Y. Binghamton Ry. Co.	1 m., Mar. '04	17,031	10,610	6,421	------	------
	1 " " '03	16,975	9,794	7,181	------	------
	9 " " '04	165,381	95,333	70,048	48,245	21,802
	9 " " '03	177,846	96,595	81 251	57,366	23,885
BUFFALO, N. Y. International Trac. Co.	1 m., Mar. '04	315,021	215,265	99,757	137,633	† 37,876
	1 " " '03	295,916	170,294	125,622	130,862	† 5,239
	9 " " '04	3 071,106	1,781,092	1,290,014	1,197,272	92,742
	9 " " '03	2,783,163	1,494,562	1,288,601	1,152,858	135,743
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co	1 m., Mar. '04	24,381	* 18,691	5,690	------	------
	10 " " '04	352,149	186,081	166,068	------	------
Chicago & Milwaukee Elec. Ry. Co.	1 m., Mar. '04	22,839	10,093	12,746	------	------
	1 " " '03	13,355	6,317	7,038	------	------
	3 " " '04	59,873	31,489	28,384	------	------
	3 " " '03	36,035	18,705	17,330	------	------
Metropolitan West Side Elevated R. R. Co	1 m., Mar. '04	189,886	------	------	------	------
	1 " " '03	180,911	------	------	------	------
	3 " " '04	536,782	------	------	------	------
	3 " " '03	524,537	------	------	------	------
Northwestern Elevated R. R. Co	1 m., Mar. '04	115,233	------	------	------	------
	1 " " '03	108,609	------	------	------	------
	3 " " '04	330,179	------	------	------	------
	3 " " '03	315,754	------	------	------	------
South Side Elevated R. R. Co.	1 m., Mar. '04	143,448	------	------	------	------
	1 " " '03	136,383	------	------	------	------
	3 " " '04	410,207	------	------	------	------
	3 " " '03	399,018	------	------	------	------
CINCINNATI, O. Cincinnati, Newport & Covington Light & Traction Co	1 m., Feb. '04	94,477	* 56,361	38,116	20,954	17,161
	1 " " '03	86,264	* 51,243	35,020	20,995	14,024
	2 " " '04	193,797	* 116,260	77,537	42,366	35,171
	2 " " '03	180,475	* 109,180	71,294	41,982	29,313
CLEVELAND, O. Cleveland & Southwestern Traction Co	1 m., Mar. '04	33,860	24,471	9,389	------	------
	1 " " '03	31,547	18,624	12,922	------	------
	3 " " '04	89,168	69,527	19,640	------	------
	3 " " '03	83,730	55,698	28,032	------	------
Cleveland, Painesville & Eastern R. R. Co	1 m. Mar. '04	14,958	9,392	5 566	------	------
	1 " " '03	14,359	8,950	5,409	------	------
	3 " " '04	38,383	27,324	11,059	------	------
	3 " " '03	38,039	24,803	13,236	------	------
COLUMBUS, O. Columbus, Buckeye Lake & Newark Traction Co	1 m., Feb. '04	9,455	8,886	569	------	------
	1 " " '03	8,717	7,490	1,227	------	------
	2 " " '04	18,862	17,206	1,656	------	------
	2 " " '03	16,046	14,521	1,525	------	------
DETROIT, MICH. Detroit United Ry	1 m., Mar. '04	334,206	* 224,396	109,810	90,315	19,495
	1 " " '03	330,668	* 795,326	135,342	82 534	52,808
	3 " " '04	933,993	* 656,428	277,565	267,669	9,896
	3 " " '03	937,495	* 568,369	369,126	244,738	124,388
DULUTH, MINN. Duluth Street Ry. Co.	1 m., Mar. '04	48,036	31,381	16,655	16,505	150
	1 " " '03	47,889	28,615	19,275	15,204	4,071
	3 " " '04	135,462	87,929	47,533	49 325	† 1,792
	3 " " '03	131,324	84,452	46,872	45,544	1,328
EAST ST. LOUIS, ILL. East St, Louis & Suburban	1 m., Mar. '04	97,033	46,902	50,131	------	------
	1 " " '03	78,015	41,046	36,969	------	------
FORT WORTH, TEX. Northern Texas Traction Co	1 m., Mar. '04	44,251	25,300	18,951	9,908	9,043
	1 " " '03	34,644	16,602	18,042	9.018	9,023
	3 " " '04	117,215	73,576	43,639	28,575	15,064
	3 " " '03	90,391	47,932	42,459	26,970	15,489
HAZLETON, PA. Lehigh Traction Co	1 m., Mar. '04	10,574	6,101	4,472	------	------
	3 " " '04	30,160	23,697	6,464	------	------
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Mar. '04	256,589	142,283	114 307	74,050	40,256
	1 " " '03	237,364	125 614	111,751	70,714	41,036
	3 " " '04	756,727	417,399	339,328	220,504	118,824
	3 " " '03	700,740	370,368	330,372	209,900	120,472
MINNEAPOLIS, MINN Twin City Rapid Transit Co	1 m., Mar. '04	343,302	164,408	178,895	90,275	88,620
	1 " " '03	319,556	*153,304	166,252	78,400	87,852
	3 " " '04	988,073	480,661	507,412	267,493	239,919
	3 " " '03	913,995	442,329	471,666	235,200	236,466
MONTREAL, QUE. Montreal St. Ry. Co	1 m., Mar. '04	184,857	148,075	36,782	19,809	16,973
	1 " " '03	171,902	118,677	53,225	18,432	34,793
	6 " " '04	1,122,680	766 334	356,346	105,598	250,748
	6 " " '03	1,017,491	652,056	365,435	100,139	265,296
MUNCIE, IND. The Muncie, Hartford & Fort Wayne Ry.	1 m., Mar. '04	12,654	* 6.797	5,857	------	------
	3 " " '04	35,501	* 20,639	14,861	------	------
OLEAN, N. Y. Olean St. Ry. Co	1 m., Mar. '04	7,365	4,337	3,029	2,452	576
	1 " " '03	6,370	3,439	2,931	2,040	891
	9 " " '04	76,031	37,110	38,920	22 069	16,852
	9 " " '03	53,626	28 581	25,045	14,129	10,917
PEEKSKILL, N. Y. Peekskill Lighting & R. R. Co.	3 m., Mar. '04	24,192	16,292	7,900	------	------
	3 " " '03	22,888	15,750	7,138	------	------
	12 " " '04	106,757	63,605	43,152	27,215	15,937
	12 " " '03	86,795	56,392	30,403	23,125	7,277
PHILADELPHIA, PA. American Railways	1 m., Mar. '04	103,622	------	------	------	------
	1 " " '03	97,566	------	------	------	------
	9 " " '04	1,048,837	------	------	------	------
	9 " " '03	909,183	------	------	------	------
ROCHESTER, N. Y. Rochester Ry. Co	1 m., Mar. '04	117,639	66,743	50,896	26,240	24,656
	1 " " '03	100,792	53,853	46,939	25,450	21,489
	3 " " '04	340,845	206,417	134,428	78,585	55.843
	3 " " '03	299,168	157,902	141,266	76,407	64,859
SAN FRANCISCO, CAL. United Railroads of San Francisco	1 m., Mar. '04	534,044	------	------	------	------
	1 " " '03	497 947	------	------	------	------
SAO PAULO, BRAZIL. Sao Paulo Tramway, Light & Power Co., Ltd	1 m., Mar. '04	127,000	45,000	82,000	------	------
	1 " " '03	110,817	33,003	77,814	------	------
	3 " " '04	368,354	122,512	245,842	------	------
	3 " " '03	312,723	95,035	217,688	------	------
SAVANNAH, GA. Savannah Electric Co.	1 m., Feb. '04	38,607	23,393	15,214	10,187	5,027
	1 " " '03	35,298	23,228	12,070	9,583	2,487
	12 " " '04	524,296	307,280	217,016	120,909	96,107
	12 " " '03	490,216	276,112	214,104	115,359	98,745
SEATTLE, WASH. Seattle Electric Co	1 m., Feb. '04	171,744	120,747	50,997	23,488	27,509
	1 " " '03	155,164	111 871	43,293	23,672	19,621
	12 " " '04	2,129,053	1,506,157	622,896	279,935	342 961
	12 " " '03	1,941,769	1,379,063	562,706	268,098	294,608
SYRACUSE, N. Y. Syracuse Rapid Transit Co	1 m., Feb. '04	63,927	40,161	23,766	20,249	3,517
	8 " " '04	556,032	322,148	233,884	162,250	71,634
	8 " " '03	495,085	273 878	221,207	152,200	69,007
TAMPA, FLORIDA. Tampa Electric Co.	1 m., Feb. '04	26,613	14,820	11,793	2,122	9,671
	1 " " '03	22,473	11,686	10,787	1,976	8,811
	12 " " '04	310,999	182,172	128,827	24,702	104,125
	12 " " '03	248,777	142,628	106,149	22,684	83,465
TERRE HAUTE, IND. Terre Haute Elec. Co.	1 m., Feb. '04	40,308	30,390	9,918	9,408	510
	1 " " '03	31,620	24,467	7,153	6,469	684
	12 " " '04	490,591	382,316	168,275	93,304	74,971
	12 " " '03	352,558	269,052	83,506	76,776	6,730
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Mar. '04	138,665	* 77,858	60,807	41,971	18,836
	1 " " '03	127,012	* 65,452	61,560	40,715	20,845
	3 " " '04	400,320	* 223,767	176,553	124,874	51,679
	3 " " '03	367,654	* 188,964	178,690	119,738	58,952
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Light Co.	1 m., Mar. '04	37,619	* 23,230	14,389	------	------
	3 " " '04	110,631	* 69,386	41,245	------	------

INDEXED

Street Railway Journal

VOL. XXIII. NEW YORK, SATURDAY, MAY 14, 1904 No. 20

PUBLISHED EVERY SATURDAY BY THE

McGRAW PUBLISHING COMPANY

MAIN OFFICE:

NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.

BRANCH OFFICES:

Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues)............................. $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Worlds' Fair Street Railway Facilities

To the street railway man no small part of the interest in any great exposition lies in the provisions made by local street railway and other transportation companies for handling the great crowds. In the last issue considerable attention was given to St. Louis Exposition matters, and this information, interesting in itself, is now completed by the outline which is presented elsewhere of the plans of the local transportation companies for carrying people to and from the Exposition. Inasmuch as many laymen have asked frequently whether the street railway companies of St. Louis will be able to take care of the great Exposition crowds, it is in order to recall some statements made in an informal talk by C. A. Moreno, chief engineer of the St. Louis Transit Company, before the Engineers' Club of St. Louis a few weeks ago, in which he truthfully said that if the Louisiana Purchase Exposition had anywhere near as many visitors as the transportation companies would be prepared to land at its gates, it would be the greatest financial success as an exposition the world has ever known.

That the street railway companies will be able to easily deliver as many people to the Exposition gates as will wish to go can hardly be doubted when the extent of the preparations made by the local companies is known. The number of terminal loops and the number of routes reaching the Exposition grounds from all parts of the city assure abundant carrying capacity for any ordinary occasion. To be sure, there will always be at an exposition certain times when the entire crowd in the grounds will move toward the street railway terminals at once in an effort to get home. Against a certain amount of congestion at such times no power on earth can guard. Such congestion is more likely to occur during the first month or two of an exposition than toward the latter part of the exposition, even though the total number of admissions per day is much greater toward the close of the season.

For example, one of the most trying times for the transportation companies at the World's Columbian Exposition, at Chicago, was on the night of July 4, after the fireworks. The abundance of transportation facilities which had never before that been taxed, led the public to believe that every one could get home at any time desired on a moment's notice, and an immense crowd remained within the grounds until after the fireworks, and then moved en masse toward the transportation lines. The greatest difficulty occurred two or more hours after the rush began, when the crowd reached the down-town district, and desired to take cars for points on the North Side and West Side. The street railway managers had hardly expected a rush-hour demand for cars at 1 a. m., but they responded as promptly as was possible under the cicumstances. Even the companies which directly reached the Fair Grounds did not anticipate any such long-continued rush. The public and the Exposition management learned its lesson thus early in the game, and later much greater crowds were handled per day with less friction, partly because the public knew that everybody could not start for home at once and hope to get there within reasonable time, and partly because the Exposition management did not again arrange matters so as to produce such congestion at one time. One other day during the Chicago Exposition, "Chicago Day," taxed the Exposition lines to their utmost from one end of the day to the other, but this was practically a single exception.

The terminals at St. Louis appear to have been arranged to admit of great flexibility, which is always desirable in handling exposition crowds. It is extremely difficult to tell before an exposition opens which entrance to the grounds will prove the most popular, and ability to operate cars from a given route to any one of several terminals, such as has been provided at St. Louis, is very desirable. Then, too, there are times when one exit will receive more than its ordinary share. If additional cars can be routed by that exit it is a great aid in handling the crowds. As regards a number of details the

plans of terminals seem to have wisely been left open to alteration and to any small changes that may seem desirable in the light of the experience of the first month. It would be contrary to all precedent if the first month's attendance was large enough to demand full completion of all details of the terminals, and there is certainly wisdom in going a little slow in completing final arrangements.

"Opening Day" Traffic in St. Louis

It is seldom that the companies handling traffic on any great day of an exposition receive such commendation as did the street railway companies of St. Louis upon the opening day of the Louisiana Purchase Exposition. Grave fears had been expressed by many people unacquainted with the extent of the preparations that had been made, lest the transportation facilities should be shown to be entirely inadequate. The judgment of the public was, perhaps, formed from experiences on Dedication Day a year ago, when so little provision had been made for handling large crowds to and from the grounds. Now that the construction period is over with and the companies have practically completed their plans for handling large traffic from all directions to and from the grounds, both the companies and the Exposition management, as well as the public, are very much gratified to find how easily such crowds as those of the opening day were handled. The companies were on trial, and withstood the test successfully. There appears to be nothing but praise from the press and the public for the way in which crowds were handled that day, which means that the service must have been most excellent, for it is seldom that either press or public goes out of its way to praise good service, however quick they may be to condemn poor service. Of course, much larger crowds than on opening day will be handled before the Exposition closes, but to withstand the first test so well before the machinery of transportation has had time to get thoroughly limbered up, is something regarding which the St. Louis companies are to be congratulated.

Traffic Peaks on Elevated and Surface Lines

The outline which is published elsewhere on the plans for increase in capacity on the Metropolitan West Side Elevated Railway system in Chicago, serve to bring to mind forcibly the fact that the elevated or underground road is pre-eminently the road for rush-hour traffic. An elevated system in a large city is sure to have a much greater rush-hour traffic in proportion to the mid-day traffic than the surface street railway lines operating through the same territory. The Metropolitan Elevated, of Chicago, figures, as given, show three times as many cars in operation during the evening rush than during the day, and even greater increase in train service is made by steam railroads giving suburban service. These facts simply mean that business people take the most rapid means of transportation, even if it involves considerable walking. Many people, shut up in offices all day, do not mind this extra walk, and the saving in time in the course of a year may be considerable by taking the fastest line. Rush-hour traffic is much of it likely to be long-haul traffic. The mid-day traffic, on the other hand, has a considerable number of short-distance riders. Shoppers, who take the cars during the middle of the day, care more for saving a walk of a few blocks and climbing elevated stairs than for any gain in time, hence they take the surface lines. The same is true of those traveling but a short distance along the street railway lines.

The tremendous increase in elevated traffic during the rush hours in some respects makes the load of an elevated railway power station like that on an electric lighting station, in that a large amount of machinery must be kept idle during the greater part of the twenty-four hours in order to take care of the peak loads. This high peak load is the cause of the recent decision of the Metropolitan management to install two storage batteries to help take care of the peak load. Other elevated roads have adopted the storage battery with the object of reducing the momentary fluctuations. These fluctuations on a system as large as the Metropolitan are not, however, great as compared to the total load, and the larger the system becomes the less marked are these momentary fluctuations. The function of the storage battery, therefore, in this case is primarily that of assisting at the peak load. Being located at points some distance from the car house, the line loss during the peak, when such loss can be least afforded, is much less than if the total load was being carried from one power station.

An Important Test of the Curtis Steam Turbine

The paper by W. L. R. Emmet before the Engineers' Club of Philadelphia upon recent developments of the steam turbine, of which a digest appears elsewhere in this issue, gives a report of one of the most important tests that has yet been made upon the steam turbine. The tests were conducted with great care by experts who were disinterested in the results, and it is probable that the results were secured with the greatest possible accuracy. The figures shown for the 500-kw turbine, operating with a steam consumption of only 22.38 lbs. per kilowatt-hour during a rapidly and widely fluctuating load, averaging at half its rated capacity are remarkable. The ability of the turbine to take care of such rapidly varying loads as those met in street railway service is very gratifying, as is also the ease with which close speed regulation is obtained; during the above mentioned test the turbine's speed did not vary more than 50 r. p. m., ranging from 1800 r. p. m. to 1850 r. p. m., while the load was varying all the way from 50 kw to 300 kw. As the diagrams which accompany the article show in an interesting way how the efficiency of the turbine is affected by superheat, by speed and how it varies with the load, they will not be referred to in detail here. In this connection, however, it is of interest to note that the result of the use of superheated steam is to increase the economy of the turbine's operation in direct proportion to the amount of superheat, a rise of superheat of 50 degs. F. effecting a saving of nearly 1½ lbs. of steam per kilowatt-hour at almost any point throughout the superheat range. On the other hand, equally as remarkable is the result of decreasing the speed, which causes a rapid decrease of economy.

An important advantage of power generation by the steam turbine which, while not new, was clearly brought out in Mr. Emmet's paper, is the possibility of returning the condensation directly from the condenser to the boiler and the consequent saving of the contained heat. It is rarely, if ever, possible in power plant practice to save the water discharged from the condenser for use over again in the boilers on account of the oil contained in it, which is taken from the engine cylinders. Many attempts have been made to solve this difficulty, as it would permit a large portion of the latent heat of the water otherwise wasted to be saved, and even of greater value, in many districts where bad feed waters are found, would be the benefits of returning the distilled water to the boilers; untold troubles with the boilers would thereby be avoided which in many places would effect great savings in repair bills. But only in rare cases can this be accomplished; indeed, so rarely is it done that it may rightly be called unusual practice.

In the use of the Curtis steam turbine at Newport, by the use of surface condensers, all of the water of condensation is saved and returned directly to the boilers entirely without the necessity of treatment for removal of the oil. The lubrication of the bearings of the moving parts of the turbines is effected in such a manner as not to bring the steam in contact with oil during its passage through the turbine, with the result that the condensation leaves the turbines absolutely pure. This makes ideal boiler feed for the boilers, as it may be used over and over again without danger of trouble in the boilers; this is of more than usual importance at Newport on account of the bad water conditions which are met at that city.

This is a feature of operation with the turbine which should receive the careful consideration of power plant engineers in future designs, as the result of this feasibility to return water of condensation directly to the boilers, and saving the large amount of heat which would otherwise be wasted, has the effect of increasing the efficiency of the turbines. This would, in fact, permit steam turbines to be used with economy if their efficiencies of operation were considerably less than that of the steam engine; the comparatively high efficiency of the steam turbine, however, makes its use of unusual advantage and importance when this favorable feature permitting continued use of the water of condensation and its beneficial effect upon the boilers is taken into consideration. Its many other advantages are, of course, well known, but this is one which will be liable to bring it into very general use where circulating water is available, permitting the use of condensers, so the full benefits of this feature may be obtained.

The New York Central Plan for Through Car Operation

Considerable discussion has taken place in engineering circles regarding the radical difference between the plans of the New York Central and Pennsylvania Railroads, so far as they have been announced, for the electrical equipment of their New York terminals. It will be remembered that while the Pennsylvania Railroad is planning to introduce electric locomotives for hauling its through trains into New York City the use of electricity by that company, for the present at least, will be restricted to a zone 4 miles or 5 miles adjacent to the New York station. The New York Central Railroad, on the other hand, is not only proposing to use electric locomotives for its New York City service proper but has decided upon the adoption of electricity as a motive power exclusively for the operation of both suburban and through passenger trains from New York City to Croton, on the Hudson River division, and to White Plains, on the Harlem division, located respectively about 34 miles and 22 miles from the New York terminal. While all traffic engineers who have given close attention to the relative advantages of steam and electricity for suburban service have recognized the desirability of operating the suburban service as far as these points by electric power, some of them have expressed surprise at the decision to extend the electric locomotive operation beyond some point at or near Mott Haven. A careful consideration, however, of the situation in which the railroad is placed will, we believe, be convincing that the decision was a wise one.

The problem before the engineers and directors of the New York Central Railroad naturally resolved itself into two questions, first, that relating to the suburban service, and, second, that in regard to the through train service. Considering the former first, the two limits selected include practically all of the territory along the lines available for the development of commuter traffic. As the use of electricity south of the Harlem River was obligatory, the loss of time and danger of congestion which would be caused by a change of motive power on suburban trains if the electric zone extended only to Mott Haven, constituted, we believe, the principal reasons for deciding upon a uniform system within the commuter territory. Again, the opportunities for increasing the traffic due to the recognized advantages of electricity, such as smaller units, frequent service, greater speed, and freedom from smoke, cinders, noise and gas, must have appealed with great force in view of the natural advantages for residential purposes which the territory directly north of New York City possesses. This district is the only one in the neighborhood of the metropolis which is as yet connected to it by an all-rail route; but, as yet, it has not been penetrated by competitive rapid transit lines. Viewing the situation broadly, therefore, it was a question, so far as this suburban business was concerned, whether the New York Central Railroad Company, in making a change, would make the strongest appeal to commuter traffic which the science of transportation can at present suggest, or whether it would continue its present steam service up to a point near the Harlem River, and thus largely nullify any advantages which might accrue from a change of motive power south of that point.

While these arguments apply to the suburban business of the company they do not necessarily concern the through train service, and while one change was contingent to a certain extent upon the other, yet the two services are by no means governed entirely by the same considerations. We must assume, however, that the directors of the company considered not only present but future conditions. For instance, the existing statute requires the change of motive power only for that section of the road south of the Harlem River. But with the installation of an electrical suburban service the force of public opinion might soon require the abolition of steam locomotives within the city limits, which would mean as far north on the two divisions as Yonkers and Mt. Vernon. But whether this should be so or not, a change from steam to electricity on the through trains at any point south of the suburban electrical terminal would involve the maintenance of three electrical and steam terminals with their extensive equipment and force of men as well as the undesirability of operating a steam passenger service with its attendant annoyances of steam, gas, cinders and noise alongside of the electrified suburban service. Again, the land required for a third terminal would be considerable, and its cost at a point such as Highbridge or Woodlawn, or even a short distance north of these points, would be large even if the topography of the land at these points was suitable for an adequate site for a terminal, which it is not. The logical solution, therefore, of the problem seemed to be a change for the through trains from steam to electricity at the edge of the suburban electrical zone, and while this change involves a large expense to the railroad company in the way of electrical apparatus, we believe it to be entirely warranted by the situation.

The Pennsylvania Railroad conditions are quite different, as the meadows in the neighborhood of Newark afford ample area for electrical and steam terminals, and as the commuter traffic on the Pennsylvania Railroad is comparatively small. We expect, however, before very long, to take up the consideration of the situation on this road. There is certainly no more interesting transportation problem in the world to-day and no more important work of this kind being carried out than that which involves the entrance into New York City of the two largest trunk lines in this country.

SOME FEATURES OF THE EAST ST. LOUIS & SUBURBAN RAILWAY

Many are not aware that there exists across the river from St. Louis, in East St. Louis and surrounding country, a large city and interurban electric railway system comprising over 120 miles of track. Besides the city lines in East St. Louis there is a line as far as Edwardsville by way of Collinsville, two lines to Belleville, a branch of the Belleville line to O'Fallon and Lebanon, and a cross-connecting line between Edgemont and Collinsville. Of the two lines from East St. Louis to Belleville, one is a double-track passenger line running over an old and well-settled turnpike. Paralleling it a short distance to the south is a line on a private right of way, which is now used entirely for freight.

FIG. 1.—EMBLEM OF SYSTEM

These two lines were originally built as competing lines, but consolidations have brought them under the control of one company. The freight business is carried on under the name of the East St. Louis & Belleville Electric Railway Company, and consists mainly of the hauling of coal from numerous coal mines along the way. The coal cars of the East St. Louis & Belleville Electric Railway Company, Fig. 2, are to be seen within parts of St. Louis delivering coal to manufacturers there. This freight business is hauled and delivered by steam roads by two electric locomotives, one of which is shown in Fig. 3. These locomotives weigh 50 tons each, and are equipped with four 160-hp motors. They will haul about twenty-five loaded coal cars.

Unfortunately, part of the East St. Louis & Suburban Railway Company's system is 4-ft. 10-in. gage, and part standard gage. The freight line is, of course, standard gage. The balance of the system is 4-ft. 10-in. gage, except that from Edgemont to Lebanon. The latter is standard gage, and, consequently, a transfer of passengers is necessary at Edgemont. Besides the electric passenger service given between Edgemont and Lebanon, a steam locomotive is used for freight, steam being used in this case because it is not considered advisable to invest sufficient money in feeders to operate the freight traffic on this division of the system electrically.

ADVERTISING

This company gives a great deal of attention to advertising, as the management considers that it is in a position where advertising can be made to yield large returns. The system being located as it is, across the river from such a large city as St. Louis, can naturally look to St. Louis for a large amount of pleasure traffic, if proper steps are taken to secure it and take care of it. It is only by vigorous advertising that the many attractive pleasure trips which the East Side offers can be brought to the attention of many people in St. Louis. Pleasure riding on the "Great East Side System," as it is commonly advertised, must depend very largely upon the amount of traffic that can be obtained from St. Louis and the familiarity of the pleasure-riding public in St. Louis with the East Side system. A number of excellent ideas in advertising can be obtained from this company's work. The company has a regular passenger and excursion agent in the person of F. H. Thomas, who gives a great deal of attention to working up both regular pleasure traffic and special excursions. The company has a regular badge or trade mark which appears on all of its advertising, which is shown at the beginning of this article. This also is put on all the company's rolling stock, and serves to give an identity to the East Side system and to attract attention to it. Another excellent idea is the map, Fig. 4, which is published on some of the company's advertising matter, and which gives at a glance the fare between different points on the line. This general idea could be copied by many other interurban railway companies. The prospective passenger does not have to hunt through a long rate schedule to find out the fare between any two points. The map does not pretend to be geographically correct, but it shows the principal towns on the line and the general direction. Another map, Fig. 5, is to be used the coming summer extensively on advertising matter, with the idea of diverting some of the traffic which would otherwise cross the Eads Bridge on the steam railroads, and go into the Union Depot. All the steam trains which enter St. Louis by way of the Eads Bridge, which is also the bridge by which the East St. Louis & Suburban cars enter St. Louis, stop at what is known as the Relay Depot, in East St. Louis, where the locomotives belonging to the various steam roads are changed for the switching locomotives of the Merchants' Bridge & Terminal Association, which takes the trains across the bridge and into the St. Louis Union Station. As there is likely to be considerable delay in the Relay Depot and the Union Station in St. Louis this is some advantage to many passengers in leaving the steam trains at the Relay Depot at

FIG. 3.—ELECTRIC LOCOMOTIVE OF EAST ST. LOUIS & SUBURBAN RAILWAY COMPANY

East St. Louis, where they can take an electric car, which will carry them across the Eads Bridge, landing them at the foot of Washington Avenue, in St. Louis, at the end of the bridge. This is directly at an important terminal loop of the St. Louis Transit Company, where cars can be secured for the World's Fair Grounds or for any other point in the city. The passenger taking this route will have the advantage of boarding almost empty cars at the Washington Avenue loop in St. Louis. These facts are all being brought out in printed matter now being distributed by the company, and the accompanying map showing this is being used in this connection. There are also some other local depots of steam lines in St. Louis which are reached by this route, as seen.

There are ten steam roads converging at East St. Louis, and the company will bill all Illinois towns within 190 miles of East St. Louis on these ten roads with posters calling attention to the East Side electric railway system and the assistance it can be in reaching the Fair. It is also expected that since the Fair will be closed on Sundays, a great many visitors can be attracted to take interurban trips on Sundays during the Fair. The interurban lines of the company offer some very attractive trips. Belleville, Fig. 7, is one of the oldest settlements in the State, and the trip from St. Louis to Belleville is described by Charles Dickens in his "American Notes." Dickens made the trip in 1842, when the transportation facilities were hardly equal to those of the present day. One of the publications of the company is a handsomely illustrated pamphlet, entitled "Charles Dickens' Trip to Belleville in 1842, and How the Trip May Be Made To-day."

FIG. 2.—TRAIN OF COAL CARS BEING HAULED BY ELECTRIC LOCOMOTIVE

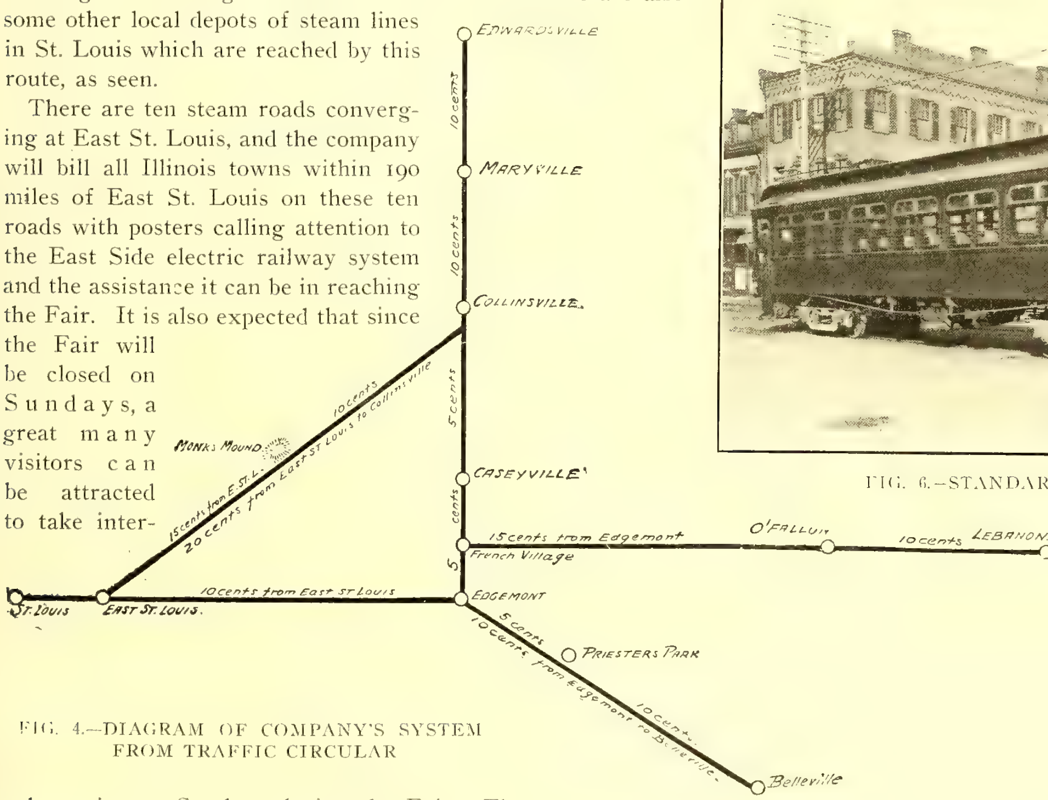


FIG. 4.—DIAGRAM OF COMPANY'S SYSTEM FROM TRAFFIC CIRCULAR

Another decided attraction on this company's lines is Monk's Mound, between East St. Louis and Collinsville. This mound is the largest one of a group of mounds thrown up in that vicinity by the mound builders of pre-historic times. These mounds are of much interest, not only to anthropologists and archæologists, but to the general public, and are well worth the trip from St. Louis. They are probably the best and most accessible examples of the mound builders' work to be found in

FIG. 6.—STANDARD CAR OF COMPANY

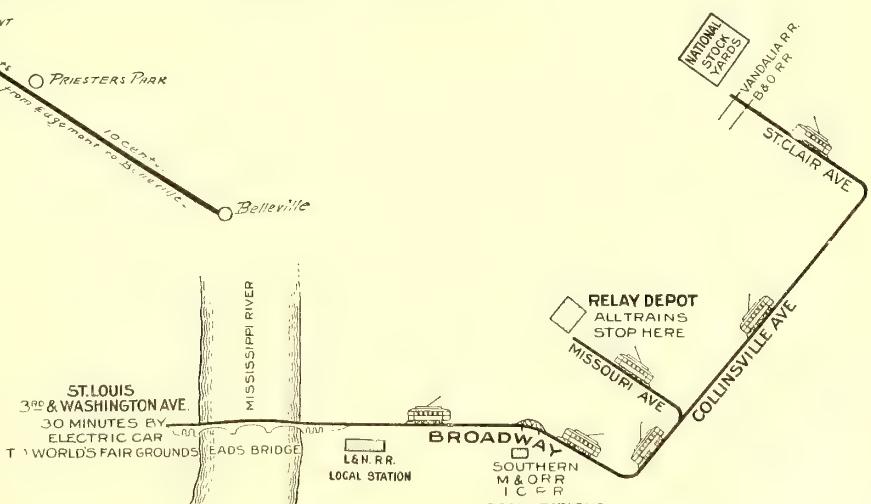


FIG. 5.—DIAGRAM FROM TRAFFIC CIRCULAR.

the United States. They rise up out of the level of the river bottom, appearing much as some glacier deposits or the remains of former river bluffs, but upon approaching nearer it is seen that there is a symmetry, both in the shape of the mound and

FIG. 7.—VIEW IN THE CITY OF BELLEVILLE

in the location of the mounds with reference to each other, showing, beyond doubt, that they were thrown up by man, even if further evidence were not available. The company distributes a vest pocket guide, 3 ins. x 4½ ins., containing, besides the covers and the map, twenty-four pages of reading matter and half-tone illustrations. The map used is that reproduced in Fig. 4. Some of the pages are given up entirely to illustrations of attractive scenes along the line. Other pages to particular points of interest and information as to the rates of fare. Much attention is given to working up private car parties. A reduction of one-third from the regular rates of fares from East St. Louis and points on the suburban lines is made to parties of ten or more traveling on one ticket on the regular cars. This enables private picnic parties to enjoy a day's outing at small cost. These special rates are not good on Sundays or holidays, as the regular traffic on these days is all the company can care

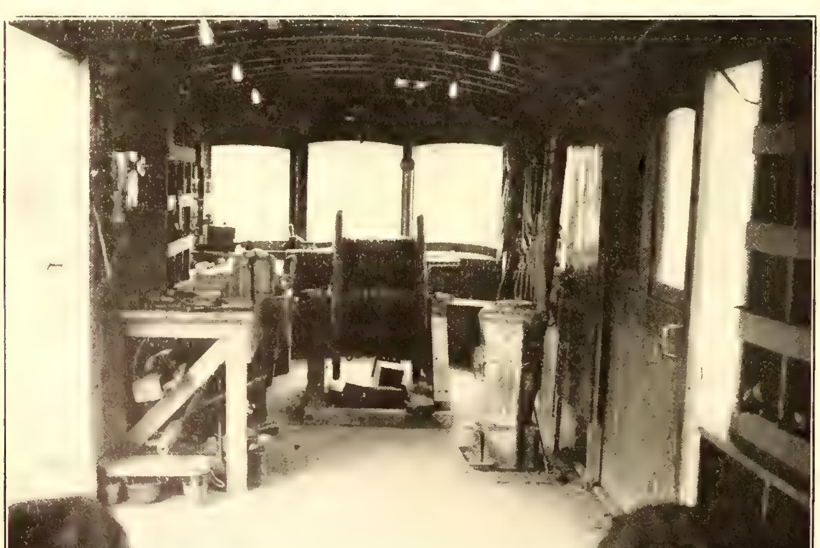


FIG. 8.—INTERIOR OF TOWER CAR

for without extra inducement in the way of low fares. The management is of the wide-awake kind, that realizes the possibilities of the property, and is taking energetic steps to live up to its opportunities.

ROAD AND EQUIPMENT

The company's equipment, including new cars purchased for World's Fair traffic, includes twenty interurban cars of the type shown in Fig. 6, which are 51 ft. over all, 4-ft. 10-in. gage, 33-in. wheels, St. Louis bodies and trucks and four G. E.-57 motors with K-14 controllers. One of these cars is shown herewith. Besides this there are seven other interurban cars with four G. E.-1000 motors; thirty city street cars with 26-ft. bodies, two Brill convertible cars, and ten twelve-bench open cars, built by the American Car Company, with Brill 27-G trucks and two G. E.-57 motors. There are also eight short single-truck cars for local service in Belleville and other short lines. The

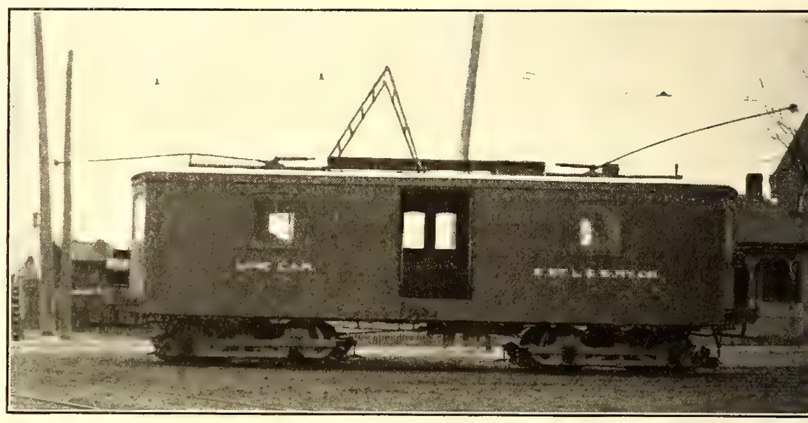


FIG. 9.—TOWER CAR

company has 600 coal cars like those shown in Fig. 2. Power is all supplied from one main power station at Winstanley Park, at the edge of East St. Louis, near the end of the St. Louis & Belleville freight line. The current is transmitted at 13,000 volts to the substations on the interurban lines. Direct-current generators supply the East St. Louis local lines.

The power station is equipped with simple non-condensing engines, as Lichter & Jens, consulting engineers, figured that coal was so cheap that the saving by condensing would not pay interest and maintenance on the extra cost of a compound condensing station with the necessary cooling towers or ponds. The consulting engineers calculated that unless the cost of coal was above 85 cents there would be nothing gained by putting in condensing apparatus, and as the company operates a coal road, it was not thought likely that the cost of coal would ever exceed this figure. It has been found advisable, however, not to burn the cheapest grade of slack obtainable, on account of the large amount of slate dust in with the slack, which is likely to interfere with keeping up steam. Sub-stations, three in number, are located near Edgemont, at O'Fallon, and about one-third of the distance between Collinsville and Edwardsville. Aluminum high-tension transmission

line and direct-current feeders are employed. High-tension lines, Fig. 10, are mounted on Knowles type-G glass insulators. High-tension aluminum cables are partly 104,000 circ. mil and partly 66,000 circ. mil. The direct-current aluminum are 790,000 circ. mil. In maintaining the line and stringing new wire a very complete line car is used, exterior and interior views of which are shown herewith, Figs. 8 and 9. This line car has a reel in each end of the car, each reel has a brake within reach of the motorman, so the motorman can run the car and keep the tension on the wire as the car moves along. The car is arranged for stringing the wire live, so that the reel and brake handle are insulated, and current is taken by the trolley wheel from the wire as it is reeled over the ladder. One reel carries figure 8 No. 00, and the other figure 8 No. 000 wire. Along the sides of the car are bins for all of the different kinds of line material used, and there is also a work bench, as shown. The car is equipped with tools both for emergency and regular electric construction work, and has an equipment of four G. E.-1000 motors. The line construction and maintenance is under the charge of R. W. Bailey.

REPAIR SHOP KINKS

The shops and main car house are within the power house at

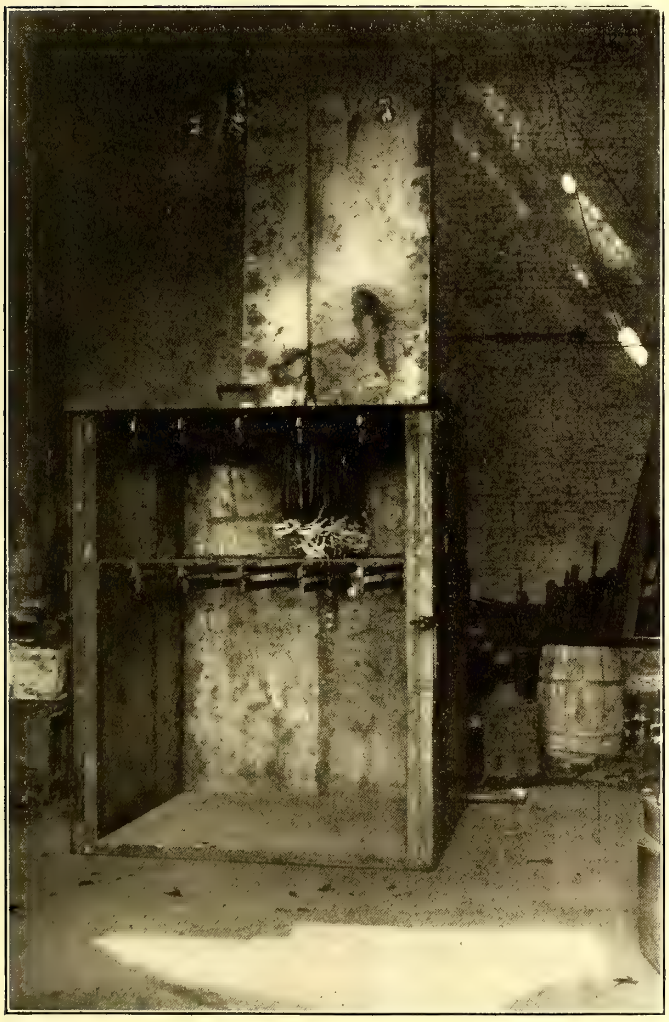


FIG. 11.—BAKING OVEN. COILS INSERTED

Winstanley Park. The master mechanic is Jos. Kuen. The general arrangement of this shop can be seen from the accompanying cut, Fig. 17. There are several tracks with brick-lined pits adjoining a machine shop. The whole shop has concrete floor. Back of the machine shop and separated by a brick wall are the blacksmith shop, store room and armature room. The paint and carpenter shops are in another adjoining portion of the building. For hoisting the motors out of the pits a compressed air hoist and swiveling crane, as seen in the engraving, is used. Compressed air is furnished by a motor-driven compressor of the type furnished by the General Electric Company for electric locomotives. The Monarch air drill is used for

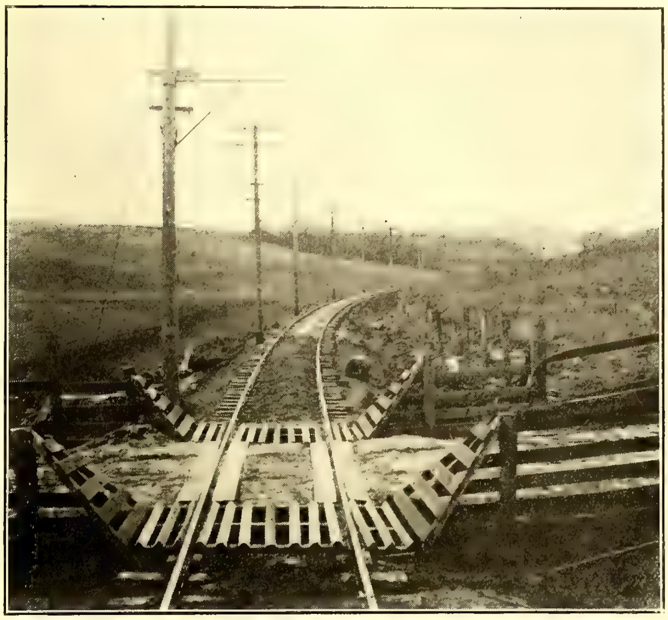


FIG. 10.—SECTION OF TRACK SHOWING HIGH TENSION LINES

drilling wherever the work cannot be brought to a drill press. Soldering irons are heated by gas. The machine tools are all modern, designed for heavy work. Among the larger tools is a wheel press, a boring mill for car wheels and a milling machine. A bolt cutter has been installed for working over old bolts. A Murphy wheel grinder has been put in for grinding wheels without taking them off the trucks. The company

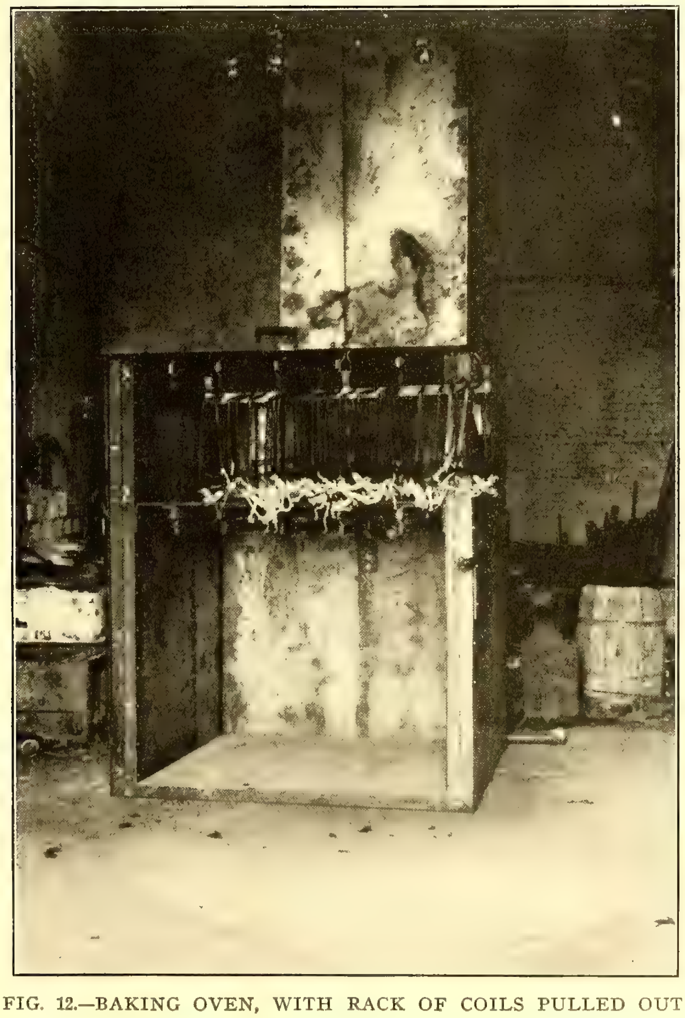


FIG. 12.—BAKING OVEN, WITH RACK OF COILS PULLED OUT

winds its own armature coils, and has forms for each type of coil. The armature winding machine is arranged so that any one of the different forms can be placed on its spindle so that

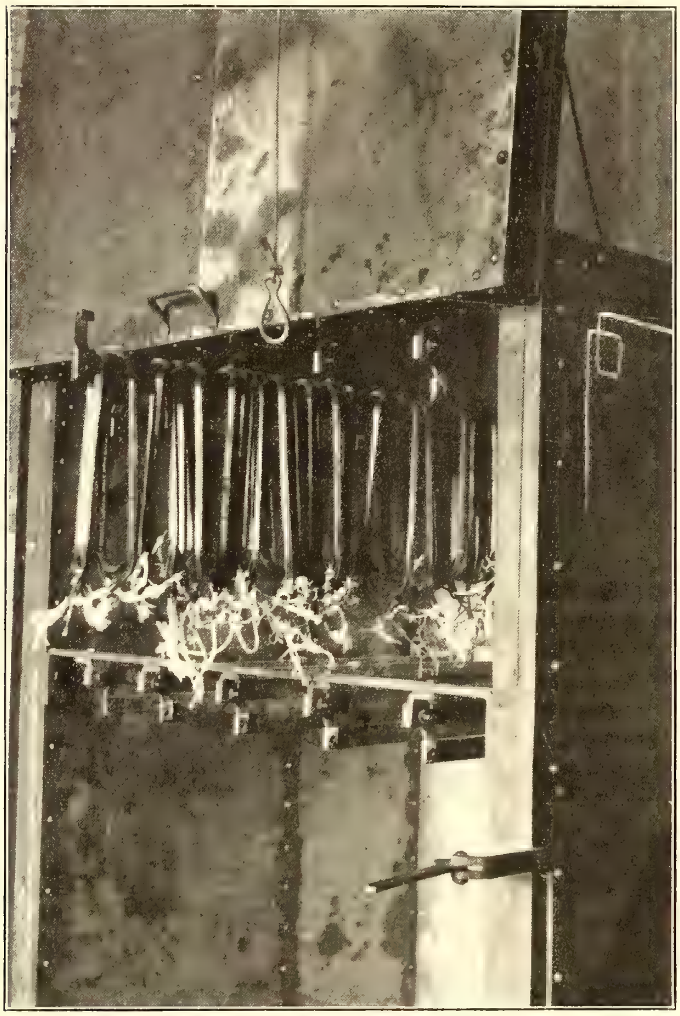


FIG. 13.—BAKING OVEN, WITH RACK PARTLY PULLED OUT

there need be only one stand and driving mechanism for winding any of the coils. In a small shop of this kind there is not enough work on any one coil to make it advisable to put in a complete winding machine for each type of coil. This coil-winding machine is driven by a small electric motor, the speed

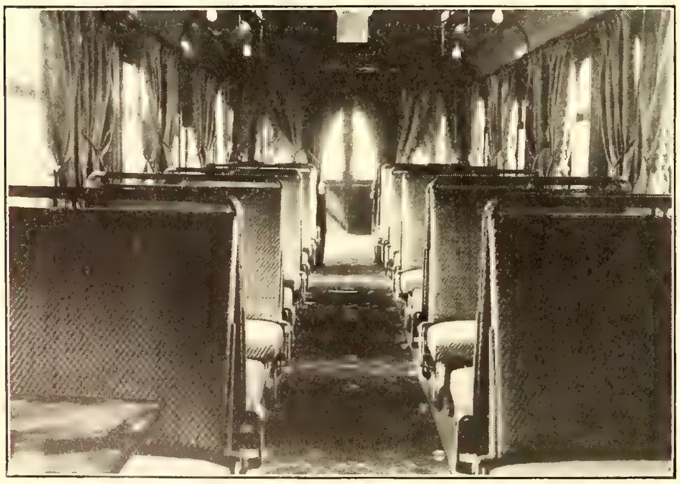


FIG. 14.—INTERIOR OF REGULAR CAR ARRANGED FOR PRIVATE PARTIES

of which can be varied and connection is made with the spindle on which the form is placed by means of a friction clutch. A baking oven for baking out armature coils is shown in three of the accompanying engravings, Figs. 11, 12 and 13. This oven is made of double thickness of sheet-iron. The novelty about it is the arrangement of racks for getting armature coils in and out of the oven. In Fig. 11 a rack full of coils is seen shoved back into the oven. In Fig. 12 the rack has been pulled entirely out and is hung from the ceiling on a ring provided for that purpose, which is in front of the oven. The rack has three hooks, which hook over the tracks in the oven, consequently it is easy to slide the rack in and out, and it can be handled easily with the assistance of the ring suspended from the ceiling. If desired, the rack can be carried to any other point in the shop for loading and unloading. In Fig. 13 the rack is half-out, almost ready to hook to a traveler or other hook.

FIG. 15

Oil lubrication is being adopted for the motors as a substitute for grease formerly used. The lubricator is in a form designed by Chas. E. Hott, master mechanic of the Columbus Railway & Lighting Company, of Columbus, Ohio, and adopted by Mr. Kuen after a visit to those shops. The lubricator consists of a cast-iron box, Fig. 15, which fits into the grease box of the motor. In the bottom of this cast-iron box is a hole, which is tapped with threads so that the plug, Fig. 16, screws into it. The cross-section of the box is shown in Fig. 18, which gives the dimensions. The

FIG. 16

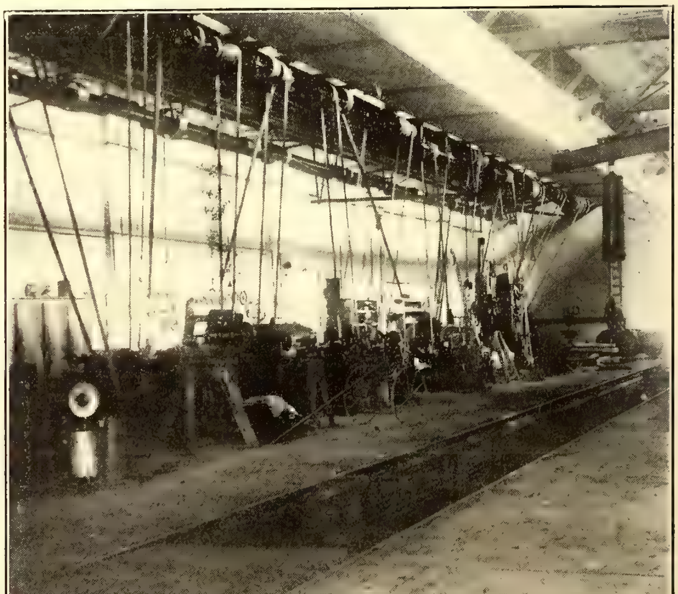


FIG. 17.—INTERIOR OF REPAIR SHOP

plug which screws into the bottom of the box has a hole drilled through it lengthwise and two holes drilled crosswise, through which latter wool waste is drawn, as seen in Fig. 16. This wool waste draws up the oil by capillary attraction, and it runs

down the hole through the center of the brass plug to lubricate the motor.

The shop number system is used in this shop, each piece of work being given a shop number, all men reporting the number of hours' work spent on different shop orders each day. Thus the labor cost of different operations can be readily determined.

OPERATION AND MANAGEMENT

The operation of the road is under the supervision of division superintendents, one for the city lines and one for the interurban lines. The operating headquarters in which men report for runs are at the large car houses at Winstanley Park. At this place the employees have comfortable rooms fitted up for their use, together with shower baths and lockers. The ordinary schedule calls for the operation of thirty-five city cars in East St. Louis, eight interurban cars between East St. Louis and Belleville (where a 15-minute service is given), four local cars in Belleville, three interurban cars between East St. Louis and Edwardsville, two operating to Collinsville by way of Edgemont, and two operating between Edgemont and Lebanon, making connection with the cars which operate between Collinsville and East St. Louis by way of Edgemont. The entire operation of the road is in charge of J. M. Bramlette, general superintendent.

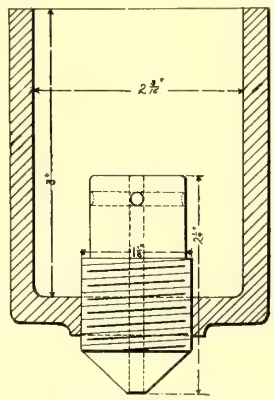


FIG. 18.—SECTION OF OIL BOX

TRACK IMPROVEMENTS IN BROOKLYN

The Brooklyn Rapid Transit Company has recently closed a contract with the Lorain Steel Company for the electric welding of track joints upon several sections of its lines. A large amount of their track is wearing into such bad condition at joints that an extensive relaying with new rail seemed absolutely necessary this spring, but electric welding is to be used in overhauling, and will, to a large extent, obviate the necessity of relaying. The Lorain Steel Company proposes to place almost all of this track in good condition by raising and electrically welding the joints, which it is claimed will more than double the life of the present rails—something that can, probably, be done in no other way.

The welding method that will be used is the improved system of the Lorain Steel Company, which was described fully in an article upon page 519 of our Sept. 12, 1903, issue. This method permits of raising the joints as much as desired, with the assurance of ample stiffness for strength. In this way it is possible to refit for service many stretches of track that are so badly worn at joints as to otherwise require relaying, although the rail itself is in such cases universally good for a large amount of additional wear. It is intended in this work to raise the receiving rail slightly higher than the other, and then, after welding, grind out the uneven surface resulting to a smooth surface; this tends to take out the battered condition and rounding end of the receiving rail resulting from the wear. Also, the Lorain Steel Company states that it is its practice not to grind the fin or projection on the face of the rail which is caused by the welding process entirely off as, if a slight portion of the projection is left and allowed to wear down by the wheel action of the passing cars, it soon smoothes out and makes a firmer and smoother surface in the end.

It will be remembered that in 1898, some 9 miles of track on the Fifth Avenue and Marcy Avenue lines of the Nassau Electric Railway Company, now a part of the Brooklyn Rapid Transit Company, was electrically welded by the Lorain Steel Company. The remarkably good results that were obtained from this work did much to induce the company to extend the welding work upon its present system. Of the entire 9 miles of track welded at that time only eight joints broke in the first year, and since that time there has been scarcely a break or any trouble whatever experienced with these electrically-welded sections of track. It is found that the track maintenance is very easy and attended by much less expense with the electrical welding, and the effect of the continuous smoothness of the rail upon the rolling stock is extremely favorable.

The Brooklyn Rapid Transit Company is also about to make a trial of the Nichols zinc-weld rail-joint on some new track which they are about to lay this spring. This joint, as here used, will be a duplicate of the zinc-weld joint which is in extensive use by the Philadelphia Rapid Transit Company, as described on page 523 of our issue of April 2. The installation of the zinc joints will also be made by the Lorain Steel Company, who will act as sub-contractor for H. B. Nichols, of the Philadelphia Rapid Transit Company, the inventor of this joint. It is not intended to use the zinc-weld joint upon any of the old track repair work, preference being given for it upon the new work. This will be an important and valuable test of the zinc-weld joint for continuous track work, and will be watched with interest by those interested in track maintenance.

TRANSFERS IN EUROPE

The following table gives statistics of the fares charged on a number of the principal street railways in Europe, whether transfers are issued, and the charge for them, if any is made, the maximum fare charged, and whether the road is under municipal or private management. The table is made up from information supplied by the roads themselves to the secretary of the International Street Railway Association, and will form the basis of a paper to be presented to that association at the Vienna meeting, to be held Sept. 11-15, 1904:

	Fare per Zone	Minimum Fare	Charge for Transfers	Required by law	Maximum Fares	Private or Municipal Road
Aachen	5 pf.	10 pf.	free	no	50 pf.	Private
Berlin-Grosse	uniform	" "	no transfers	no	10 "	"
" Licht'f'de	5 pf.	10 "	free	no	20 "	"
Brussels	5 cent'm	10 cent'm	5 and 10 cent'm	yes	15 cent'm	"
Crefeld	5 pf.	10 pf.	free	yes	15 pf.	"
Dessau	5 pf.	10 "	free	no	------	"
Dresden Tramways	5 pf.	10 "	free and 5 pf.	------	25 pf.	"
Dresden Company	uniform	10 "	5 pf.	yes	------	"
Barmen-Elberfeld	uniform	10 "	free	no	10 pf.	"
Erfurt	uniform	10 "	free	no	10 "	"
Frankfurt	5 pf.	10 "	free	no	20 "	Municipal
Hamm	uniform	10 "	free and 5 pf.	no	10 "	Private
Hannover	uniform	10 "	5 pf.	no	10 "	"
Heidelberg	uniform	10 "	5 pf.	no	15 "	"
Helsingfors	uniform	15 pen.	free	no	15 penni	"
Konigsberg	5 pf.	10 pf.	free and 5 pf.	no	15 pf.	Municipal
Leipzig-Grosse	uniform	10 "	free	yes	10 "	Private
" Eleck	uniform	10 "	free	yes	10 "	"
Linz-Urfahr	from 4 to 10 heller	6 hel.	10 hel.	no	40 heller	"
Lyons	uniform	20 cent'm I 10 " II	free	yes	20 and 10 cent'm	"
Madgeburg	uniform	10 pf.	"	yes	10 pf.	"
Mannheim	5 pf.	10 "	"	no	20 "	Municipal
Nordhausen	uniform	10 "	"	yes	10 "	Private
Cie Gne Paris'ne (on principal lines)	uniform	30 cent'm I 15 " II	free or 15 cent'm	yes	------	"
Prague	8 heller	12 hel.	free	yes	20 heller	Municipal
Rheims	uniform	15 cent'm I 10 " II	free	yes	15 and 10 cent'm	Private
Remsheid	5 pf.	10 pf.	free	yes	20 pf.	"
Strasburg	5 pf.	10 "	free	no	------	"
Turin	5 cent'm	10 cent	free and 5 cent'm	no	20 cent'm	"
Vienna	2 to 10 heller	10 hel.	free	------	30 hel.	Municipal
Yaroslaw	uniform	5 copeks	free	yes	5 copeks	Private
Zurich	5 cent'm	10 cent'm	free	no	20 cent'm	Municipal
Zwickav	5 pf.	10 pf.	free	no	20 pf.	Private

WORLD'S FAIR TERMINALS OF TRACTION COMPANIES AT ST. LOUIS

At a meeting of the Engineers' Club of St. Louis, recently, C. A. Moreno, chief engineer of the St. Louis Transit Company, presented the first complete map to be compiled showing the location of all the street railway terminal loops for delivering passengers to the Exposition. This map is reproduced herewith. A map showing the St. Louis Transit Company's system alone and the location of the six loops of that company at the Exposition grounds was published in the March 5 issue of the STREET RAILWAY JOURNAL. The present map shows the location, adjoining the Exposition gates, of the terminal loops of both the St. Louis Transit Company and the St. Louis & Suburban Railway Company, as well as the Wabash Railroad, which operates a steam suburban service. Both of the street railway companies will operate to the Exposition grounds over all of the routes that are anywhere near in that vicinity. There are six "Transit loops" and two "Suburban loops."

THE MOVABLE FENCE AT THE DE BALIVIERE ENTRANCE

As regards the capacity of these loops and the lines leading to them, Mr. Moreno says:

"On the Olive Street loop we will operate cars on a half-minute space or better. Our cars seat forty-eight people, and adding those on the platforms and in the aisles, each car will hold easily 100 passengers. One hundred passengers every half-minute, provided the cars are not closer together than that, is 200 per minute, or 12,000 per hour. The Delmar loop will do as well, and I estimate that the remaining four loops between them will handle 26,000 per hour, making a total of 50,000 per hour for the St. Louis Transit Company. The St. Louis & Suburban Railway Company, I am advised, expects to be able to handle 7500 per hour on its Union Avenue loop, and 2500 per hour on the Skinker loop, and the Wabash, with its shuttle trains, 15,000 per hour, making the total of 75,000 per hour, which I mentioned in the beginning as the capacity of the three companies."

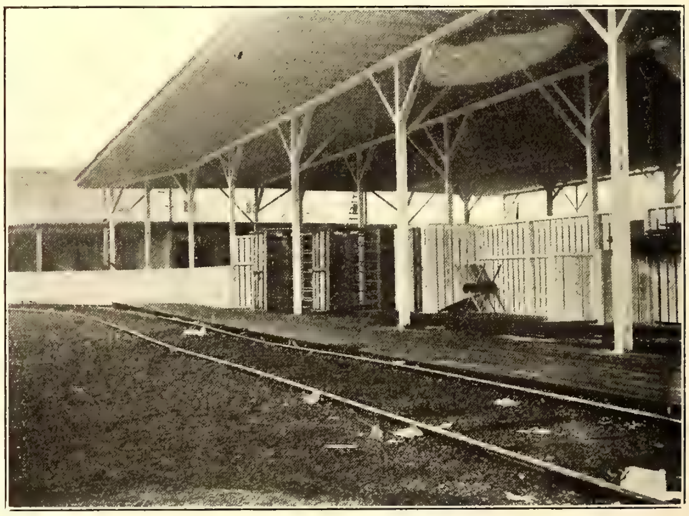
The St. Louis Transit Company's east loop at De Baliviere and De Giverville will be used by the Olive Street cars, and the west loop by the Delmar line. The Hamilton Avenue loop, which is opposite the Pike entrance to the grounds, will be used by the Easton and Taylor Avenue lines, the Skinker road loop by the Page Avenue cars, and those on the south side by the Market and Laclede lines. The Market cars now run to Tower Grove Park, while the Chouteau Avenue cars run out along the south side of the Fair Grounds to West End Heights. After the Fair opens, however, in order to avoid taking the Exposition crowds over the grade crossing of the Transit tracks with those of the Missouri Pacific on Chouteau Avenue, the Chouteau cars will turn out of Chouteau into Manchester, and thence to Tower Grove Park, thus taking care of the travel now handled by the Market Street line south of Chouteau, while the Market Street cars will turn into Chouteau at Manchester and follow the present route of the Chouteau cars.

This change will prove doubly advantageous to Fair patrons, inasmuch as it will enable them not only to escape the dangers of the grade crossing on Chouteau Avenue, but will provide a way for them to take a car at Union Station which will run directly to the grounds.

The loop at the southeast corner of the Fair Grounds is filled with storage tracks, which have a capacity of ninety cars, while in the loops on the north side no provision has been made for storage. The reason for this is that the main car yard, with a storage capacity of 500 cars, is located at Delmar and De Baliviere Avenues, which is only 1500 ft. from the two principal loops at De Giverville and De Baliviere Avenues, and when it is necessary to throw additional cars into service at these loops they can reach them in 2 minutes from the yard. Surplus cars for the loops at Hamilton and Skinker can also be stored at this yard, from which they can be put in service at the former in 4 minutes and at the latter in 6 minutes.

Another feature of this series of loops is that each one has a direct connection with all of the others, so that in the event of any special attraction at the Pike or Skinker entrances the Olive and Delmar cars can run directly there and return by their customary routes with no inconvenience and but little loss of time.

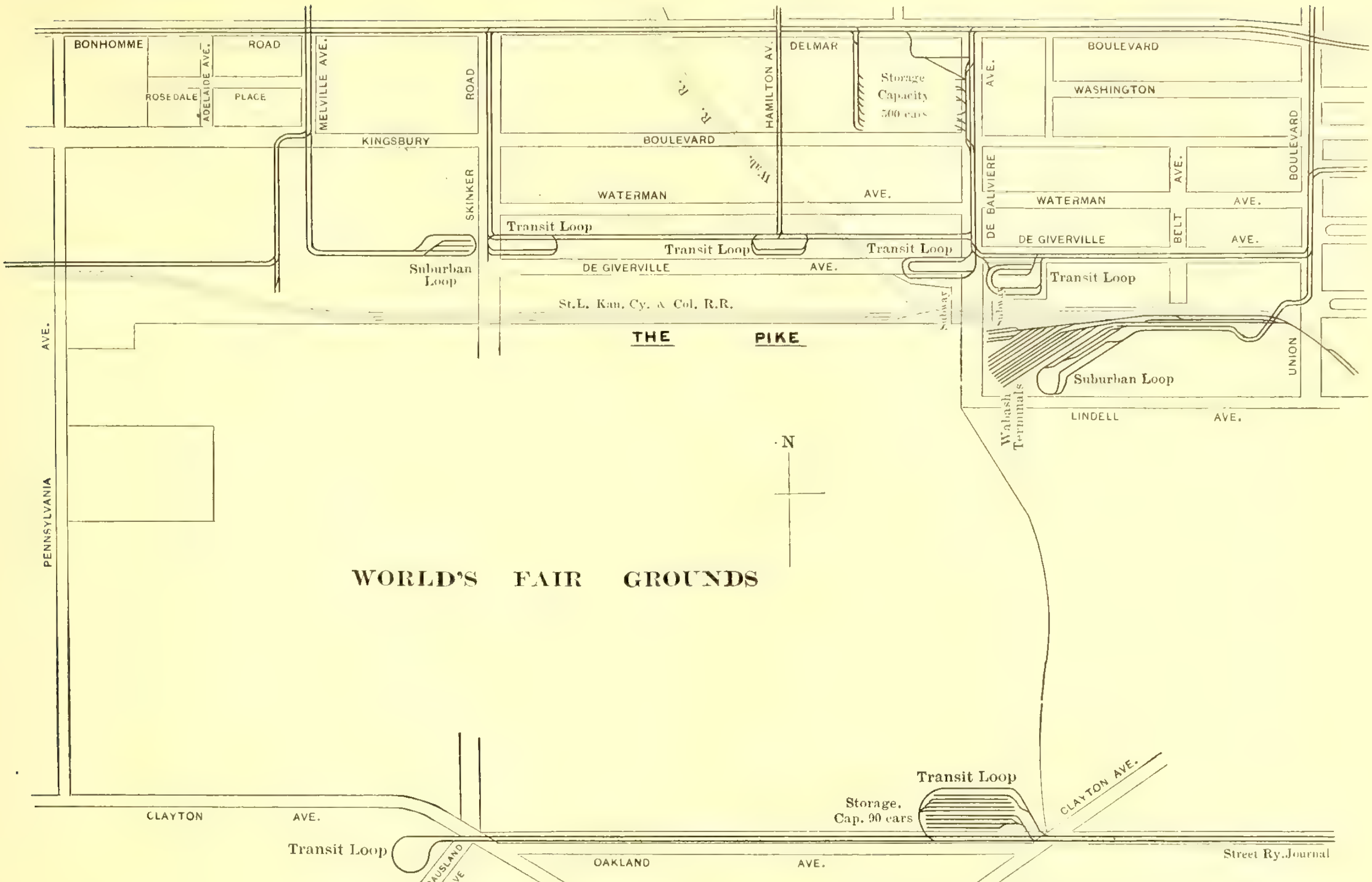
The ability of the local transportation companies to handle the crowds was demonstrated to the great satisfaction of both companies and public at the first real test, which was on opening day, April 30. The crowds were taken care of so well on that day as to excite much favorable editorial comment from the St. Louis daily papers. The statements of the street railway men, that upon the opening of the Exposition the companies would be prepared to handle with ease all the traffic offered, were amply borne out. The opening day crowds were carried comfortably and without crowding.



PART OF THE STILE AT DE BALVIERE LOOP

The St. Louis Transit Company on that day carried about 927,000 people with 1000 cars in operation; the St. Louis & Suburban about 94,000 with 110 cars, and the Wabash shuttle trains 16,514.

It is reported that the Columbus, London & Springfield Electric Railway Company, operating between Columbus, London and Springfield, Ohio, will put in operation regularly for one round trip each, morning and evening, the parlor cars heretofore reserved exclusively for private parties.



PLAN OF STREET RAILWAY TERMINALS AT THE WORLD'S FAIR GROUNDS

THE MAIN SHED AND LOOP AT DE BALIVIERE ENTRANCE

STREET RAILWAY ACCIDENTS—THEIR CAUSES, PREVENTION AND ADJUSTMENT.

BY HENRY W. BROOKS, JR.

While it is true that street railway accidents bear but a very small ratio to accidents of all kinds; that the proportion to total population is gradually lessening, and that the number of accidents to number of passengers carried is also steadily decreasing, yet their total cost in dollars to the companies has increased to such an extent as to compel very serious consideration by those financially interested in and those responsible for the management of street railway properties. It is a feature of railway operations of such manifest importance as to necessitate a careful investigation and study of the causes and situations under which accidents arise and what measures can be taken to prevent them; also to call for liberal cash outlays in investigating, experimenting with and adopting safety appliances.

To the sensitive, ambitious and conscientious manager, accidents are a sort of nightmare, for he never knows when they are going to happen nor the extent of their severity, and they seem to stand as a potent and unanswerable criticism of his personal efficiency and management. To the security holders they often appear like an avoidable cost, entailed by poor management, notwithstanding the fact that their cost is an item that every careful manager constantly endeavors to keep down to the lowest possible figure.

The sums paid in settlement of such claims and the expense attached thereto, reach surprisingly large amounts yearly, and constitute a large leak or heavy drain on the income and resources of nearly all companies. They make heavy inroads on the earnings of the large metropolitan railways, and the small interurban road is often forced to face serious financial exigencies by a single serious accident.

Not only are the opportunities for accidents increasing by reason of the more congested conditions of city streets, higher speeds and other causes, but also by reason of the heavier burdens that are being imposed upon the car companies by new acts of legislative bodies; the finding of new causes of legal liability by the courts, and the action of juries in increasing awards and establishing new and higher values for personal injuries. While we believe the majority of men are fair, honest and just, yet, we must confess, it sometimes seems as though juries took a personal pleasure in making excessively heavy awards against street railway companies. There is no doubt that the amounts awarded by the latter bodies are far greater when caused by surface railways than by factories and other lines of trade, agriculture or mining.

As nearly as ascertainable, the companies throughout the United States sustained a loss during 1902 from accidents of about $9,400,000, exclusive of the cost of repairs and renewals of equipment, this being about 1 per cent on the total capital stock issued, about 4 per cent of gross earnings and 0.9 cent per car mile.

To the above figures must be added a very large amount for the replacement and repairs of equipment and other property, charged to other accounts, but, nevertheless, a part of the accident cost. Also to this direct loss must be added that uncertain quantity, yet none the less real, loss of revenue by reason of the fear of accidents. A recklessly operated road, with a bad record for accidents, is bound to lose the confidence, and thereby patronage, of a certain proportion of the local traveling public. They will omit pleasure travel and select another line or method of transit for necessary trips, if they feel the management is careless of their safety or incompetent to protect them.

A few words about accident statistics: In dealing with them it must be borne in mind that the amounts paid for the year are not necessarily a fair charge against that year's operations, as many accidents occurring during that period may be unsettled at the end of the year, owing to the congested conditions of the courts, which prevents speedy trials, and payments may have been made for accidents of previous years. Also, in reference to comparisons of the number of accidents, it must be noted that many companies are now recording from year to year a larger number of slight accidents than formerly, which partly accounts for many apparent increases.

The management should make, from time to time, comparisons of the cost of accidents, watching the item closely and calling for explanations of marked fluctuations. In this respect the claim department can furnish the manager some valuable, current data, as mentioned later.

The two essential elements, to the practical manager, in a study of the accident problem, are the cause and the prevention, a knowledge of the former being the first step in effecting the latter. It has been found by practical experience that it is not at all easy to determine with accuracy the real cause of each accident occurring on the road. It may be due to a single cause or conjunction of a number of causes. Again, what at first may have been mistaken for the cause, may in reality be one of the results, as a part broken after the initial cause and not intensifying the trouble. It calls for discrimination—not only the knowledge of materials and equipment, but the weighing of the evidence of men, accurately and definitely to find the cause and fix the blame.

When do accidents happen? In general, we find a very direct connection between the safety of travel and the volume of traffic, the "pressure" under which it is conducted. When business is light or normal, there is, naturally, comparatively greater safety than during "rush hours," holiday travel or sudden unexpected increases in traffic. When the facilities and men are overtaxed, and the passengers crowded and excited, there is greater risk.

In tracing out the causes of accidents, we may classify them into the following five general groups, although a single accident may be the result of two or more causes, as first stated: First, those due to imperfect track and roadway; second, those due to defective equipment; third, due to negligence in operating on the part of employees; fourth, those brought about by contributory negligence on the part of passengers and the public; and, fifth, due to unseen causes.

Beginning with the first group, the history of the road may shed quite a little light on this point. As is too frequently the case, the road may have been built by a group of speculators, whose policy is plainly seen in poor location, bad roadbed, light track and cheap equipment.

Again, the cause may be traced to poor engineering in original location and design. The organizers may have been honest in their plans, but the size of the projected road, perhaps, seemingly may not have warranted high-priced engineering talent, or they may have regarded engineering services in the light of an "expense" capable of being cut to a low figure—even congratulating themselves on the economy effected, utterly unconscious of the added construction and operating cost. This is a false economy, and the writer has many times been surprised to see relatively enormous capital outlay entrusted to low-salaried engineers. Again, the organization of the engineering construction force may be such that important features are left to subordinates.

Among the detailed causes of accidents attributable to imperfect track and roadway in original construction or maintenance, or both, are the use of heavy cars on old, weak bridges, resulting in bridge and trestle failures; defective location, such as poor alignment, sharp curves on grades, foot of hills or brink of ravines, improper curve elevation, spreading of rails on curves, worn curve rails, lack of guard rails or timbers, poor surfacing, light rails, small ties, poor track fastenings, improper relation between the standard of track and weight of equipment, broken

rails, broken or defective switches, all resulting in derailments; failure of block signal system, lack of derailing switches, signal apparatus and other safety devices at dangerous points, by placing point switches on cross-overs, double-track roads, grade crossings, right angle crossings with roads where the view is obstructed, resulting in head-on and crossing collisions; also, falling wires, although these are decreasing in number owing to the use of better line material.

The second group of accident causes includes those due to defective equipment; improper car design, such as long cars with too short wheel base, defective trucks, broken wheel flanges, loose wheels, improperly gaged wheels, axles out of line, and defective braking apparatus, resulting in derailments; defective or improperly maintained electrical equipment, car wiring, etc., brakes and brake chain failures, vestibuling city cars, etc., resulting in head-on, crossing and other accidents; worn or poorly designed car steps, grab handles, etc., resulting in accidents to passengers.

Coupled with a dangerously located road, having sharp curves on heavy grades, steep embankments at foot of long hills, etc., poorly maintained, with poorly disciplined motormen and heavy traffic, the brake question is one of life or death, and any evasion of its financial folly, not to say criminal negligence.

The third group, or those accidents due to negligence in operating on the part of employees, is hard to regulate, prolific of trouble and requires eternal vigilance in watching. Speaking of this class in a general way, we head the list with the manager himself, because he heads the organization, and any lack of efficiency, knowledge of materials or equipment, or handling men, any lack of attention or forethought on his part may be the real cause of an accident happening to a car under the immediate control of his representative, the motorman. However, the writer believes the majority of managers are keenly alive to the accident question, yet they must bear in mind that eternal vigilance is the price of safety.

The human element in railroading is liable to err, and cannot be depended upon to operate with mechanical regularity or accuracy. For that reason it has been the constant endeavor of railway managers to reduce to a minimum the human element, and to regulate its action within certain bounds by a code of laws, and by discipline to compel the observance of such laws. The lack of prompt obedience to proper authority and the unhesitating and exact observance of the established rules of the company are fertile causes of trouble, in fact are the cause beyond all others of accidents.

We may trace many of this general class of accidents to the selection, in the first place, of poor human machinery. The man causing the trouble was not of the right material or constitution to begin with. He may be one of those careless men who treat lightly their own criminal negligence in risky operating. Lack of attention or forgetfulness is a frequent explanation of the cause. To go into this more fully would require a chapter on the selection of employees.

Then, again, while normally an able man, at the time of the accident he may have been sick, fatigued with over-long hours, in poor physical condition or intoxicated.

To repeat, the first cause of this kind of accident is the inefficient, unreliable human element; second cause, imperfect, inexplicit, incomplete and improperly drawn rules; third cause, lax discipline.

But to itemize those accidents which are due to discipline or negligence in operating: First, those which result in crossing collisions, and which occur at grade crossings with steam or electric railways, which accidents are almost wholly due to violation of rules, although some are caused by the trolley leaving the wire when crossing, derailment or otherwise breaking down on the track, as mentioned in a previous classification. Second, right-angle collisions between cars and vehicles, for which there is no reason on a broad street, or where the view is unobstructed. Under high speeds or certain circumstances, as, for instance, the Columbus Avenue line, New York City, running between the pillars of the elevated railway structure, these accidents are extremely serious, frequently jamming the wagon between the car and pillars, and causing heavy damage claims, as both have the same right of way. Third, with persons crossing the street at cross-walks, those occurring in the middle of the block being very infrequent. The former are a frequent and serious class of accidents in congested cities. Fourth, those which arise when a pedestrian or alighting passenger passes around rear of car and is struck by the car approaching on the other track, whose motorman failed to ring gong or slacken speed.

The principal accidents resulting in derailments due to employees' negligence, may be sub-divided as to cause as follows: Open and misplaced switches, excessive speed or losing control of cars on poor track, curves, grades, or descending grades at approaches to bridges, negligence on the part of trackmen, and open draw.

Crews attempting to "steal switches" where due to meet another car, form a large number of the causes; misunderstanding 'phone orders, misplaced signals, running work cars or specials without proper notice, are the causes of many "head-on" collisions, often of a serious and expensive nature.

Cars coming to stops at a point where the view of the following car is imperfect; cars standing on the track at night without lights, as "dead" cars with broken trolley wheels and no kerosene signal lights; running into work cars or specials standing on the track; running into cars or wagons on the track ahead; running rapidly with too close headway; running at high speed in foggy or snowy weather, where the view is obstructed and the rails slippery, etc.

Among the accidents to passengers caused by employees are those occasioned by the conductors discounting the time required for passengers to get on or off cars, or even get a firm foothold, before signaling to start; in not giving passengers time to get inside the car body of an open car; allowing passengers to crowd on running board, and in motormen not stopping or even slowing down for intending passengers, or in starting too soon.

The fourth general group of causes embraces those which arise with the passengers and public—contributory negligence: Crossing streets in front of approaching cars; upon leaving car at the rear platform crossing in front of the car approaching from the other direction; alighting before the car stops; mistaken efforts to board a moving car, falling off platform or running board. Many of these accidents arise at points where there is the greatest rush, hurry and excitement, as at terminals, transfer points and crowded crossings.

The fifth and last group are due to what may be termed "unforeseen causes," for instance, washouts and landslides, snow or ice, accidental obstructions and malicious obstructions.

Doubtless the reader's experience and observation will add many other causes too numerous to be included here.

It is generally stated that "it is always the unexpected that happens,"as if events happened "hit or miss," yet upon the discovery of the cause and upon reflection, we see there is no reason why the accident should not have happened. Not only that, but given the same combination of circumstances, a similar accident will occur. The law of cause and effect most certainly applies to accidents. If, by a little forethought, we could have seen the cause as clearly as we now see the result, or as we see the cause after the accident, the catastrophe might and would have been averted.

A careful scrutiny of the records of accidents should lead to the removal of those conditions that cause accidents. There is not the slightest doubt but that prudent, persistent, intelligent and businesslike methods can reduce accidents to a minimum,

It is surprising that many street railway companies seem indifferent to investigating the possibility of accidents on their roads, while others, fully cognizant of danger spots in their systems, apparently ignore the serious situation. In many instances the directors do not devote personal attention to the operating affairs of the road, and frequently the manager has not at his disposal sufficient funds for radical preventive methods.

We have previously considered the cost of accidents, but a few further remarks on the financial side of this subject as related to preventive methods are pertinent. Undoubtedly, this is a matter capable of being figured out mathematically. It will be found that the cost of eliminating these danger spots, or sources, will be far less than the expense entailed by accidents, and that it is a wiser policy to appropriate a certain outlay of funds for permanently bettering the roadway and equipment than disburse the same funds, and more too, from time to time, in accident expenses. Further, it will lessen the company's vexatious and costly legal affairs and act as a sort of insurance against sudden financial exigencies, arising through heavy, unexpected damage claims.

We know accidents occur. We know they cost money. What we want to get at is how to prevent them.

The first step is a study. If due to defective track construction the remedy is easily found, though, perhaps, not so easily applied. In his consideration of this question the manager should not confine his improvements to remedying conditions which have already caused accidents, but should be equally ready to correct other defects in the track construction which may provoke them in the future.

Having gone over the list of accidents chargeable to the physical condition of track and roadway, the manager should next turn to those caused by equipment.

This might call for a radical change in car design, as, for instance, the discarding of long car bodies with short wheel base. This, of course, can be most economically brought about gradually when purchasing new equipment or by rebuilding. On lines running through congested, narrow city streets, crowded by car, team and pedestrian travel, vestibules would be dangerous and should be avoided. Interurban cars, whose service calls for taking heavy grades and sharp curves at high speed, should be amply provided with the very best braking appliances, sand-boxes and signals obtainable.

A system of careful, practical inspection of all parts of the brake, rigging, running gear and electric equipment, to see that all vital parts are in perfect working order, will prevent serious trouble. See also to the perfect safety of what may be termed "little things." Select the best gates, headlights, gongs, car fenders and keep up the standard of maintenance of equipment. The electric equipment of cars, or motive power-producing machinery should be carefully maintained in the best condition.

From a transportation standpoint, the schedule or headway must be so arranged as to afford the maximum safety combined with the traffic needs. On single-track interurban lines a telephone, if not telegraphic, train despatching system should be instituted.

Proper provision for the sudden increases of traffic should be provided for, otherwise there will be the increased liability of accident by reason of the employment of new, untried men, the lack of careful examination and selection, the insufficient time allowed for breaking them in and training in their duties. A large proportion of new or green men may seriously interfere with the methodical working order of the organization.

From an operating standpoint, distribute the traffic, so far as possible, over those lines whose facilities afford the greatest safety, bearing in mind, also, those lines affording the greatest economy of operation, both of which are usually coexistent. Certain kinds of accidents, especially those to passengers, are more prevalent where the traffic is congested, therefore, distribution tends to minimize their occurrence. Another preventative method is to divert, so far as possible, travel from those lines under reconstruction or contiguous to construction work of any kind.

Last, but, perhaps, most vital, in the prevention of accidents we mention efficient discipline.

The first essential in this respect is an efficient manager, who has perfect control of a well-organized staff and force, guided by a serviceable code of rules and regulations, which are thoroughly enforced by strict discipline. The manager is the power or source that guides, directs, controls the large body of motormen, conductors and others in their various acts. This he does, largely, through a code of rules, which are the result or concensus of years of his own and others knowledge and experience in railway operations. These rules should be as few, simple and explicit as possible and well known by the men. They should be drawn up with special forethought for the prevention of accidents, and so worded as to be readily and fully understood from the standpoint of the men.

There are certain rules which might be a standard on any road, but to this list should be added such special rules as operating conditions on each individual road necessitates. Further, each road will have its rules as to the local points, such as reducing speed to a safe limit while passing over a certain dangerous bridge, around a certain sharp curve, and otherwise cautioning safety at all the dangerous points on the line.

The best code of rules ever drawn will not prevent accidents, unless reinforced by close inspection and strict enforcement of regulations. The system of inspection will depend on the size and conditions surrounding the road, but should always provide the proper check and instruction to the men. Stringent discipline keeps alert to prevent accidents. If the rule says the motorman is not to "steal" a switch, and he does so, he should be detected and punished for so doing, whether or not an accident ensues. Too often lax observance of rules is engendered because of the harmless violation of rules several times, until, finally, a violation results in a serious accident. It is only by strict surveilance that this carelessness, the forerunner of accidents, is prevented and held in check.

The proper selection of new men affords another opportunity for the prevention of accidents. Only those who are physically, mentally and morally competent should be admitted to the service. Employment should be based strictly on merit only.

Having good material to begin with this can be shaped up and improved by systematic, intelligent training. The manager can create a spirit of better service, a pride in their work, an ambition to become better motormen or conductors. The training in their duties afforded by the "schools of instruction" conducted by some of the larger roads, and continued through their system of inspection on the road, together with plain, practical talks in railway association meetings, lead to greater intelligence and efficiency on the part of employees, correspondingly reducing the "human element" causes of accidents.

Along these lines the writer has in mind the reduction of accidents on one road from a monthly average of about 325 to 200 in the course of a year, by reason of the system of promotion of intelligence among the men, and a practical, thorough instruction in their duties, followed up by helpful, watchful inspection by competent men.

Better instruction and training on the part of the motormen is called for on roads poorly constructed, equipped and maintained. They should be good enough railroaders to understand the road and equipment they have to work, and, therefore, not ignorantly speed a heavily laden, teetering car with short wheel base and weak brake power down steep grades, around sharp curves and over light track, hazarding the lives of many passengers and the company's property.

Lose no opportunity to call attention to and forcibly impress

upon the men the lesson of each accident, as brought out by the investigation. It will be an object lesson to the other employees not so easily forgotten, that will tend to prevent repetition of the same kind of accident.

One of the stimuli to attentive, careful conduct of their duties is the appreciation of the good work of the men. The manly, friendly recognition of careful service inspires loyalty and personal interest in their work. On a road the writer has in mind, a "Roll of Honor," or monthly list of motormen and conductors who have not had blamable accidents, is conspicuously posted, and has a good effect on the accident record.

More effective still is the "premium system," of financially rewarding conductors and motormen for the avoidance of accidents. In one instance an extra cent an hour is added to their wages. The system has proved practical and satisfactory, both to the men and to the company, resulting in a decrease of over 40 per cent in the number of accidents during the first few months it was put in operation. It has since maintained this good record, but considerable care is required to award the premiums justly and prevent feeling among disappointed men.

The work of prevention of accidents should not be a spasmodic, impulsive attempt, but a systematic, carefully planned effort to strengthen the whole operating structure. It requires both a comprehensive plan of reform and a daily campaign. Each accident must be followed by a well-directed effort to correct the weak point in the operating system, gradually building it up to higher degrees of safety. The manager must be alert to new mechanisms and safety appliances, new ways of doing things, that lead to greater safety. All this cannot be accomplished in a day, but only by courageous, determined and well-directed work.

Another very important feature of the accident problem, from the financial standpoint, is the handling or adjustment of accident claims with the increasing number of accidents; the large court awards, which are printed in the daily newspapers with all the allurements of "get-rich-quick" advertisements; the methods of appealing to human weakness and inciting to cupidity employed by many unscrupulous attorneys, whose fees are large and possibilities so great, together with the protection afforded them by statutes in the enforcement and collection of contingent fees and expenses; the investigation by doctors who are also avaricious for high fees as expert witnesses, and many other causes all contribute to add to the large number of claims made daily upon surface railway companies. More demands are made upon roads operating in large cities than country roads, and some particular cities like Brooklyn, New York and Chicago seem to be more afflicted with personal injury litigation than other cities.

About seventy-five to a hundred claims are made daily on the New York City lines, about 7 per cent or 8 per cent of which result in suits, the balance being dropped or adjusted. Comparatively few of those claims that are made are just or the claimant fair and reasonable in his demands. Even although the claim departments are better organized, yet there has been a steady increase in suits during the past decade.

To meet these incessant and vigorous attacks on the companies' revenues, well organized and skilful claim departments have become a necessity to the larger roads. Perhaps, even more than the merits of the case, the satisfactory adjustment of claims depends largely upon personality—both claimant and adjuster. The great essential of the successful adjuster, therefore, is the right personality and the ability to deal with the various characteristics of those making demands, together with the understanding of human nature. This requires a suave, pleasing address, firmness, honesty and a clear, hard head. Claim agents, I believe, are born, not made.

The province of the claim agent is not only in the disposition of claims for damages and injuries, after the accidents have arisen, but also in assisting in the prevention of accidents by serving as a check on the operating departments.

By co-operating, without friction, with the other department heads he can effectively aid in the elimination of the causes of accidents from year to year. His records, when properly tabulated, for a complete exposition of the causes and results of accidents, thereby pointing out to the superintendent, master mechanic or track master where the dangers lie. They can apply the remedy and prevent repetitions.

The first step in handling claims begins at the time of the accident, and should be in the form of an exact and comprehensive report by the conductor, who should be supplied with properly designed accident blanks, ready for filling in, together with brief-pointed directions regarding reports and the rules relating to accidents. It is essential that they promptly make accurate, truthful and complete reports, no matter how trifling the accident may apparently be. The statement of exact facts must be clearly separated from any opinions, suggestions or inferences of the conductor which he may volunteer. The circumstances surrounding an accident often make conductors fearful and personally prejudiced in reporting the true causes or affording them a motive for concealing facts to shield someone. Despatch in reporting accidents is essential, especially so in the event of a serious accident, when the claim agent should be notified by 'phone that the proper investigation may be immediately instituted. The rule not to discuss accidents or give information except to the one in proper authority is important, and generally well observed. By tactfully and effectively securing proper witnesses the conductor can display some useful ability.

From the inception of an accident, preparation for a law suit must be conducted simultaneously with negotiations for a settlement. Being prepared for litigation, and the knowledge by the claimant that the company is fully posted as to all details and ready with a strong defense, have considerable weight in modifying his demands.

The prompt investigation of all facts and circumstances by the claim department should be instituted. This necessitates a considerable amount of skilful and careful work. It is easy to say, "get facts," but much harder to sift out conflicting testimony and determine them. Conductors' reports must be scrutinized, witnesses visited and examined at their homes or places of business, and after these and other sources of information have been exhausted, facts must be ascertained and the question of legal liability determined.

The claimant must be met—in fact he usually is not bashful in making himself known, and his first demand, as may be anticipated, is a liberal "strike." Upon his first interview it is well to question the party closely and record the results. It is also well to deal with the claimant direct, simplifying matters and usually being cheaper and more satisfactory to all concerned.

No fixed rule of proceedings can be laid down, each case having to be handled differently, according to its individual circumstances.

Having determined whether or not the company is legally liable, the next step is the decision of what amount should be offered or paid in settlement, provided the company is liable. This involves a number of nice questions, for instance, the nature of the injury, the value set upon similar injuries, the personal characteristics of the claimant, and the general conditions surrounding this particular case. The claim agent must base his offer, to a large extent, on the average payments made in his locality for such accidents.

It sometimes occurs that even though there is no legal liability binding the company, it may be wise to make some gratuitous payment. The claim agent must decide this, and, if so, set the amount. In all this work, it is seen, there can be no fixed rule or mathematical calculation of amount, but each particular case must rest on the judgment of the adjuster.

But having determined these points the most difficult work comes next—in effecting an equable settlement. It is not always easy to satisfy the claimant and his attorney as to the amount of compensation. The injured party's ideas may be exorbitant; may be warped by his sufferings; he may not be just and reasonable enough to admit the amount offered to be a fair and adequate consideration, or he may not concede it to be as much as a jury would award.

In making offers it usually is unwise to offer a great deal less than what is a fair compensation for the particular case. Neither is it wise, once having set a figure, to raise the amount, unless, of course, some unexpected or unknown conditions come up and fully warrant such change.

In the adjustment of claims it is well to pursue a firm, just, conservative and comprehensive policy. The claim agent must be careful not to get a reputation for settling everything easily, neither should he go to the other extreme by unfairness or fighting everything. Unfairness and sharp practice may give a temporary advantage or saving to the company, but a broader experience has shown it to be a wiser and more economical policy in the end to deal promptly and justly with those really entitled to compensation for injuries sustained. Meet an honest man honestly. Settle promptly all serious cases that would eventually result in loss.

Owing to the public nature of its business, the necessity for further franchises, the danger of excessive awards by antagonistic juries, and other excessive burdens, it is reasonable for the company to avoid all causes, so far as possible, that engender public hostility.

On the other hand, street railway companies should strenuously resist all impositions. Run down all organized attempts to swindle the company by claims for physical disabilities of antecedent origin or otherwise. Fight vigorously all those cases that are fraudulent or possess little or no merit, and fight to win. I wish the victories for the companies were as well advertised in the daily papers as are the large verdicts of juries for plaintiffs.

In conclusion it may be stated that inasmuch as many accident causes arise on the part of the public and largely outside the control of the companies, also that the public has required the present faster car service, therefore, it behooves the public, as a body, to assist in the work of accident prevention, and individually to take greater precautions.

It is hoped that a careful, analytical study of the accident element in railroading by managers, and the practical, prompt execution of their findings, will result in a still better accident record and largely increased net earnings of their properties.

In order to have its employees better prepared to act in emergencies for the relief of persons who may be hurt on its lines, the Oakland Transit Consolidated, of Oakland, Cal., is considering a plan for the training of its motormen and conductors in the methods of first aid to the injured. Claim Adjuster John Ferrin, of the company, has been working for some time on a stretcher specially designed for use on street cars, and has just completed his models. The stretcher is so built that it folds quickly into a small package to be stowed under a car seat. When extended the device can be used to carry an injured person, or as a cot on which a person hurt may be laid in some comfort until aid can arrive. Mr. Ferrin has so arranged the stretcher that when an injured person must be transported some distance on the car for the purpose of securing medical relief, the litter can be hung between the seats back of the conductor's stand. The company is considering the installation of one of these stretchers on each car running on its system.

Mail service has begun on the Indianapolis & Northwestern Traction line between Lebanon and Frankfort.

NEW STEAM TURBINE DEVELOPMENT

In a paper under the above title recently read before the Engineers' Club of Philadelphia, W. L. R. Emmet, of the General Electric Company, presented the results of an interesting series of tests that have recently been made upon one of the first of the Curtis steam turbines that was put into practical operation. This first machine, which is of 500-kw capacity, operating a 2300-volt, 60-cycle generator, was installed in a power station of the Massachusetts Electric Companies, at Newport, R. I., where it has been in continuous service since July, 1903. It has carried the service load of this station entirely without interruption, and the results accomplished by it have proven very satisfactory. Two similar machines have lately been installed at this station also, but have been in service for only a few months; the operation of these machines is also proving very successful, and no trouble is being experienced.

In starting up the first turbine at Newport several troubles were met which required considerable experimenting to overcome, but after a considerable amount of experimental work, by permission of the owners, these have been successfully done away with and now the turbine is giving perfect satisfaction. The first serious trouble encountered was with the balance of the generator, which resulted in trouble with the bearings; this was overcome when the balance was improved by the attachment of suitable weights. Another trouble developed in the step-bearing which made possible a certain degree of instability of its action under certain conditions, but changes of design were adopted which have entirely overcome this trouble. The valves were also changed somewhat from their original design so as to embrace changes of proportions of parts, but without any change in general principle of action; this also resulted in improved action of the machine. Since these changes there has been absolutely no trouble in the operation of the turbines, and the labor of attendance and possibility of interruptions have been reduced to a minimum.

The following tests, which were recently conducted upon these machines, were made by George H. Barrus, of Boston, representing the owners, the Massachusetts Electric Companies, with a view of ascertaining whether they had met the guarantees of the contract. Associated with him in the work was R. H. Rice, recently of Rice & Sargeant, and A. R. Dodge, who represented the General Electric Company. The tests were made and water rates measured with various conditions of fixed load, both with and without superheat. Tests were also made with such variable commercial loads as are daily handled at this plant, and the steam consumption per kilowatt-hour under working conditions was ascertained by the most careful determination of the total water condensed, and the load as measured by many instruments and as recorded by carefully checked recording wattmeters.

Attention is specially called, in the paper, to the records of operation under commercial load, since they illustrate the great practical advantage afforded by apparatus of this kind. The character of the load during these tests involved incessant rapid fluctuations, with an average sudden variation of about 100 kw, and with an average load of only 253 kw in one case and 421 in another. In the former case the average steam consumption per kilowatt-hour was only 22.38 lbs. It is positively asserted by Mr. Emmet that the best steam engines now used for such purposes in this country would consume at least 28 lbs. of steam per kilowatt-hour under such load conditions, and in most cases the consumption would be considerably larger. The consumption of 20.73 lbs. per kilowatt-hour with an average of 421 kw of such variable load is a very fine performance.

In considering these results Mr. Emmet advises that it should also be borne in mind that the plant, which gives these results, possesses many other practical advantages which conduce to economy. All the condensed water in this plant, since it

originally started, has been returned directly to the boilers, and the boilers are, consequently, at the present time in a perfectly clean condition, although the natural water supply at Newport is bad. During all this time no oil has passed into the boilers nor been wasted; it is simply circulated and used over and over again. The absence of air leakage in the turbine, and the absence of air in the feed-water, greatly simplify the maintenance of a good vacuum, which, of course, contributes to these excellent practical results.

SUMMARY OF COMMERCIAL RUNS OF THE CURTIS STEAM TURBINE

Newport, R. I., Power Station of the Massachusetts Electric Company

	January 15, 1904	January 26, 1904
Duration	12 hours	15 hours
Total coal (wet)	13,517 pounds	10,205 pounds
Moisture in coal	3.1 per cent.	5.5 per cent.
Water evaporated	127,267 pounds	104,026 pounds
Drip withdrawn from steam pipe per hour	....	46 pounds
Moisture by calorimeter	3.05 per cent.	2.1 per cent.
Total steam to turbine	108,100 pounds	86,833 pounds
Steam per hour to turbine	9008.5 pounds	5769 pounds
Dry steam per hour to turbine	8733.8 pounds	5667 pounds
Load by polyphase meter	406.4 kw	234.7 kw
Load on auxiliaries (average)	14.9 kw	18.5 kw
Total load (average)	421.3 kw	253.2 kw
Dry steam per kw hour	20.73 pounds	22.38 pounds
Dry coal per kw hour	2.67 pounds	2.54 pounds

In regard to the larger units of the Curtis turbines Mr. Emmet stated that in October last the first 5000-kw turbine was installed in the new plant of the Chicago Edison Company, and

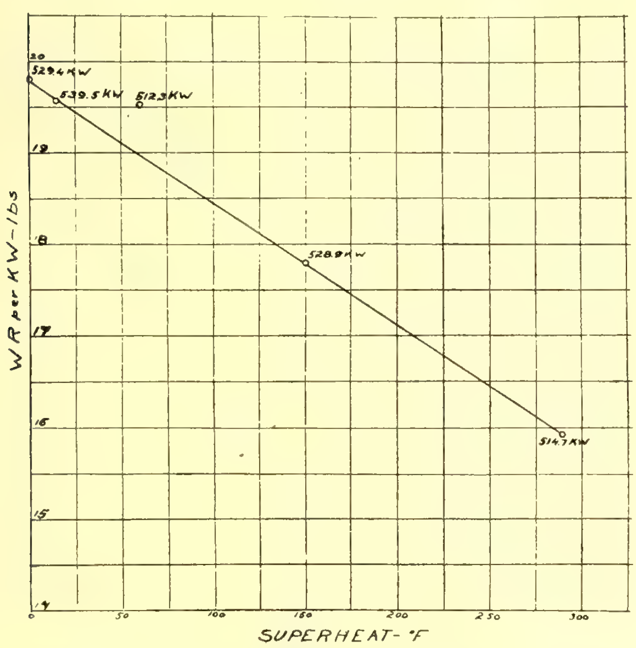


FIG. 1.—500-KW CURTIS TURBINE AT NEWPORT, R. I., CURVE SHOWING EFFECT OF SUPERHEAT ON STEAM CONSUMPTION (WATER RATE PER KW-HOUR)

since that time two others have been installed. This machine was put into commercial service soon after its installation, and has been in service daily since its original starting, and the second machine has been in service for several months past. Neither of them has been subject to any interruptions of service through its own defects, and for some time past they have both operated almost continuously, on some occasions having been kept under load for five days without stopping. In many cases they have operated with extreme overloads and have regularly been depended upon throughout the past winter.

Several unforeseen troubles have been experienced with these machines also; the valves, as originally designed, have been subject to the same difficulties experienced at Newport,

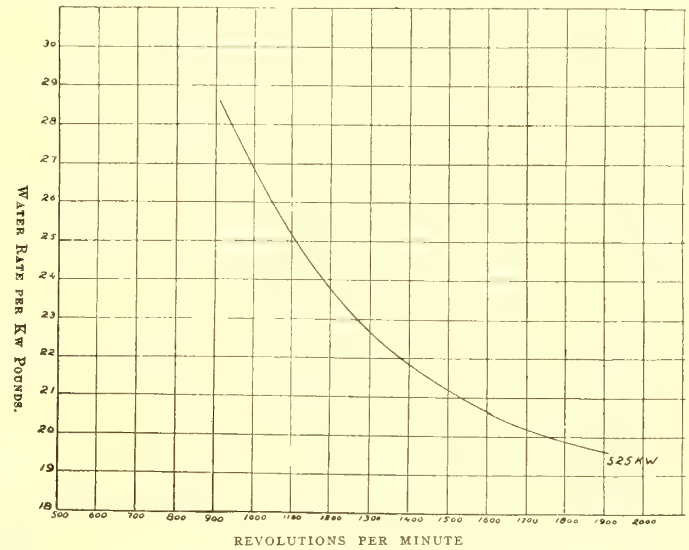


FIG. 2.—500-KW CURTIS TURBINE AT NEWPORT, R. I., CURVE SHOWING EFFECT OF SPEED ON STEAM CONSUMPTION (WATER RATE PER KW-HOUR)

and have been replaced by valves of such improved construction as could be applied without loss of time or interruption of service. This trouble with valves has, however, caused no stoppages, since the principle of governing is such that each valve operates independently, so that the failure of one simply serves to throw the work on to the next in order.

There have also been at Chicago certain unexpected movements of wheels, through variations of temperature, which

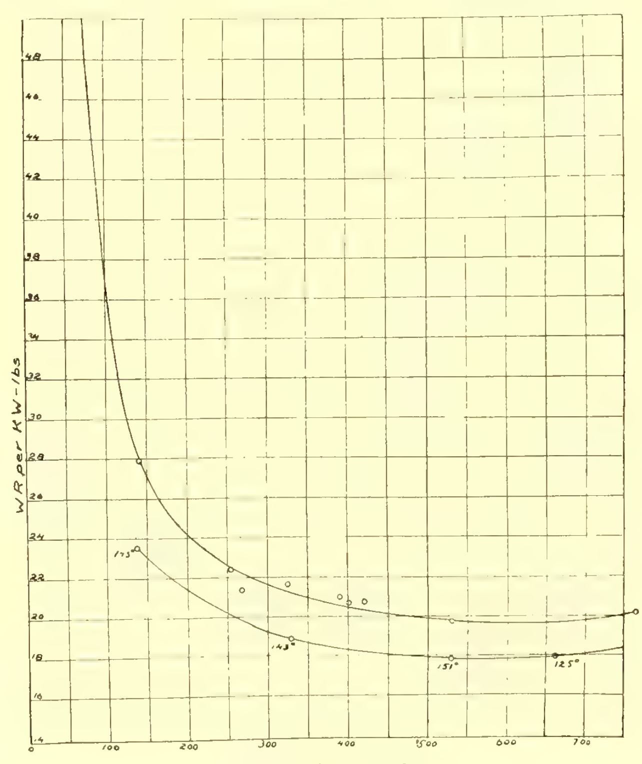


FIG. 3.—500-KW CURTIS TURBINE AT NEWPORT, R. I., CURVES SHOWING STEAM CONSUMPTION (WATER RATE PER KW-HOUR) AT DIFFERENT LOADS, WITH AND WITHOUT SUPERHEAT—INITIAL PRESSURE 145-LB. GAGE

have made necessary certain adjustments which were not originally intended. The fact that the machines have been required for daily service has made it impossible to correct the cause of these difficulties and has occasioned a little inconvenience in handling them. No trouble has arisen in connection with these,

or other machines, which is not readily curable and which cannot be avoided in all future machines, and none of the troubles has been of sufficient magnitude to interrupt the continuity of service or appreciably impair the efficiency of action.

The machines in Chicago operate with wonderful steadiness and freedom from vibration under all conditions of load. The generators are cool and have given no trouble whatever. The electrical regulation is good and the speed control has always been perfect, in spite of the difficulties with valves above mentioned. The machines have repeatedly been subjected to sudden accessions of heavy load, in cases of accidents with other apparatus, and have repeatedly been called upon to operate non-condensing without interruption of service, through some failure of the condensing facilities. In all such cases they have successfully performed the duty for which they were designed, the step-bearings never having given any trouble from the time the plant was started.

No official tests of the Chicago units have ever been made, and no accurate knowledge concerning their steam consumption is possessed. Tests were begun at one time, but a large and variable leakage in the condenser made it impossible to weigh water, and testing was postponed on account of the late season, which made it necessary to keep the machine in commercial service.

The facilities for shipment by rail limit the diameter of a 5000-kw machine of the Chicago type, and it is, therefore, designed for a lower peripheral velocity than other machines of the kind. It was guaranteed to give about the same steam economy as the machine at Newport, and it is probable that it gives a very similar result.

THE NEW TYPE OF CURTIS TURBINE

In regard to the most recent developments of the Curtis turbine, Mr. Emmet states that the early experience led to the adoption of new principles of turbine designs before the machines above mentioned were put into service, and very recently the first machine of this new type has been run and tested. These new condensing turbines are still of the vertical shaft type, but have four stages, while the earlier machines have only two. In each of these four stages there is a cast-steel wheel carrying at its outer edge two rows of buckets; the stages being separated by diaphragms which form separate compartments, and which are so shaped as to bear the pressure of steam to which they are subjected. In these diaphragms, or attached to them, are sets of nozzles which deliver the steam to the wheel of the succeeding stage, the number and size of these nozzles, and the portion of the circle which they cover, increasing from stage to stage as the steam expands. The wheels of these machines are of extremely simple construction and the attachment of buckets is simple and strong. They are operated with ample clearances and no adjustment whatever is required in their operation under any conditions. These machines can be started immediately without preliminary heating, and require no adjustments with changes of temperature, load or vacuum.

These new machines are also governed solely by the original admission of steam, the number of first stage nozzles in flow being controlled by the governor, and always kept proportional to the load. The stationary buckets in these machines project from heavy strips of metal fitted in slots and firmly held to the stationary part by heavy bolts from the outside. The construction is such that the injury through accidental interference between the moving and stationary parts is very small, no distortion or warping being possible,. and is such as to make it easy to avoid such touching altogether, even where machines are started for the first time.

A 2000-kw machine of this new four-stage type was recently tested under the conditions of vacuum and superheat afforded by the Schenectady power station of the General Electric Company, although tests have not yet been carried far enough to fully analyze the possibilities of this machine with the best adjustment of shell pressures and all other conditions. The tests have, however, shown remarkably good steam economy, and it is probable that still better results will be produced within a short time.

The results and conditions of some of these tests are given in the following table:

	February		March					
	23d	25th	11th			12th		
	1	2	3	4	5	6	7	8
Load in kilowatts	1750	2400	1740	2210	2760	637	1000	2000
Revolutions per minute	760	760	750	750	750	750	750	750
Gage pressure	140.5	156.5	155	160	160	150	160	160
Superheat, F.	200	239	202	212	192	215	242	242
Inches of vacuum	28.5	28.5	28.73	28.50	28.35	28.2	28.9	28.78
Pounds of water per kilowatt hour	14.2	13.5	15.30	15.20	16.20	20.1	16.30	15.30

After the first two tests here reported a change in the arrangement of the machine was made, and this change produced an unforeseen condition, which was thought to be very disadvantageous to the machine. All the tests given were made with the best facilities for long periods with perfectly fixed conditions, and are believed to be nearly correct. The tests made under the second condition were witnessed by many prominent engineers, and all the conditions were accurately verified.

Satisfactory tests, without superheat, have not yet been made upon this machine. The indications of such tests as have been made are that the improvement with superheat is very large, and that in this respect the functioning of the machine is very similar to that of the Parsons turbines, which show more benefit from superheat than the earlier turbines of the Curtis type. The use of high degrees of superheat has been considered commercially desirable in connection with the Parsons turbines, and the indications are that the same reasoning applies to machines of this type.. These machines are designed to operate with superheat, without any mechanical difficulty, and it is probable that future steam plants designed for the use of such apparatus will use high steam temperatures.

NEW DETERMINATION OF THE SPECIFIC HEAT OF SUPERHEATED STEAM

Mr. Emmet states in this connection: "In the course of tests with experimental turbines, A. R. Dodge, of Schenectady, has observed certain conditions which indicate serious errors in the ideas previously accepted concerning the specific heat of superheated steam, and these observations have led us to make investigations of this matter. By delivering superheated steam to a turbine fitted with a water brake we can, at will, vary the amount of work extracted from the steam, until the exhaust is brought to a saturated condition. If we know accurately the temperature and weight of exhaust steam, and the temperature and pressure of the steam admitted, and have an exact measure of the work extracted from the steam, and of the heat radiated, we have in our possession all data necessary to calculate the total heat of steam admitted. This method of test is subject to certain difficulties and inaccuracies, but has the advantage that it can be carried on on a considerable scale with large flows and steadily maintained conditions. We have made such tests with different degrees of superheat, and have checked approximately some of our results by other methods of investigation. The result of these tests indicates that the specific heat of superheated steam under the conditions ordinarily used is much greater than has generally been supposed. The idea generally accepted, until quite recently, has been that the specific heat of superheated steam under all conditions was 0.48. Our investigations indicate the following figures:

VALUES OF Cp AT 155 LBS. ABSOLUTE

(Cp being the average of specific heat up to these temperatures; not the heat required for a rise of 1 deg. at these temperatures.)

Superheat	Cp.
0° F.	0.52
100° F.	0.65
150° F.	0.7
200° F.	0.74
250° F.	0.77

"It is probable that our investigations on this subject will be carried further, and that Mr. Dodge will publish fuller and more accurate figures. Since this work was done very similar figures have been arrived at independently and by different methods in England and in Germany."

DISCUSSION

In reply to questions from members and visitors at the meeting Mr. Emmet made some interesting explanations as follows:

"This type of turbine is adapted to operation between any pressure limits, and the work obtained will generally vary in approximate proportion to the variable energy in the steam.

"The wear of buckets, as determined by experience with existing machines and by experiment, is so small as to indicate inappreciable expense in maintenance. The appreciable wear is confined to parts which are in continuous contact with steam having a high density and high velocity, and these parts are small, inexpensive, and easily replaced. The first set of stationary buckets is subject to more wear than any other part. In a 500-kw machine this part should wear at least two years and should not cost more than $25.

"All of these turbines have been designed for electrical purposes and for operation at a fixed speed, the design being made with a view to accomplishing the highest attainable economy at this speed. The machines will, however, operate at other speeds higher or lower, and will give a fairly good economy through a considerable range of speed. I cannot, from memory, give specific data on this subject. Such machines give a large torque at low speeds, but there is, of course, a very rapid reduction of efficiency as the speed is reduced. The normal speeds of some of the machines which I have mentioned are as follows: 5000 kw, 500 r. p. m.; 2000 kw, 750 r. p. m.; 1500 kw, 900 r. p. m.; 500 kw, 1800 r. p. m. All of these speeds are fixed by the frequency of the alternators which they drive.

"All of the machines which have been described are designed for operation with condensers. They are all suitable for use non-condensing, and it may be roughly estimated that their steam consumption non-condensing would be about twice as great as it would be with a good vacuum. It is hoped that better non-condensing results can be obtained with designs made particularly for that purpose.

"When these machines are operated with superheat the bearings are in no way affected by the high temperature, the bearings being entirely external to the turbine.

"The relative economy of one of these turbines and a Corliss engine may be judged by the steam consumption figures which have been given. Much of the advantage of the turbine in this respect arises from the high degree of expansion which can be provided for in its design. Under conditions which are ordinarily practicable, I think that the turbines, even in their present state of development, are very decidedly superior to Corliss engines.

"There is no appreciable change in speed of the turbine when the machine passes from a condensing to a non-condensing condition. To operate with the same load non-condensing it must open more admission valves; consequently, the range of speed would be slightly greater. As our machines have generally been built, the maximum variation of speed non-condensing would not exceed 3 per cent.

"The pressure required in the step-bearing of the 5000-kw machine is about 1000 lbs. per square inch, and that in the 500-kw machine about 200 lbs. per square inch.

"The clearance between moving and stationary parts in the four-stage machine, which has been described, is about 0.05 of an inch. A less clearance would be practicable, but would be of very little advantage.

"The effect of wear upon the step-bearing is to gradually lower the revolving part. In the 500-kw machines with which we have experimented, the lowering, after the lubricant had been stopped, went on at the rate of about 0.01 of an inch per minute. In no case has any damage been done through the failure of the step-bearing except the wear on the blocks themselves, which involves inappreciable expense. As a rule, it is not necessary even to re-surface the step-bearing blocks after a stoppage has occurred. They tend to wear to a proper engagement, and if they do not they can generally be made to do so by successive short interruptions of the oil pressure. In properly arranged installations troubles of this kind can easily be avoided, and this should, of course, be done if possible. Weighted accumulators, as a reserve on the pumping system, are very desirable in this connection.

"The effect of rubbing, between the moving and stationary parts of these machines, causes surfaces to wear away gradually, but does not cause the rapid injury which might be expected. In many cases, through improper arrangements or inaccuracy of work, we have had serious and repeated rubbing, but in no case has this put a machine out of service or caused any serious injury to it.

"The smallest machine which we have built is of 1¼-kw capacity, designed to run an electric headlight on a locomotive. Its speed is 5000 r. p. m.

"The packing around the shaft, where it passes from one compartment into the next, in our existing turbines, simply consists of a loose sleeve which gives a considerable clearance around the shaft and is free to center itself. The pressure tends to hold this sleeve in any position to which the shaft may force it. Since the sleeves are inaccessible, considerable clearance is used, so that there will be no risk of cutting. There is, of course, a loss through the leakage of steam past these sleeves. This loss is, however, not very great. We have used successful packings which give much less leakage, and they may be regularly adopted in future.

"There is no lubricant of any kind used in connection with these packings, and since the bearings are external to the turbine base, there is no means by which oil can get into the steam. This is one of the greatest advantages of our turbine, and is an advantage which has not been fully realized in turbines of other makes. In most of the plants which we have installed, water is being returned directly from the hot well to the boilers, and there is no waste of water or accumulation of dirt or scale in the boilers.

"Mr. Curtis has made arrangements for reversing turbines of this type by using a separate set of buckets on the same wheel designed to receive steam from an opposite direction. These reversing buckets would ordinarily be applied to the wheels which operated in the vacuum space, so that in reversing the machine would operate as a single-stage condensing machine.

"The driving power of the turbine is confined to the buckets which come opposite to the nozzles which are in flow, and these nozzles occupy only a portion of the circumference, except in the last stage, where they generally occupy all or nearly all of the circumference. There is no unbalancing of the wheels caused by the delivery of steam to one segment at a time.

"The steam required to drive auxiliaries will depend upon local conditions. In the 5000-kw installation at Chicago, all of the auxiliaries are driven by a single-cylinder Corliss engine, and this engine delivers 70 ihp when the 5000-kw machine is running at full load.

"I cannot give any definite statement as to the degree of

superheat which may be economical. I am inclined to think that where superheat is provided by increased heating surface in the boiler, it will be found economical to use considerable degrees of superheat, possibly 150. I will have much more information on this subject within a short time, and would rather not express a positive opinion at present. Every turbine shows a different degree of improvement by superheat. In some machines the advantage is undoubtedly small, while in others it is certainly very great.

"We have built a very successful direct-current machine for our 500-kw turbine, which operates at 1800 r. p. m. This machine is of a very radical type, and its success shows the possibility of much other work in the same direction. I cannot say just what the possibilities are, but I am inclined to think that we can successfully apply direct-current machines to most of the turbines which we have built for alternating work, and that the results from these machines will be very satisfactory."

CORRESPONDENCE

DROP LETTER BOXES ON CARS

DULUTH STREET RAILWAY COMPANY
Duluth, April 25, 1904.

EDITORS STREET RAILWAY JOURNAL:

In your issue of April 16 you refer to the use of drop letter boxes on cars. Letter boxes of this kind are carried on two of our lines in the city of Superior. On the line running to Billings' Park such a box is attached to a car at 3:47 p. m. in the center of the city, and makes a trip out and back, and is then taken to the postoffice. A mail carrier usually stops the car and puts what mail he has collected from the street boxes into this box. There is no postoffice or sub-station upon this line. The box is taken from the postoffice and is returned to the postoffice by one of our employees. On the line running to the East End a similar box is put on a car in the afternoon and taken off at the East End postoffice. Later in the afternoon the postmaster at the East End sends the box back upon another car, and it is taken to the central postoffice by one of our employees.

Persons sometimes stop cars en route to mail letters in these boxes, but not very frequently—if they did it would become a nuisance. The carrying of these boxes is something that was started before the present company had anything to do with the operation of the lines in Superior. The Government does not pay the company anything whatever for handling these boxes, although we handle closed pouches also upon the East End line and are paid for that service at the regular rate. We have recently had some correspondence with the Postoffice Department with regard to this service, and have had some thought of discontinuing it, but will probably not do so as it is more or less of an accommodation to the public, and we do not want to take any action that would inconvenience those accommodated by it unless it should become a nuisance.

HERBERT WARREN.

SAND TUBES FOR SANDING

Rochester, N. Y., April 30, 1904.

EDITORS STREET RAILWAY JOURNAL:

It is well known that most sand boxes will not sand the rail properly when the car is passing around a curve. The reason for this is that as the box is carried on the car floor or platform and is placed directly over the rail when the car is on straight track, it will throw the sand to one side of the rail when on a curve. There are one or two methods for correcting this trouble, but as a rule when a car gets stalled on a curve the motorman or conductor gets a handful of sand out of the sand box and throws it under the wheel. To do this he usually has to ask the passengers who are sitting over the sand hopper to move so that he can get at the sand. Another serious objection to this primitive method of sanding the track is that the conductor's hands become soiled by contact with the sand, and this is not a desirable thing for a man who has to hand out and make change all day.

It has always seemed to me that it would be a very easy thing to provide two or three paper or tin tubes filled with sand and hung up some place in the car. These tubes should be about the same size as those used for dry fire extinguishing powders; that is, they should be 2 ft. or so long, perhaps 2 ins. in diameter and capable of holding a quart or so of sand, and might be hung up by a hook inside the car. When the car wheels commence to slip on a curve, it would then be a very easy thing for the conductor to grasp one of these tubes, pull it down so as to pull off the cover, step out of the car and throw under the wheels all or part of the sand contained in the tube. The tube could then be hung up again and refilled at any time. The tubes would also be useful in putting out flaming fuse boxes, and also for cleaning up the car floor from any cases of car-sickness.

R. P. GORMAN.

ELECTRIC VERSUS STEAM LOCOMOTIVES

New York, May 9, 1904.

EDITORS STREET RAILWAY JOURNAL:

In the issue of April 30 the editorial comments on the high-speed tests of German steam locomotives and on speeds attained in this country were interesting. The writer, who has some knowledge of both sides of the question—that of the contest for supremacy between the steam and electric locomotive—is of the opinion that the fight has only begun. Certainly most steam engineers are to-day as confident of victory as ever, and do not consider the contest at all one-sided, as our electrical friends seem to think it.

The strongest argument of the steam engineer is their contention that they will never be beaten in the long-distance haul. They do not necessarily mean high speed or great mileage per locomotive day, but length of track. They believe that there is a limit to the distance which it would pay to equip with electric traction a railway doing a general freight and passenger business, and in the present state of the electrical art they are right. They are not yet ready to admit defeat even in short-haul suburban passenger traffic, and will await the result of those, to them, experiments which are about to be tried at enormous expense by several railways.

To one who has watched the improvements in both kinds of locomotives during the past five or six years, it is difficult to decide whether the steam or electric locomotive has improved the faster. The steam locomotive of to-day presents about the same comparison to that of the earlier date as does the modern interurban car to that of six years ago.

The improvements in the steam locomotive, as exemplified in the "Atlantic" and "Lake Shore" types have been many. They include the wide fire-box, with its immense grate surface, and the increase in size and capacity of the boiler. The boiler pressure has been carried up to 250 lbs. per square inch, and the steaming capacity of the boiler, even with poor fuel, has been made sufficient to supply the largest cylinders which could be used with the tractive weight of the engine. The use of the piston value and the various types of compound cylinders has added greatly to the general efficiency.

It must not be supposed that this increase in efficiency means higher speed with a decrease in consumption of fuel, water and oil. The steam engineer was not trying to do that, but to reduce the cost per ton-mile hauled, and he has succeeded. He hauls freight and passenger trains of far greater weight than before, and at higher speed at less cost.

A somewhat mistaken idea has been held by many that the

steam locomotive designer is trying to save weight. This is not always so, but frequently railways ordering new power specify the maximum weight, generally on account of the strength of their bridges, and sometimes the weight of their rails.

They also carefully specify the minimum clearances of their railway, and locomotive design has now reached the point of producing the most powerful engine that can be built within given dimensions of height and width. The result of the increase in the size of boiler, diameter of wheels, etc., has all tended to raise the center of gravity so that if clearances were somewhat increased it would hardly be safe to raise it further on our now narrow standard gage.

Referring to speed contests, especially long steam locomotive runs, is there any evidence to support the theory that the locomotive failed to maintain the speed acquired in a spurt because of lack of steam?

The man at the throttle of a modern locomotive running at a speed of 100 m. p. h. over the best American railway, would have to be made of steel if he was to maintain that speed between water stations, even if they were 200 miles apart. Assuming that the grades are negligible, the alignments, strength and rigidity of the track determine the speed of either the steam or electric locomotive, although it must be true that the electric locomotive can be safely driven much faster over the same track than the other, owing to the absence of the terrific vibration produced by the reciprocating parts.

If, on the other hand, a straight rigid track of any length be built for the purpose of holding competitive speed tests between the steam and electric locomotive, the "power station on wheels" will surely be beaten as long as reciprocating engines are employed. The speed of the steam locomotive is limited by the speed of the steam in passing in and out of the ports, and by the effect upon the engine itself and upon the track, of the vibration caused by the great piston speed and the weight of the driving rods.

In discussing extremely high speeds in the future the "personal equation" of the engine driver must inevitably come into the question. Probably not one man in a thousand is able, however well trained, to drive a steam locomotive at a fairly continuous speed of 80 m. p. h. to 100 m. p. h., and do it day after day, without breaking down. The same conditions do not apply to an electric locomotive running at the same speeds. The sensation is different, and the strain is not so great, except that of watching signals. The electric motor seems to float and hardly touch the track, the motion is perfectly smooth, and one is apt to feel a sense of gratification that the car is heavy enough to hold itself down to the track, and that the steel-tired wheels have the M. C. B. standard tread and flange.

It is a little strange that many writers seem to put so much stress on the necessity of economizing weight in the design of a high-speed electric locomotive or car. Of course, a car can be made too heavy, but the trucks must be made heavy enough and strong enough to carry the powerful motors, and the car body of sufficient strength to withstand the strains incident to extreme high speed.

Perhaps those who are devoting their attention to increasing the speed of the steam locomotive do not realize that it is possible to design and equip an electric locomotive with motive power far greater than they can ever hope to achieve with the reciprocating steam engine within the limits of space required. It may be difficult to realize that it is not at all impossible to provide motors powerful enough to drive an electric locomotive or car up to a speed of, perhaps, 200 m. p. h. if all other conditions were favorable. In other words, the electrical designer is not troubled by the question of power, but only need concern himself with the resistance of the air as the ultimate limit beyond which he cannot go.

EDWARD C. BOYNTON.

MOVING THE PUBLIC FORWARD

Newark, N. J., May 5, 1904.

EDITORS STREET RAILWAY JOURNAL:

A careful perusal of the criticism in your issue of April 30 of the article entitled "Moving the Public Forward," convinces me that the gentleman who wrote it conducted his persistent studies from elsewhere than the rear platform of a street railway car. He speaks three times of the will of the conductor and the conductor's wishes in the matter. In regard to moving with a hydraulic rammer, I will say that I certainly would like to move out of the way those passengers who make themselves a nuisance on the rear platform, with a hydraulic rammer or anything else which would be effective. Where passengers are allowed to leave the car by the front platform, as in this city, the argument that it is necessary to stand on or near the rear platform in order to leave the car without crowding or pushing, disappears. A street railway company very properly can, and should, formulate rules which will save those passengers who occupy seats within the car from the necessity of pushing their way out through a crowd of men standing on the rear platform. Women passengers, especially, need this protection when these passengers include, as they often do, one or more of the rowdy class. Any legitimate means of forcing these persons to "move forward" would be welcome.

WILLIAM BROWN.

REMARKABLE EARNINGS OF THE DES MOINES-COLFAX LINE

In an interview with a representative of the STREET RAILWAY JOURNAL recently, President H. H. Polk, of the Interurban Railway Company, stated that the gross earnings of that company's line, between Des Moines and Colfax, were nearly $5,000 per mile of single track for the first year of operation. This record is remarkable, because of the low population tributary to this line.

In the STREET RAILWAY JOURNAL of June 20, 1903, an article was published regarding this company's lines, and comment was made on the high earning capacity of the Colfax line up to that time, which was before the summer business opened up. At that time it was stated that the earnings would be at least $3,200 per mile, but that they would reach close to the $5,000 mark, and rival the earnings of many interurban properties running through much more thickly populated districts in Ohio, Michigan and Indiana, few would have dared to predict at that time.

The population tributary to the Des Moines-Colfax line, outside of the city of Des Moines, is not over 286 per mile, counting in everything that can be counted on a most liberal estimate. The actual population in 1900 of the towns and villages along the line was about 100 per mile.

When asked to explain the reason for such unusual earnings with such a small population, Mr. Polk says that it is probably due to the prosperous condition of Iowa farmers. The farms in Iowa are not as large as in some of the States where interurban building has been more extensive, hence the rural population per mile is not large, but what population there is has money to spend. The company sells mileage tickets, containing 500 miles, for $6.25. These mileage tickets are good for three persons. The mileage is on a strip, and the general form of the ticket is similar to the strip mileage used extensively by steam railroads. The three holders of a ticket must sign it when it is issued, and identification is by signature. It is believed that the selling mileage tickets to farmers encourages riding very much, as when once a ticket is purchased the inclination is to make use of it sometimes when cash fare would not be paid.

CONVERTIBLE CAR AT ST LOUIS EXPOSITION

The car shown in the accompanying illustrations is one of the three patented types exhibited by the J. G. Brill Company at the St. Louis Exposition. It is a significant fact that the main features of this car are the same as the first car of its type exhibited in 1898. In that car the window sashes were hinged together, while in the present arrangement the lower sash is raised alone until the tops of both sashes are abreast when they automatically engage, and the smaller sash is carried on the larger into the pocket. This lessens the depth of the pocket, and is an exceedingly simple and satisfactory method. The former type of revolving seat has been replaced with a stepover seat with a wider and more comfortable cushion. Brackets close the space between the seat back and the post, and are made to serve as grab handles, doing away with the usual grab handle on the outside of the post. Entrance guards slide inside the posts, and when not in use are held by patent gravity catches under the curtain guards. For cars longer than the one shown, longitudinal corner seats for three passengers are used, and solid panels extend from the double corner post to the first side post.

EXPOSITION CAR READY FOR WINTER SERVICE

INTERIOR OF CONVERTIBLE CAR AT ST. LOUIS EXPOSITION

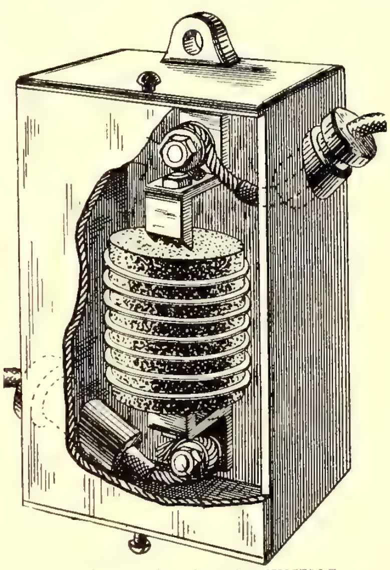
This car for the Exposition is finished in solid mahogany, of natural color, rubbed to an egg-shell gloss and richly inlaid with holly and ebony. The ceilings are of bird's-eye maple, with graceful decorations. Length over end panels, 25 ft. 9 ins., and over vestibules, 35 ft. 2 ins.; from end panels over vestibules, 4 ft. 8½ ins.; width over sills and panels, 7 ft. 6¼ ins., and over posts at belt, 8 ft. 1 in.; sweep of posts, 3½ ins.; from center to center of side posts, 2 ft. 7 ins.; thickness of side posts, 3⅜ ins., and of corner posts, 3¾ ins. The side sills are 4¾ ins. x 7 ins., with 7-in. x ⅝-in. plates on the outside; end sills, 4¾ ins. x 7 ins. Among other patented specialties of the builder's make with which the car is equipped are angle-iron bumpers, radial draw-bars, "Dedenda" gongs, "Dumpit" sandboxes, ratchet brake handles, and round-corner seat-end panels. The cars are mounted on Brill "Eureka" maximum traction trucks with 4-ft. wheel base, 33-in. driving wheels and 20-in. pony wheels.

EXPOSITION CAR READY FOR SUMMER SERVICE

NON-ARCING LIGHTNING ARRESTER

The Franklin Institute, Philadelphia, Pa., has recently awarded the Edward Longstreth medal of merit to H. M. Shaw, of Newark, N. J., for the invention of the non-arcing lightning arrester shown in the accompanying cut. The simplicity of this device will be apparent from the following description:

The arrester is furnished with a plate of insulating material to which flat metal ribbons are secured by screws, the latter serving also as binding posts for one stranded wire and one grounded wire. These ribbons project from the plate for a certain distance, and are then bent parallel to the plate so as to have their serrated edges directly opposite. Between these serrated edges is placed a composite cylinder made up of alternating plates of non-arcing material, such as carbon and thin mica sheets. The carbon plates are mounted on insulating washers, and the mica plates extend down between these washers to a bolt made of some non-conducting material. The ends of this bolt are attached to the metal ribbons, as shown in the illustration.



NON-ARCING LIGHTNING ARRESTER

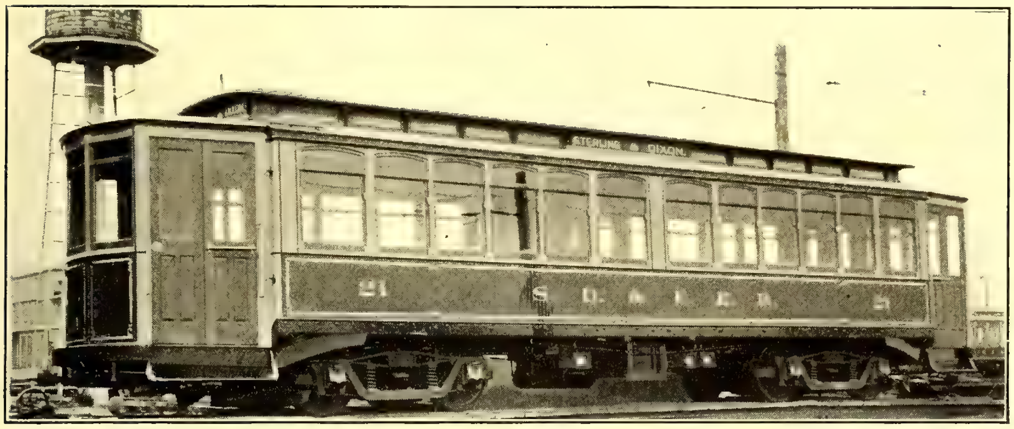
The lightning discharge enters the instrument by way of the stranded wire, passes through the first ribbon, and on reaching the serrated edge of this ribbon is broken up into small arcs and diverted to the flat carbon discs, which in turn break up the discharge into infinitesimal sparks. The latter are received at

the serrated edge of the second ribbon and conducted to the ground. By thus sub-dividing the discharge its destructive effect is reduced to a minimum, while the resistance of the composite cylinder is so great that the line current cannot follow the static discharge. The complete instrument consists of the foregoing parts mounted in a substantial case having a removable front.

STERLING AND DIXON INTERURBAN CARS

The cars for the Sterling, Dixon & Eastern Electric Railway, illustrated herewith, have a length of body of 34 ft. and a length over all of 46 ft. The width over all is 9 ft. These cars seat forty-four people. The platforms have double folding doors on each side. There are two compartments, one for smoking. Between the compartments is a heater on one side and closet on the other. The cars have the St. Louis reversible seats, covered with canvas-lined rattan. At each end of the car and next to the partition are longitudinal seats. The doors in the partition are double-sliding automatic as well as in the vestibule. The sash is arranged to drop as on a city car.

The trucks are the St. Louis Car Company, 23-AE, which is built on the same general lines as the other No. 23 trucks of this company, the main difference being in the arrangement of the end frames. G. E.-70 motors are used under this car. The sand-box and draw-bars are also of St. Louis manufacture.



EXTERIOR AND INTERIOR VIEWS OF INTERURBAN CAR FOR STERLING, DIXON & EASTERN ELECTRIC RAILWAY

IMPROVEMENTS ON THE METROPOLITAN ELEVATED, CHICAGO

The Metropolitan Elevated Railway Company, of Chicago, has recently ordered sixty-eight new motor cars, in anticipation of an increase of its train service next fall, when its new stub terminal at Fifth Avenue, near Jackson Boulevard, is completed. The plan is to run a large number of trains into this stub terminal during the morning and evening rush hours instead of operating them around the loop, as the maximum possible number of trains is now being operated around the loop. These sixty-eight new motor cars will be equipped with the Westinghouse electro-pneumatic turret train control system. The adoption of a train control system is essential to the rapid handling of trains in a stub terminal of this kind. The new motor cars, twenty-four of which will be built by the Jewett Car Company and forty-four by the American Car & Foundry Company, are to have sheet-steel floors underneath the wooden floors for preventing the spread of fires due to electrical causes underneath the car. The car wiring will be run in iron pipe conduit. The company has under construction an all-steel car, as an experiment, but owing to the importance of early delivery (as the present order of sixty-eight motor cars must be ready for service next fall), and because of the many details calling for special parts in an all-steel car, it was decided not to adopt the all-steel construction for this order. It is believed that the steel sub-floor will prevent the spread of the majority of fires, as the greater part of them originate under the car floor. The motor cars will have two motors each. Fifty-six G. E.-55 motors have been ordered and fifty Westinghouse 150-hp motors. One motor car will be used per train for this stub terminal service, and trains of not over four cars will be run. For some of the new motor cars motors will be taken from present four-motor equipments which the company has.

It is interesting to note in this connection that for the past three years the company has been operating a service terminating at Canal Street during the rush hours, and in this service twenty three-car trains have been used. These trains have consisted of a motor car with two trailers. In order that the train can be operated from either end without switching at the terminals, the motor car is placed at one end of the train with a type-L controller, and in the rear of the trailer at the other end is a modified type-L controller. By running three wires the length of the train from the motor car to the rear controller, the rear controller can be used to operate the motors either in series or parallel. The reversing is accomplished by electro-pneumatic control of the reverse cylinder on the motor car controller. An air cylinder, controlled by electro-pneumatic valves, throws the reverse switch of the motor car controller one way or the other. The circuit controlling these valves is connected to the reverse switch of the trailer controller.

The company has ordered two batteries, one to be placed at Forty-Sixth Avenue, on the Garfield Park line, and the other at Robey Avenue and North Avenue, on the Logan Square line. Both these batteries are the chloride type, with a capacity of 1200 amps., discharging at the 1-hour rate. Boosters will be installed in connection with these battery plants, and the object of the battery is to aid in carrying the morning and evening peak loads, which are very high compared to the midday load. The company has three-times the number of cars in service during the rush hours that it has during the middle of the day, and this difference is likely, if anything, to be increased when the new Fifth Avenue terminal is established.

Representatives of the Pavers' Union called on General Manager Stanley, of the Cleveland Electric Railway Company, a few days ago, to remonstrate with him for employing Italians, who work for $1.65 to $2 a day on paving work, as compared with the union scale of 50 cents an hour. The union leaders claimed the Italians were poor workmen, slow and wasteful, and that it would be cheaper in the long run to employ union men at the wage mentioned. Mr. Stanley stated that his company was looking for results, and that he would try a gang of union men with a union foreman, and that if they could show that union labor was cheaper the company would employ union pavers in the future. The proposition was accepted.

THE MANUFACTURE OF OVERHEAD APPLIANCES AT MANSFIELD, OHIO

The importance to successful railway operation of high standards of overhead insulation, and the probability of the use, through the development of the alternating current railway motor, of still higher voltages than those now employed, make a study of the methods of

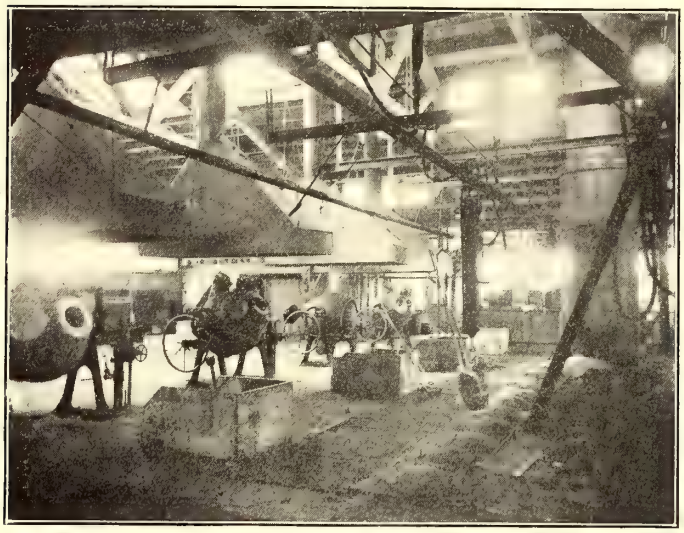


FIG. 1.—PART OF BRASS FOUNDRY, SHOWING GAS FURNACES

insulation for overhead conductors of more than ordinary interest at the present time. It is proposed in the accompanying article, therefore, to outline the practice in this respect of the Ohio Brass Company, as well as to describe briefly certain of the main features of the company's present works.

The plant of the Ohio Brass Company covers about 5 acres, with a floor space of buildings of about 200,000 sq. ft., and possesses the unique distinction of occupying a triangle made by three of the great trunk lines of the country, the Pennsylvania, the Erie and the Baltimore & Ohio Railroad. As switches connecting with each of these lines extend into the company's grounds its shipping facilities are of the best.

The power for the entire plant, as well as the heating of the several buildings, is furnished by a power plant, which occupies a separate building. The equipment consists of two tandem compound Buckeye engines, one being 300 hp, and the other 200 hp. Each of these engines is direct connected to a two-phase alternating-current Westinghouse generator of 180-kw and 120-kw capacity, respectively. These generators are arranged to run in parallel. The machinery throughout the plant is driven by fourteen induction motors of various sizes, each manufacturing department being operated by an individual motor. The boiler equipment consists of five Cahall water-tube boilers, aggregating 800 hp. The exhaust steam from the engines is piped through the various buildings for heating. A large air compressor is also provided for operating the pneumatic carriers in the foundry, and several other devices.

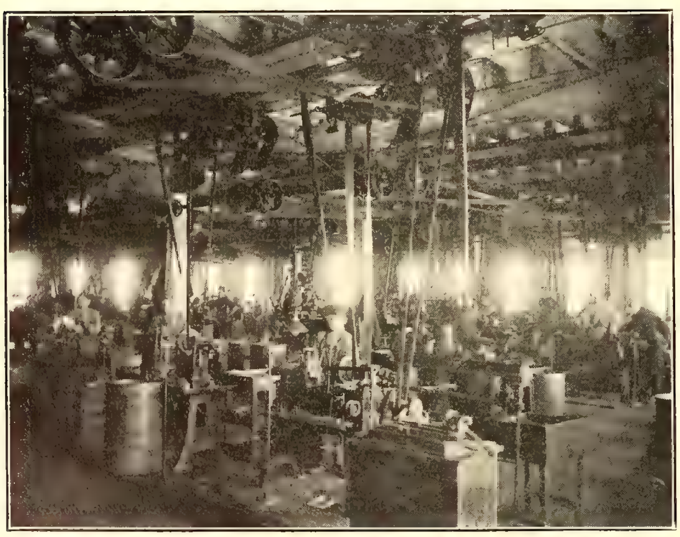


FIG. 2.—BRASS FINISHING MACHINE SHOP

As the greater portion of the products of the company is produced from castings, the foundry and coremaking departments are very extensive. In the brass foundry the company melts up an average of from 8 tons to 10 tons of metal per day. A view of the brass foundry is presented in Fig. 1. Until recently, all metal was melted in crucibles in brass furnaces, and twenty-eight of these furnaces are still in regular use. In addition to these, four large gas furnaces to use natural gas have recently been installed. By this method the metal is melted much more quickly, so that the output of material is much greater than by the old method. Installed in the foundry is a pneumatic carrier system for conveying retorts of molten metal to and from the furnaces. As both wood and metal patterns constitute one of the most valuable assets of a firm in this line of business, it is essential that they be fully protected against danger of loss by fire, and for this purpose a large three-story fire-proof brick vault has been built in connection with the foundry where all patterns are stored except when in use. Each of these patterns is numbered and indexed by a card index system, so that any one of the many thousands of patterns can be located in a moment. A large pattern shop is operated in connection with the plant for the manufacture of both wood and metal patterns.

The brass finishing machine shop, in which all brass parts are finished, occupies the second floor of the larger building. A corner of this shop is shown in Fig. 2. The equipment embraces the latest types of engine lathes, turret lathes, planers, milling machines, etc. A number of special turret lathes are employed which have been designed especially for the particular work which they

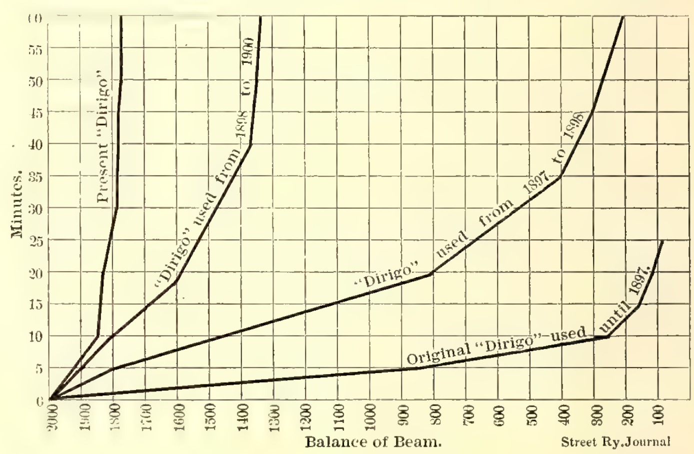


FIG. 3.—DIAGRAM SHOWING IMPROVEMENT IN DIRIGO

produce. Among the products of this department might be mention a large variety of trolley ears, clamps, etc., as well as motor bearings. Of the latter, over 150 varieties are made, all of which are accurately machined to gage. A large and well ventilated polishing department adjoins the brass finishing shop.

The general machine shop occupies the first floor of this building. Here is performed all the general machine work aside from the brass finishing. The equipment is very complete, including a number of very heavy tools. Aside from its railway material, the Ohio Brass Company is a large manufacturer of brass, bronze and copper goods of all kinds, and at present is doing considerable heavy work for the government war and navy departments. A part of the general machine shop is divided off for a tool room, where nearly all the special tools, dies, etc., used in the various departments are manufactured. A corps of tool makers is regularly employed at this work.

Probably the most interesting part of the establishment is the insulation department, which occupies a fine, new building 165 ft. long x 75 ft. wide, constructed entirely of brick and having a structural steel roof frame. The company has made a careful study of insulating material, and its present insulation, which is known to the trade as "Dirigo," is the result of experiments covering a number of years, with a great variety of substances, careful observations of the practical uses and results of these substances, together with the installation of a number of special machines for working the material. The requirements of a successful insulation for overhead line material are numerous. It must have extraordinary tensile strength, and great resistance to crushing strain. It must be absolutely uninflammable and moisture-proof, and must be able to withstand extremes of temperature, and above all, must be highly non-conductive. An interesting little book recently issued by the company on the sub-

ject of insulation shows, in the form of a curve sheet Fig. 3, the progress made in developing Dirigo insulation along the lines indicated above. The insulation is made directly from materials in the raw or crude shape. Fibres and gums of several kinds form the basis of the composition, and with these are mixed numerous other ingredients for obtaining the desired results. The composition, after being thoroughly mixed in special mixing machines, is ready for moulding, and is delivered to the pressmen operating hydraulic presses, where it is placed in dies and subjected to hydraulic pressure, which in some cases is as high as 80 tons. The hydraulic presses are operated by means of high and low-pressure pumps and a steam accumulator. Evidence of the extreme care used in maintaining the quality of Dirigo insulation, is shown by the fact that any waste composition remaining after each piece has been formed and smoothed off, is thrown into the scrap heap and afterward destroyed. It is never worked over again, as it is claimed that the wear from the dies and presses, together with dust collected, might impart to the composition particles of metal and other foreign substances which would tend to depreciate its insulating qualities.

Before leaving the insulation room, each piece of insulation is given a careful test, both electrically and mechanically. After the various parts have been assembled, and just before the complete article is shipped, each insulated piece is given another, and more thorough test. The testing devices used in this final test are located in the shipping department, and are shown in Fig. 4. In the mechanical test, each insulator is subjected to a severe tensile strain, which tests not only the strength of the insulation, but also the malleable iron or bronze castings which constitute part of the article. In the electrical test, insulators which are

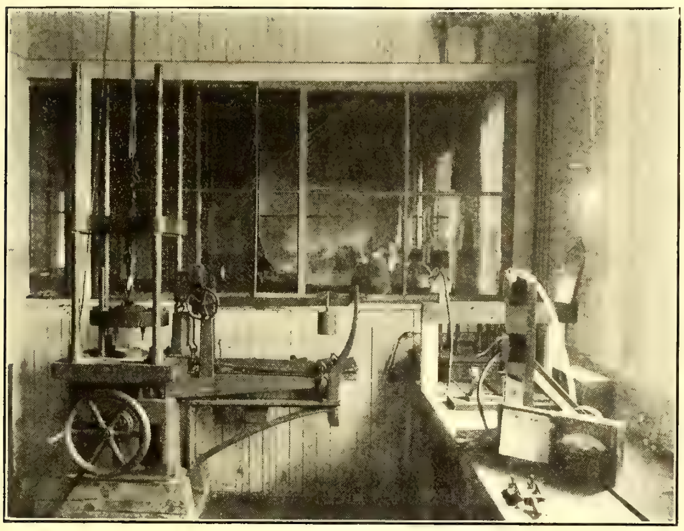


FIG. 4.—APPARATUS FOR APPLYING STRAIN TESTS TO INSULATING DEVICES

designed for 500 to 600 volts are tested to from 7000 to 10,000 volts. Any material which proves defective in the slightest degree in any of these tests is immediately destroyed, so that there is no possibility of any being shipped which is not up to standard.

All overhead material in which malleable iron is used is given either a japanned or galvanized finish. The japan finish used is what is known as the "baked finish," and not air dried, as the baked finish will stand rough usage in the weather much better than the air dried. The galvanizing department is a large one, and contains seven galvanizing tanks.

The production of rail-bonds is a large and important part of the company's business, and a specialty is made of the well-known "all wire" bond, which, as its name implies, is constructed wholly of wire. The wire is received on reels as continuous copper cable and is first cut to length. The pieces are passed to a special press, which bends them at right angles, and then doubles them. From there they pass to an upsetting machine, which forms the ends into the terminals, the strands of wire being compressed cold into the shape of the terminals, although the size of the latter is considerably larger than in the finished bond. Bonds in this stage are shown on the truck in the foreground of the view of the rail-bonding department (Fig. 5). The ends of the bond are then heated, one at a time, to the welding point in a special furnace, and in this condition are placed in a special press designed by the Ohio Brass Company. The dies in this press compress the terminals to approximately the required size and shape, and the wires composing the terminals are perfectly welded together into a homogeneous mass of solid copper. The terminal is finally placed in a trimming die and finished accurately to size. Bonds of this type are made in twelve varieties.

A new soldered bond, known as the Type G, which has lately

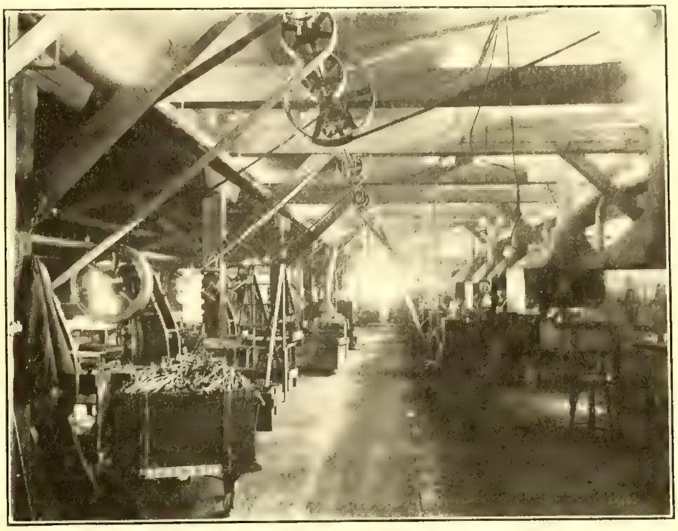


FIG. 5.—RAIL BOND DEPARTMENT

become very popular, is made in a manner similar to the process described above. The bond consists of a number of strips of soft cold rolled copper, the ends of which are welded, forming solid copper terminals. They are secured by soldering them to the ends of the rails, and for this purpose a special soldering torch and the requisite tools are supplied. The soldered bonds are made in two standard forms, one for attaching below the rail, and the other for attaching at the side of the ball of the rail.

As a large part of the product is shipped in barrels and boxes, an extensive carpenter and cooperage shop is required for the making of barrels, boxes, etc.

Although the company has been a strong advocate of, and has accomplished a great deal in the standardization of track and line material, it can fairly be said that the company has ever been ready to develop and bring out material to conform to the ideas of railway engineers who desired special goods, and a large part of its success has undoubtedly been due to this fact. A good idea of the number of articles manufactured by the company is best discernible by a walk through the storerooms. For example, in the line of pole brackets are over sixty types, the number of pieces in each ranging from fifteen to thirty, and each arm is made in four different lengths, and also several sizes of pipe. In the standard forms of line material manufactured, provision must be made for four sizes of round trolley wire four of figure 8 wire and three of grooved wire; in addition to this, a number of ears are made in a variety of different lengths and trolley wire hangers are made in bronze metal and malleable iron, both galvanized and japanned. From this the large variety which must be carried in

FIG. 6.—FIRST FLOOR OF WAREHOUSE NO. 12, SHOWING ARRANGEMENT OF SECTIONAL BINS

stock will be readily realized. In addition to overhead materials the company makes, or handles, an extensive line of motor and car supplies, general electrical supplies, third-rail insulators, construction tools, track-bonding tools, etc.

FINANCIAL INTELLIGENCE

Wall Street, May 11, 1904.

The Money Market

Rates for money have made the low records of the season in the course of the last fortnight. A million or two was actually offered and loaned on the Stock Exchange last week at ½ of 1 per cent. For sixty day accommodations on good collateral as low as 2 per cent was quoted, 2½ was paid for ninety days and 4 per cent for loans extending over the first of the year. The same conditions of extreme ease are revealed in the market for commercial paper. Here they take the form of an urgent demand on the part of bankers having money to lend, for all paper of the better grades that is offered for discount. Rates are quoted on the business at 4 to 4¼ per cent. Until Monday of this week, the supply of funds in all branches of the market ran far ahead of the requirements. A change toward a nearer balance between supply and demand has been noted, however, within the last day or two. The cause of this lies plainly enough in last Saturday's remarkable bank statement, which showed a decrease of $10,400,000 in the surplus reserve. This somewhat startling shrinkage is ascribed to the operations connected with the New York City bond issue of $37,000,000 announced a week ago. The City Treasury has evidently been borrowing heavily in anticipation of the proceeds of the sale, and this accounts for most of Saturday's $21,000,000 loan expansion. When the subscription money is all in, these loans will doubtless be paid off promptly and surplus reserve will regain most of what it lost in consequence of the operation. The effect on the money market has, on this version of the case, been more moderate than would ordinarily have been expected. The surplus even as it is, reduced below $23,000,000, compares with a total of only $10,000,000 for the corresponding date last year. While we are witnessing precisely what these articles foreshadowed several weeks ago—a rapid decline in bank reserves, the movement is not likely to go far enough to change the present easy situation very seriously. As soon as there is any hardening at all in money rates, the export of gold will cease, and with it the only important source of depletion for local bank resources.

The Stock Market

Extreme dullness has been the only feature in the week's stock market. Considering the stagnation in every quarter, prices have held very well, only a few of the regularly active issues having changed as much as a point. New York Central has been conspicuously weak on the report that the management are about to come out with a note issue. The Erie stocks have also shown some special selling pressure due partly to the poor earnings of the company and partly to their comparatively unprotected position in the market, now that the voting trust has been dissolved. Consolidated Gas has declined sharply on the expectation that the Governor will veto the so-called Remsen Bill, and Metropolitan Street Railway has slumped again for reasons which will be discussed presently. With these exceptions the market has held up very firmly. In spite of the unusually low condition —76 per cent—revealed in yesterday's monthly report on winter wheat, and in spite of the rather gloomy advices concerning the railway traffic outlook which have recently been received, holders of the granger railroad stocks seem to be confident of their position, and bearish operations directed against this group have so far failed to make headway. The view taken in banking circles is that the present dullness is a reflection of the lull which is everywhere being observed in the country's industries. Uncertainty as to the presidential nominations and elections, and as to the harvest future is largely but not entirely responsible for this lapse in activity. Beyond and above these more obvious influences is the fact that investment confidence, so rudely shaken in the upheaval of a year ago, needs a longer interval before it is completely restored. It is showing itself to a gratifying degree in the higher branches of the bond market, but there are no signs of it reaching yet awhile to the stock market. The men who manage the great Stock Exchange campaigns are undoubtedly waiting for the time when they can appeal to investment capital with more hope of success than they can just now. In this lies the real secret of the market's inactivity.

Metropolitan has been the center of interest in the local traction group this week. The theory now held by professional Wall Street, is that there must be something wrong with a 7 per cent guaranteed stock for it to sell so low. The argument is that either the price ought to be considerably higher or that it ought to be considerably lower, that the stock would be worth a good deal more if the dividend were regarded as absolutely safe, consequently it must be assumed that those who are in a position to know do not feel entirely secure that the 7 per cent can be maintained. These are the current Wall Street opinions given for what they are worth. They have been strengthened by the recent figures of the State Railway Commission, showing that Metropolitan has borne only an inconsiderable share in the general increase of the city's traffic during the past year, and by the further reflection that the opening of the subway is bound to cut heavily for a time at least into the company's business. On the other hand Manhattan stock has been bought by investors who have been impressed by the excellent showing of traffic disclosed in the State Commissioners report.

Philadelphia

The only features in the recent Philadelphia trading have been the strength of Union Traction stock and the weakness of Philadelphia Electric. The latter has again been heavily sold on the talk of an impending assessment, and it has shown itself more sensitive than any of the other traction properties to the collapse in certain other and more notorious quarters of the Philadelphia market. At 5¼—the low price of the week—Electric shares showed a loss of a full point from the high a month ago, which is considerable of a drop for a stock with a $10 par value. The advance in Union Traction to 50⅛—the highest price in a long time—is explained simply on the ground of an active inquiry from investors. Philadelphia Traction rose sympathetically a half point to 96. Philadelphia Company common was fairly actively traded in, but within a narrow range between 38½ and 39. The preferred sold at 44½. American Railways gained a half point, from 44 up to 44½. Only one sale of Rapid Transit was reported at 13. Consolidated Traction, of New Jersey, was notably strong, 150 shares changing hands between 64¾ and 65. Fairmount Park Transportation rose from 25 to 26 on transactions of 200 shares. One hundred Reading Traction went at 30½, 10 shares of Indianapolis Street Railway at 85¼ and 160 Rochester Passenger at 103. Three hundred United Railways, of San Francisco, common, sold at 10½ and 10¼ and the same amount of the preferred from 45¾ to 46¼.

Chicago

It is the opinion in speculative circles that the recent decline in the shares of the Union Traction and affiliated securities was greatly aggravated by bearish operations. In part proof of this West Chicago stock was offered down to 38, then when a genuine order to buy 100 shares came into the market it could not be executed better than 40¼. Union Traction has been active and stronger during the past week, selling at 5⅜ and 5½. According to present expectations, the decision in the ninety-nine-year franchise case will be handed down about May 25. Recent purchases of Union Traction shares have been based partly on the idea that this decision will be in the company's favor, and partly on the improving earnings of the lines, which, during April, were fully 15 per cent larger than a year ago. According to Exchange gossip the Metropolitan Elevated also had an excellent month last month, its earnings figuring out at the rate of 4½ per cent on the preferred stock. The market for the shares has shown no enthusiasm, however, over these computations. Scattering sales have occurred between 46 and 46¾. Lake Street Elevated receipts sold at 3¼ and 3⅜. Fifty shares of Nothwestern common went at 16, and South Side was strong at an advance of half a point, from from 91 to 91½.

Other Traction Securities,

Boston traction specialties have generally gone backward in the market of the last two weeks. Elevated, after selling as high as 142, sagged off to 140⅛ and then rallied to 141. Massachusetts Electric common dropped from 20 to 19¼ recovering only to 19½, while the preferred was decidedly weak at a decline from 73¾ to 72¾. West End common receded from its top figure—92⅝—to 90, but only odd lots sold at the lower level. West End preferred, on the other hand, rose a point from 111 to 112. Georgia Railway & Electric issues—newly traded in on the Boston Exchange—

were active, the common advancing from 38½ to 40, and holding most of its gain, the preferred rising from 79½ to 80. In Baltimore weakness has continued in United Railways securities; it is apparently part of a general downward movement among all the Baltimore home properties, which has been in progress intermittently since the fire. One hundred shares of the stock sold last week at 6¾—the low of the season. The income bonds, which have recently been quoted as high as 53, touched 49½ and rallied only to 49¾. The 4 per cent bonds meanwhile fell a point from 91¼ to 90¼ and later rallied to 90¾. Trading elsewhere in the Baltimore traction department was less active than usual. Anacostia & Potomac 5s lost 2 points from their late high figure, selling down to 98. Other sales comprised Lexington Street Railway 5s at 99½ to 100, Augusta Street Railway 5s at 101, and Norfolk Railway & Lighting 5s at 80. On the New York curb Interborough Rapid Transit has been decidedly strong, selling up to 110¼, as against 107 two weeks ago. Trading on the advance has been light. One hundred and fifty St. Louis Transit sold last week at 13 and 12½. A small lot of American Light & Traction preferred went at 92. Nassau Electric 4s have again been actively bought between 80 and 80½. New Orleans Street Railway 4½s sold between 75½ and 76.

Tractions were inactive at Cincinnati last week. Cincinnati Street Railway sold for about 330 shares with a range of from 137½ to 138. Detroit United dropped to 61½ and Toledo Railways & Light declined to 20¼ on small sales. Cincinnati, Newport & Covington preferred sold at 85½ to 86 on three small sales and the common sold at 30, a decided decline from recent prices. Cincinnati, Dayton & Toledo 5s sold at 78, also a decline. Five hundred shares of Miami & Erie Canal sold at 50 cents a share, which shows that holders are willing to take anything they can get to relieve themselves of the responsibility.

At Cleveland, Cleveland Electric advanced to 72¾ on sales of 175 shares. Northern Ohio Traction & Light came into the trading at irregular prices from 13½ to 14, all small lots. A small lot of Elgin, Aurora & Southern sold at 28, two points off from last sales. Northern Texas sold ex-dividend at 35½, a fraction above the last previous sale. Aurora, Elgin & Chicago 5s sold at 77½, a decline of two points from last sale. Demand for Northern Ohio Traction & Light 5s was active, and the price advanced from 70 to 72¾ on sales of $15,000 worth. The 4s sold at 57½ for $5,000 worth. It is stated that negotiations are pending with Eastern bond buyers for taking up the $3,000,000 first mortgage issue of the Aurora, Elgin & Chicago Railway, and the $2,000,000 of Northern Texas Traction Company's 5s which are held under pool agreements until July 1.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with two weeks ago:

	Closing Bid April 26	Closing Bid May 10
American Railways	44	44½
Aurora, Elgin & Chicago	a14..	a14
Boston Elevated	142	140
Brooklyn Rapid Transit	46½	45¾
Chicago City	155	158
Chicago Union Traction (common)	5½	5½
Chicago Union Traction (preferred)	30¼	30½
Cleveland Electric	72½	72½
Consolidated Traction of New Jersey	64	64¾
Consolidated Traction of New Jersey 5s	106½	106⅝
Detroit United	61⅜	61½
Interborough Rapid Transit	107⅝	110
Lake Shore Electric (preferred)	—	a30
Lake Street Elevated	3⅜	3¼
Manhattan Railway	142⅛	143
Massachusetts Electric Cos. (common)	20	18½
Massachusetts Electric Cos. (preferred)	73	72
Metropolitan Elevated, Chicago (common)	15	15
Metropolitan Elevated, Chicago (preferred)	46	46
Metropolitan Street	113	108¾
Metropolitan Securities	79½	75
New Orleans Railways (common)	8	8¼
New Orleans Railways (preferred)	28	25
New Orleans Railways 4½s	75	76
North American	82½	84
Northern Ohio Traction & Light	13	13
Philadelphia Company (common)	39	38⅞
Philadelphia Rapid Transit	13½	13¼
Philadelphia Traction	96	95⅞
St. Louis (common)	11¾	13
South Side Elevated (Chicago)	**91**	**91**
Third Avenue	120	116
Twin City, Minneapolis (common)	92¾	94½
Union Traction (Philadelphia)	49⅝	50
United Railways, St. Louis (preferred)	53	57½
West End (common)	92	91
West End (preferred)	112	111¾

a Asked.

Iron and Steel

The break-up of the Lake Ore iron pool has been the absorbing topic of interest in the iron trade. Although the dissolution had been long expected, it came as a good deal of a shock. A long period of unsettlement is now apprehended during which consumers in all departments will buy as little as they can consistent with their immediate wants. Prices have not as yet reflected the change, but owing to the recent great expansion in output it is thought that the sudden let-down in the consumptive demands will necessarily cause some weakening. Quotations are as follows: Bessemer pig iron $13.85, Besemer steel $23, steel rails $28.

Metals.

Quotations for the leading metals are as follows: Copper 13⅜ cents, tin 27¾ cents, lead 4½ cents, and spelter 5¼ cents.

CONSOLIDATION OF ROCHESTER COMPANIES

A plan has been outlined for the consolidation of the Rochester Gas & Electric Company and the Rochester Light & Power Company, of Rochester, N. Y., and the acquisition by the consolidated company of a controlling interest in the stock of the Rochester Railway Company.

The capital and funded debt accounts of these companies are as follows:

ROCHESTER GAS & ELECTRIC COMPANY	
Bonds and water power and real estate mortgages	$6,230,000
Preferred stock, 6 per cent cumulative	2,360,000
Common stock	2,150,000
Total	$10,740,000
ROCHESTER LIGHT & POWER COMPANY	
Bonds	$125,000
Stock	500,000
Total	$625,000
ROCHESTER RAILWAY COMPANY	
Funded debt	$4,593,000
Preferred stock, 5 per cent cumulative	2,500,000
Common stock	2,500,000
Total	$9,593,000

The name of the consolidated company is to be Rochester Railway & Light Company. Its capital stock will be $3,000,000 of preferred stock and $6,500,000 of common stock. An issue of first consolidated mortgage 5 per cent bonds to an amount not exceeding $16,000,000 will be authorized. These bonds will be used to retire the present funded debt of the Rochester Gas & Electric Company, to take up the preferred stock of that company at 120 and its common stock at 110. Provision has been made for the sale of $500,000 of these bonds at par and accrued interest, and the balance will be reserved for future requirements of the consolidated company.

The bonds of the Rochester Railway & Light Company will be appropriated as follows:

To take up the Gas & Electric preferred stock at 120.	$2,832,000
To take up the Gas & Electric common stock at 110.	2,365,000
To be sold for cash	500,000
Trusteed against funded debt of Gas & Electric Co.	6,230,000
Trusteed for future requirements	4,073,000
Total authorized to issue	$16,000,000

The bonds are to be secured by a first consolidated mortgage upon all the franchises, real estate, plants, etc., of the consolidated company, and by a deposit as additional security, with the trustee, in pledge, of a majority of all present and future issues of Rochester Railway stock. The bonds will mature in fifty years, but will be redeemable on any interest day and on ninety days' notice at 110.

Stockholders of the Gas & Electric Company who so desire may receive the preferred stock of the consolidated company instead of bonds on the basis of 120 per cent for both preferred and common stock of the Rochester Gas & Electric Company. The amount of the preferred stock of the consolidated company will be increased to such an extent as shall be necessary to provide preferred stock for the Gas & Electric stockholders who shall elect to take it instead of bonds, and the amount of bonds set aside for them shall be added to the amount trusteed for future requirements.

Three million dollars of the preferred stock of the consolidated company is to be set aside to be used together with part of its common stock in the purchase of the common stock of the Rochester Railway Company. The common stock of the consolidated company received by the holders of railway common stock will be issued 50 per cent paid and liable to assessments of 50 per cent. The bondholders and stockholders of the Rochester Light & Power Company are to receive common stock of the consolidated company for their bonds and stocks.

No bonds will be used to acquire the bonds or stock of the Rochester Light & Power Company or the majority of the present issued stock of the Railway Company. By reason of the ownership of a majority of the stock, the consolidated company will control the Rochester Railway Company and the mortgage will contain a guarantee on the part of the Rochester Railway & Light Company that the Rochester Railway Company shall not incur any indebtedness of any kind except for current expenses and such as may be temporarily incidental to the ordinary course of its business, but this shall not prevent the refunding of existing liens or the sale by the Railway Company of its bonds already authorized but not issued, provided that its present bonded debt is not thereby increased to a greater extent than $125,000.

The three companies to be consolidated control the entire gas, electric light, power and railway facilities of the city.

Under the provisions of the plan about $1,250,000 in cash will be immediately available for the company's purposes; and from further assessments on the common stock and from surplus earnings it is estimated that another $1,000,000 will be forthcoming for betterments, extensions and improvements during the years 1904, 1905 and 1906, making a total of about $2,250,000 provided for use in that period, of which but $500,000 will come from the sale of bonds. In addition to this estimated amount of $2,250,000 there will be in the hands of the trustee $4,073,000 of bonds reserved for future requirements, and the common stock will be liable to further assessment of $1,300,000.

The plan for the combination of these companies has been formulated by Frederick Cook, Albert H. Harris and Granger A. Hollister, as representatives of the Rochester Gas & Electric Company, and E. W. Clark, Jr., C. M. Clark and A. G. Hodenpyl, as representatives of the Rochester Railway Company. These gentlemen, as a joint committee, will have charge of carrying out the details of the plan.

JOHN SCOTT MEDAL FOR MR. BRILL

The John Scott Legacy Premium and Medal issued by the Franklin Institute, of Philadelphia, for meritorious inventions has just been awarded to John A. Brill, of Philadelphia, for his invention of the Brill convertible and semi-convertible car. This award is based upon Mr. Brill's patents Nos. 623,724 and 691,351, also upon an investigation of the practical merits of the two types of car which was undertaken without the knowledge of any of the officers of the Brill Company. In its report, which is quite a lengthy one, referring to the method of construction and the desirability of these cars, the committee of the Franklin Institute says:

"The semi-convertible is unquestionably the safest and most comfortable car that we have yet seen, and as constructed by the J. G. Brill Company is the nearest approach to the ideal car that has come to our notice. The few advantages of wide openness and rapid filling and emptying capabilities of the open-side car are only gained at the expense of the safety of the passengers and the discomfort of getting into and out of them past an already occupied end seat. They have been tried thoroughly and are disappearing because these defects and discomforts are greater than their advantages, while the center aisle cross-seats and easily managed windows of the semi-convertible type of car is rapidly gaining popularity on its real merits.

"The ingenious and practical devices which have been developed and applied by the J. G. Brill Company in the production of their improved cars merit the unqualified approval and commendation of the Franklin Institute, and in testimony of this appreciation we recommend the award of the John Scott Legacy Premium and Medal to Mr. John A. Brill."

SAN FRANCISCO ANNUAL REPORT

The second annual report of the United Railways Investment Company, of San Francisco, and of the United Railroads of San Francisco, was made public May 2.

UNITED RAILWAYS INVESTMENT COMPANY, OF SAN FRANCISCO

GENERAL BALANCE SHEET AND COMPARISON, DEC. 31, 1903

ASSETS

Investments—	
United Railroads of San Francisco capital stock: 200,000 shares preferred, $100 par value each, 199,991 shares common, $100 par value each, valued at	$24,799,784.00
Organization expenses	294,055.71
Cash on deposit	226,064.96
Total assets	$25,319,904.67

LIABILITIES

Preferred capital stock: 150,000 shares, $100 par value each	$15,000,000.00
Common capital stock: 100,000 shares, $100 par value each	10,000,000.00
Bills payable	64,582.66
Dividend on preferred capital stock—declared and payable	225,000.00
Profit and loss—surplus	30,322.01
Total liabilities	$25,319,904.67

STATEMENT OF INCOME AND PROFIT AND LOSS FOR THE YEAR ENDED DEC. 31, 1903

Gross Income—		
Dividends of 2 4-10 per cent on 200,000 shares, par value $100 each, of the preferred capital stock of the United Railroads of San Francisco		$480,000.00
Total expenses		13,109.66
Net income for the year		$466,890.34
Profit and loss—surplus at beginning of the year		13,431.67
Profit and loss—gross surplus		$480,322.01
Profit and loss charges—dividends on preferred capital stock—declared June 9, 1903; payable July 3, 1903; 1½ per cent on $15,000,000	$225,000.00	
Declared Dec. 9, 1903; payable Jan. 2, 1904; 1½ per cent on $15,000,000	225,000.00	
Total		450,000.00
Profit and loss—Surplus, Dec. 31, 1903		$30,322.01

UNITED RAILROADS OF SAN FRANCISCO

The business of the road for the year ending Dec. 31, 1903, resulted as follows:

Earnings—		
Passenger receipts	$6,189,898.01	
Other sources	53,320.96	
Total gross earnings		$6,243,218.97
Expenses—		
Operation (including $96,545.66 charged in monthly instalments for renewals)	$3,350,862.25	
Renewals (balance)	37,500.00	
Depreciation	113,272.81	
Taxes	409,200.00	
Total		$3,910,835.06
Net earnings		$2,332,383.91
Other income		24,754.00
Total Income		$2,357,137.91
Deductions from income		12,388.09
		$2,344,749.82
Fixed charges—		
Interest on bonded debt	$1,524,050.10	
Sinking funds	123,999.67	$1,648,049.77
Balance		$696,700.05
Two dividends paid		480,000.00
Surplus for the year		$216,700.05

Charged for renewals and depreciation for the year 1902, no charge having been made during that year.	157,500.00
Leaving a balance carried to surplus account of....	$59,200.05

The gross earnings are in excess of those of the year previous, a portion of which, however, is due to the strike of 1902, lessening the receipts of that year. The operating expenses and taxes for the year amount to 60.22 per cent of the gross earnings—an increase over the year previous, due to renewals of track, overhead line and equipment, increased wages of carmen and other employees, and extra expenses attending arbitration and other labor troubles. During the present calendar year additional provision must be made of over $11,000 per month for the first annual sinking funding requirement of the 4 per cent sinking fund gold bonds of this corporation.

While the amount expended for construction work has been in excess of the cash fund of $1,600,000 provided for that purpose by about $1,000,000 (provided from surplus, depreciation, and other funds) further amounts will still be required in the near future to meet the expense of additional car equipment ordered, reconstruction of the Cliff House steam line, additional power station equipment; as also for the erection of shops upon the site purchased for that purpose during the past year. The Sutter and Polk Street cable lines are inadequate to meet the present requirements of the traveling public and provision must also be made for their reconstruction within the not distant future. In view of these requirements your directors consider it advisable to make provision for them as rapidly as the opportunities present and thereby establish the permanency of the company's dividends.

UNITED RAILROADS OF SAN FRANCISCO GENERAL BALANCE SHEET

ASSETS

Railroads, properties and franchises		$71,479,664.90
Additions and betterments to property		2,556,741.94
Market St. Railway Company bonds in treasury		1,500,000.00
Mortgage sinking funds invested		878,665.87
Four per cent sinking fund gold bonds reserved—		
For underlying liens assumed	$9,866,000.00	
For future betterments, acquisitions, etc.	5,409,000.00	
Total bonds reserved		15,275,000.00
Fund for acquirement of outstanding stocks of—		
Market Street Railway Company	$25,400.66	
Sutter Street Railway Company	15,120.00	
Sutro Railroad Company	2,020.00	
Total fund for acquirement of stocks		42,540.66
Constituent companies—pro rata stock purchase consideration		23,145,539.34
Betterment fund from property sales		40,020.31
So. S. F. R. R. & P. Co. Stock		1,350.00
Material and supplies		352,880.99
Current assets—		
Cash with treasurer	$331,698.80	
Bills receivable	5,250.00	
Accounts receivable	39,603.39	
Cash on deposit to pay interest	145,327.00	
Cash on deposit to pay interest coupons in New York	20,380.00	
Change and bail funds	2,250.00	
Unadjusted accounts	1,230.00	
So. S. F. R. R. & P. Company	43,335.35	
Total current assets		589,074.54
Payments in advance—		
Insurance	$8,466.35	
Taxes	47,739.39	
Interest	365.40	
Total payments in advance		56,571.14
Total		$115,918,049.69

LIABILITIES

Capital stock—		
Common	$20,000,000.00	
Preferred	20,000,000.00	
Total capital stock		$40,000,000.00
Bonded debt—		
Four per cent sinking fund gold bonds		$35,275,000.00
Total underlying bonds assumed		14,591,000.00
Total bonded debt		$49,866,000.00
Reserve for mortgage sinking funds		$932,838.28
Reserve for insurance		200,000.00
Reserve for renewals		133,022.35
Reserve for depreciations		19,339.93
Constituent companies—obligations		23,188,080.00
Current liabilities—		
Accounts payable	$372,462.84	
Pay rolls	143,928.07	
Unclaimed wages	1,382.64	
Employees' deposits	24,042.50	
Employees' hospital fund	2,526.14	
Tickets sold—unredeemed	2,392.51	
Bond interest due and unpaid	20,670.00	
Bond interest due Jan. 1, 1904	108,000.00	
Total current liabilities		675,404.70
Accrued, not due—		
Bond interest	351,016.66	
Sinking funds	60,000.00	
Miscellaneous interest	3,999.30	
Total accruals, not due		415,015.96
Profit and loss		488,348.47
Total		$115,918,049.69

THE OPENING OF ASSOCIATION ROOMS IN HARTFORD

On May 3 the new rooms of the Hartford Street Railway Employees' Voluntary Mutual Aid Association were opened in the new Wethersfield Avenue car house of the company. This organization is a mutual aid association existing among the employees of the Hartford Street Railway Company, with weekly dues of 50 cents per member, and with the usual sick and death benefits. The association is entirely self-supporting, and has been most successful. The new association rooms at the Wethersfield Avenue car house were provided by the company, and are probably as well equipped and as convenient as any meeting rooms of the kind that can be found. The furniture, which includes a new billiard table, was also the gift of the company, and was presented to the members of the association on the occasion of the opening, May 3.

Exercises of a special dedicatory nature were held on the evening of May 3, at which the keys of the rooms were presented to the officials of the association by B. R. Howe, secretary and treasurer of the company, and at which there were other special features in commemoration of the event. In recognition of the liberality of the company to the association on this and past occasions the members of the association presented E. S. Goodrich, president of the company, with a masonic jewel, emblematic of his thirty-second degree of masonry.

AN ELECTRIC RAILWAY PROJECTED BETWEEN INDIANAPOLIS AND CHICAGO

The Chicago & Northern Indiana Railroad Company, which proposes to build an electric railway from Indianapolis to Chicago, passing through Lake, Porter, Jasper, Pulaski, White Cass, Howard, Clinton, Tipton, Hamilton and Marion counties, has been incorporated, with a capital stock of $25,000. The directors of the company are: Lester Soule, A. L. Wheeler and Charles N. Thompson, all of Indianapolis; Henderson E. Davenport, Sheridan; James G. Kemp, Kempton; Martin W. Eikenbury, Russiaville, and Luther McDowell, of Young America. Of the capital stock Mr. Soule holds $15,000. He is president of the Globe Construction Company, of Des Moines, Ia., which has the contract for building the Indianapolis, Logansport & Chicago railroad, which received a franchise the last administration to enter Indianapolis.

The new road will operate in competition with the steam roads running between Indianapolis and Chicago, carrying both freight and passengers. The line will be equipped with cars of the latest construction and sleeping cars will be run between Indianapolis and Chicago.

Work on the new road will begin without delay. It is announced that a corps of civil engineers will start at once to survey the route. It is the intention to have the surveys made between Indianapolis and Logansport so that the work of construction may be begun June 1. This division of the road will be finished first, and will run through Sheridan, Russiaville, Kempton and New America, all without adequate transit facilities.

The new line will enter Indianapolis on the basis of other interurban railroads. By the consent of the board of works and by an agreement with the Indianapolis Traction & Terminal Com-

pany, the terminal station, at Market and Illinois Streets, will be used for the passengers, while the freight cars will be transferred to the other railroads at the Belt and taken to the freight depots.

Mr. Soule says that it will take between $1,500,000 and $2,000,000 to construct the road between Indianapolis and Logansport. The officers of the company are: Lester Soule, president and general manager; Henderson E. Davenport, vice-president; A. L. Wheeler, secretary and treasurer.

CONVENTION OF SOUTHERN STREET RAILWAY AND ELECTRIC ASSOCIATIONS

The Southwestern Gas, Electric & Street Railway Association and the Southwestern Electrical Association held a joint annual convention at Dallas April 25, 26 and 27, at which it was decided to unite the two organizations under the name of Southwestern Electrical & Gas Association. Those eligible for active membership in the new association are companies, firms or individuals engaged in the manufacture of gas, generation of electricity, operation of electric railways, telephone exchanges and telegraph lines. The officers elect of the new association are as follows: President, J. F. Strickland, of Waxahachie; secretary, F. E. Scovill, of Austin, and treasurer, A. E. Judge, of Tyler, Tex.

Most of the first day's session was occupied with discussions as to the benefits and evils of telephone competition. This discussion grew out of a paper read by Mr. J. E. Farnsworth, general manager of the Southwestern Telegraph & Telephone Company. At the conclusion of the afternoon session the members were tendered a trolley excursion around the city. In the evening various entertainments were provided for the visitors.

Among the papers announced on the programme were "Municipal Franchises," by John W. Shartell, president of the Metropolitan Railway Company, of Oklahoma City, and "Advantages of Combination of Gas and Electric Plants," by R. R. Stitcher, of the Cleburne Gas & Electric Company, of Cleburne, Texas. Mr. H. F. MacGregor, vice-president of the Houston Electric Company, read a paper entitled "Accidents and the Damage Suit Industry." Mr. MacGregor referred to the growing evil of damage claims based on the slightest pretext and frequently on fraud, and gave some advice as to the management of this department of companies. He stated that the increase in the amount of damages recovered from public service companies had recently become so large as to attract the attention of the Railroad Commission of the State of Texas to the injustice. Every member of the association, he said, should enlist in the campaign of exposure of fraudulent claims. Corporations have suffered from the administration of justice in Texas, not so much from the intent of juries not to reach the justice of the case, but from perjured testimony that creates conflict and confusion in juries and the failure of the trial court to assume the responsibility of setting aside a verdict that it conscientiously knows to be unjust. He urged upon the members of the association to give publicity to existing conditions in order to bring about a reform.

THE ST. LOUIS TRANSIT COMPANY'S FAIR EARNINGS

According to the statement issued by the St. Louis Transit Company May 6, the gross earnings for the month of April, 1904, were the largest in the history of the company. The best previous record was in October, 1903, but it is stated that the gross earnings of last month exceeded the earnings of last October by about $65,000. In April, 1903, the gross earnings of the company were $607,031, which was the high record up to May, 1904, but the earnings of last month were more than 17 per cent greater, being $710,338. Out of a total of 20,225,000 passengers carried last month, it is estimated that 14,206,760 were revenue passengers. In April, 1903, the total number of passengers carried was about 17,460,000. Based upon the gross earnings of last month, it is estimated that the daily receipts during April gained nearly 2500.

The statement of May 6 included the gross earnings for the four months up to April 30, 1904, which approximate $2,484,176. Contrasted with the same four months in 1903, this statement shows a gain of $303,882, or an average monthly betterment of $75,970. The net earnings of the company will be given out only in the yearly statement of operations, it being stated that it is practically impossible to determine the operating costs from month to month.

The company has fixed charges amounting in round numbers to $3,000,000, and it is believed that the surplus over the cost of operation will be more than sufficient to pay these charges, especially under the measures for retrenchment instituted by Vice-President and General Manager McCulloch.

Letters were sent to the managers of the street car companies by the World's Fair Manager, C. L. Hilleary, congratulating the company on the excellent results obtained. In his letter sent to Mr. McCulloch Mr. Hilleary says: "I feel it a pleasure as well as my duty to write to you and say how much pleased the World's Fair is with the excellent transportation facilities furnished by your company April 30. You and all your men are certainly to be congratulated. The transportation has been just as good since the opening, and we highly appreciate the work of the three companies. Chicago, with her elevated railway, her train and street car service, was far behind the work of the St. Louis companies. The crowd April 30 was the largest on the opening day of any exposition and the best handled."

TRAFFIC FIGURES OF NEW YORK COMPANIES FOR YEAR ENDING MARCH 28, 1904

At the meeting of the New York State Railroad Commission in New York City last week a statement of the traffic business of the surface and elevated railroads of the city, brought down to Feb. 29 of this year, was made public. The report for the year ending on that day shows that 670,000,000 passengers were carried in the Borough of Manhattan alone, not including transfers, which were 166,000,000. Some of the figures in detail are:

In Manhattan on the Interborough Rapid Transit (the elevated system) the total number carried in 1903-4 was 273,133,242 exclusive of transfers. This is an increase of 37,318,852 over 1902-3, which was 235,814,390. The total car mileage was 60,730,337, an increase of 12,870,859 over the previous year.

The New York City Railway Company, formerly the Interurban, carried a total of 397,644,829, an increase of 144,311. There was an increase of 5,129,287 in the first three-quarters of 1903-4, but the last quarter there was a large decrease of 4,984,976, making a small net increase. This did not include transfers. On transfer there were 166,310,453 passengers carried, an increase of 11,435,049. The car mileage showed a total of 62,412,527, a net increase of 954,666. The increase for the first three quarters was 1,661,666, but the large decrease of 706,900 for the last quarter reduced this considerably.

The Union Railway Company carried in the year 21,273,870 passengers, an increase of 1,998,543 over the year 1902-3, which was 19,275,327. With transfers the total number carried was 21,698,501. In the Bronx, all railroads, the total number carried for the year was 22,147,077, an increase of 1,988,636.

In a recapitulation for the Borough of Manhattan the enormous total of 670,778,071 passengers carried in the twelve months is shown, which is an increase of 37,463,163 over the previous twelve months. On transfers all lines carried 166,310,453 passengers, an increase of 11,435,049. There were no transfers listed from the Interborough. The total car mileage was 123,142,864, an increase of 13,825,625.

In the Borough of Brooklyn the Brooklyn Heights Railroad Company, which is operating the Brooklyn Rapid Transit system, carried 285,725,986 passengers, an increase of 23,280,423 over the previous year, which was 262,445,563. On transfers the road carried 55,146,001 passengers, a total net increase of 3,772,959. There was an increase in the number of transfers of 5,407,647 for the first three quarters, but the last quarter had a decrease of 1,634,688, reducing the net. The car mileage of this railroad was 54,394,315, an increase of 3,025,769.

The Coney Island & Brooklyn Railroad Company carried 33,129,812 passengers; an increase, net, of 967,765. There was an appreciable decrease in the second quarter on this road of 605,021, reducing the increase total of 1,572,786 quite considerably. This road carried 6,016,455 passengers on transfer, an increase, net, of 88,063. The total car mileage was 6,212,762, a net increase of 43,854.

The total number of passengers carried in Brooklyn on all lines was 320,107,163; an increase of 24,363,201 over the previous twelve months, which was 295,743,962. The passengers carried on transfers number 61,281,419; an increase of 3,864,782. The total car mileage was 60,733,233, a total net increase of 3,069,386.

In Queens and Richmond Boroughs the totals were, of course, much smaller. The total number of passengers carried in Queens without transfers was 16,058,207; an increase of 762,354. On transfers 2,080,913 passengers were carried, an increase of 52,777. The total car mileage was 3,875,573; an increase of 155,454.

In Richmond, on all roads, 7,744,255 passengers were carried without transfers. This is an increase of 498,610 over the previous year's total of 7,245,645. On transfers the various roads carried 746,468 passengers, an increase of 72,721. The car mileage was 2,259,520; an increase of 138,580.

The greater city, on all railroads, surface and elevated, carried 1,036,834,773 passengers. This is an increase of 65,075,964 passengers. The total in all boroughs for the previous year was 971,758,809. On transfers the total carried was 252,853,130, an increase of 18,015,410 net. There was a decrease in Richmond of 72,721. Last year the total number carried on transfer was 234,-837,720. The total car mileage in the greater city was 197,826,719, an increase of 18,220,741.

UNIFORM SYSTEM RECOMMENDED FOR INDIANAPOLIS

City Engineer Jeup, of Indianapolis, has recommended to the Board of Public Works the adoption of a general plan for the extension of the street railway lines in the city, and to this end advises that a conference be held some time in the near future by the Board of Works and the Indianapolis Traction & Terminal company. As has been demonstrated by the number of requests for street car extensions along certain streets, serious complications are met by the board in fixing the routes, since there is no general system of car lines to be followed. At the present time there are ten requests before the board for extensions. Some of the routes asked conflict with the general system, and should many such extensions be constructed the system would become complicated and inconsistent.

THE TERMS OF THE SAN FRANCISCO SETTLEMENT

Last week the bald statement was made in the STREET RAILWAY JOURNAL that an agreement had been reached between the United Railroad of San Francisco and its employees, and that the threatened strike had thus been averted. Since then details have come to hand of the various overtures made by both sides, of the anxiety of the city during the hours of suspense, and of the good offices of Mayor Schmitz, which were in the main responsible for the settlement. A few hours before the expiration of the old agreement, and when it was generally thought that a strike soon would be on, the Mayor went before the men in meeting, and in the face of opposition from President Mahon, of the Amalgamated Association, and Mr. Cornelius, of the local association, secured the declaration of a truce for three days. This proved sufficient to effect a compromise. It was on May 3 that the union voted to accept the very agreement which on April 25 it had rejected. The terms finally accepted were practically the same as those noted in the STREET RAILWAY JOURNAL of April 23. The one point of difference was the question of the employment of union labor and the final stand of company in this matter as accepted by the men is best given in the letter of the company to the Mayor, which follows:

May 3, 1904.

To the Mayor of San Francisco.

Sir: We were notified by the Carmen's Union early on the morning of May 1 that action had been deferred by them, at your request, for three days. We were requested, thereafter, by your Honor, to meet you in the matter.

We feel it incumbent upon us, under these circumstances, not only to comply with your request, but to extend our proposal to the men till 3 a. m. on next Wednesday morning, in the meantime the status quo to be maintained; and, further, to emphasize our attitude toward our employees, we gladly accept your suggestion that the following words be embodied in our proposal, constituting the fortieth and final clause thereof.

"Section 40. The company fully recognizes the union as provided in this contract, and will not, directly or indirectly, interfere with or prevent the joining of the union by any man employed by the company after the date of this agreement, and it will be entirely satisfactory to the company if he should join. The company will neither discharge nor discriminate against any employee because of his connection with the union nor for any participation in any of the discussions or differences arising out of the present or any past controversy between the company and the union to the date of adjustment.

"When any member of the union shall have been discharged (except for failure to register fares) the president of the union shall be notified, and if in the opinion of the union the discharge is unjust, the matter shall be taken up with him and the member in question by the officers of the company having in charge the employment and discharge of men."

It is understood that one of the terms of this extension and addition is that the contract be for one, two or three years, as the union may elect, within the time above limited.

THE UNITED RAILROADS OF SAN FRANCISCO,
By Its Executive Committee.

Attest: GEORGE B. WILLCUTT, Secretary.

The agreement, by the way, is to stand for one year, or till May 1, 1905, and has been signed on behalf of the company and the men.

The Public Service Corporation of New Jersey has placed on sale at its trolley terminals, gas offices, etc., commutation tickets good over any division. Transfers will be issued for tickets for any 5-cent distance. Tickets will be sold in strips at the rate of twenty-one for a dollar, and books of 106 for $5.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED APRIL 25, 1904

758,131. Emergency Brake for Street Railway Cars; Patrick Flood, Albany, N. Y. App. filed Aug. 27, 1903. Details of mechanism whereby the brake-shoe may be thrown to a position between the track and the periphery of one of the wheels.

758,140. Magnetic Brake; John D. Ihlder, Yonkers, N. Y. App. filed Sept. 2, 1903. An electro-magnetic brake having means operated by the magnetic flux for effecting a slow action of the brake.

758,141. Track-Sanding Device; Washington H. Kilbourn, Greenfield, Mass. App. filed Aug. 13, 1903. Details of construction.

758,153 Ice Cutter for Third Rail Electric Railways; Samuel B. Stewart, Jr., Schenectady, N. Y. App. filed Sept. 20, 1901 Two pressure rollers traveling on the third rail, having corrugations on their peripheries at an angle to said periphery and scrapers adjacent to the rollers.

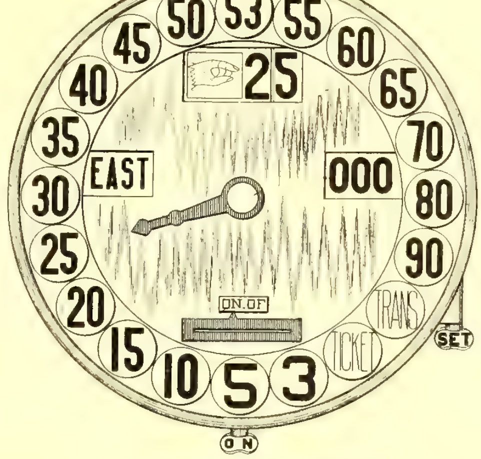
758,320. Train Control System; Harold E. White, Schenectady, N. Y. App. filed Nov. 20, 1902. The motors throughout the train are connected in pairs in such a manner that the armature of each motor of a pair is in series with the field of the other motor of the pair; the armature and field combinations are then treated as if they were series motors by connecting them in series and parallel in the customary manner.

758,355. Trolley Wheel; James S. Fletcher and Donald H. Waters, Chicago, Ill. App. filed Sept. 3, 1903. Details of the mounting and contact devices of the wheel.

758,398. Signal Operated by Car Brake Beams; Samuel N. Wilcoxson, Collingwood, Ohio. App. filed Jan. 13, 1904 The circuit to a signal lamp at the rear of the car is closed when the brake is applied, to notify a following car that the car ahead is being stopped.

758,445. Trolley Head; Peter D. Hean and John J. Egan, Media, Pa. App. filed Dec. 26, 1903. Details of a construction for maintaining the wheel in contact with the wire.

758,488. Fare Register: Hiram Tyler, Dayton, Ohio. App. filed Jan. 13, 1903. The fare register keeps a total record of the



PATENT NO. 758,488

cash fares separately, a total record of transfers and tickets separately, and a grand total of all the fares registered and indicated irrespective of their denominations of classes.

758,528. Current Collector; John E. Greenwood, Utica, N. Y. App. filed May 16, 1903. Consists of a double wheel trolley.

758,538. Rail Cleaner; Homer C. King, Elgin, Ill. App. filed June 30, 1903. A corrugated wheel adapted to be lowered against the third rail in oblique relation thereto.

758,552. Switch Operating Mechanism; John H. Miller, Christiana, Tenn. App. filed Sept. 24, 1903. Details of mechanism for throwing the switch from a moving car or train.

758,592. Safety Trolley; William M. Gruner and William C. Fink, Springdale, Pa. App. filed No. 5, 1903. Details.

UNITES STATES PATENTS ISSUED MAY 3, 1904

758,722. Controller Regulator; Vandiver J. Van Horn, Keokeu, Iowa. App. filed Sept. 10, 1900. Details of a motor controlling device which will enforce gradual movement of the controller handle in starting.

758,846. Auxiliary Fare Indicator and Protector for Street Car Registers; Felix Paduveri, San Francisco, Cal. App. filed Feb.

24, 1903. In a combination open and closed car, a bell is placed in the open part of the car and adapted to operate in conjunction with the fare register bell in the closed part of the car.

758,977. Guard Covering for Third Rails of Electric Railways; John Kress, New Rochelle, N. Y. App. filed Dec. 30, 1903. The roof of a third rail covering is divided into two laterally sliding parts, adapted to be moved aside by the plow as it progresses and afterwards to automatically close.

758,990. Railway Truck; William E. Ludlow, Cleveland, Ohio. App. filed Feb. 15, 1904. Details of construction of a light truck upon which a drill is mounted for operation upon the rail.

759,060. Electric Railway Switch-Point and Operating Means Therfor; Arthur J. Backer, Syracuse, N. Y. App. filed July 8, 1903. A magnet for throwing the switch tongue is located in the switch itself.

PERSONAL MENTION

MR. WILLIAM S. ROCK, who has been superintendent of the Raritan Traction Company, of Perth Amboy, N. J., for the past four years, has resigned and will handle masons' building supplies, etc.

MR. JOSEPH M. WALKER has been appointed chief engineer of the Pennsylvania & Mahoning Railway Company of Youngstown, Ohio, succeeding Mr. John N. Wolff, who recently resigned. Mr. Walker had charge of the construction work on the new Struthers line built by the company.

MR. JOHN GRANT, the retiring general superintendent of the St. Louis Transit Company, was agreeably surprised at his residence Friday evening, April 29, when a delegation of gentlemen connected with the Transit Company under his management presented him with a magnificent solid silver tea service appropriately engraved. The presentation was made by Mr. John L. Miers, division superintendent of the Olive Street line.

MR. ARTHUR E. APPLEYARD, of Boston, has been elected president of the Columbus, London & Springfield Railway, the Dayton, Springfield & Urbana Railway, and other properties in Ohio controlled by the Appleyard syndicate, succeeding Mr. John S. Harshman, of Springfield, Ohio, whose affairs were recently placed in the hands of the bankruptcy court, due largely to the failure of the Victor Rubber Tire Company, in which he was interested.

MR. GEORGE R. SCRUGHAM, president and manager of the Interurban Railway & Terminal Company, of Cincinnati, Ohio, recently contributed to the Cincinnati Enquirer an interesting illustrated article on the growth of the electric railway in the Ohio Valley. In this day, when so much is being said in the magazines and newspapers about scientific and other special subjects, it is indeed a pleasure occasionally to run across an article bearing on its face the stamp of authority and authenticity.

MR. RICHARD McCULLOCH, son of General Manager Robert McCulloch, of the St. Louis Transit Company, has accepted a position which will practically make him assistant to his father, giving particular attention to the mechanical and engineering departments. Mr. McCulloch is at present acting general manager of the Chicago City Railway. He is thirty-two years old, unmarried and was educated in St. Louis, finishing his studies with two years' work with a street railway company in Geneva, Switzerland. Returning to this country, he became his father's assistant in Chicago.

MR. H. I. BETTIS, who was formerly general manager of the Atlanta Consolidated Street Railway, and later auditor of the Paterson, Passaic & Rutherford Railway, and who left street railway service to become associate general auditor of the Union Pacific Railway Company, at Omaha, Neb., was recently appointed auditor of the San Pedro, Los Angeles & Salt Lake Railway Company. This corporation is one in which Senator Clark is largely interested, and is building a steam railroad line between Salt Lake City and Southern California.

MR. BENJAMIN S. HANCHETT, secretary and treasurer of the Grand Rapids Railway Company, of Grand Rapids, Mich., has in addition to his present duties been elected to the position of general manager, held by the late Mr. G. Stewart Johnson. Mr. Hanchett has been connected with the Grand Rapids Company and its predecessors continuously for twenty-one years. In 1883, when fourteen years old, he left the Grand Rapids High School to take a position in the office of the company. Soon afterward he was promoted to the position of assistant bookkeeper and then to bookkeeper. In 1888, under General Superintendent Bevier, he was made chief clerk. His next promotion was to the position of paymaster, and then he was chosen secretary of the old horse car system. When the Valley City Street & Cable Company purchased the car lines of Grand Rapids Mr. Hanchett became secretary and assistant treasurer of the consolidated systems. This company immediately began the conversion of the cable and horse car lines to an electric system. Mr. Hanchett continued as secretary of the Consolidated Railway Company until 1900, when the system was sold to its present owner, the Grand Rapids Railway Company, and he became secretary and treasurer of that corporation.

MR. C. P. WEAVER, special agent of the Philadelphia Rapid Transit Company and manager of Willow Grove, died a few days ago at his home in Philadelphia, after a brief illness. Mr. Weaver was born in Philadelphia Sept. 24, 1859, and was educated in the public schools and at Lafayette College. About twenty-six years ago he began his railroad career with one of the old horse-car companies. In a short time he was made an auditor in West Philadelphia and won steady promotion, until he became special agent and superintendent of Willow Grove Park.

MR. W. H. PAPE has recently become connected with the Galena Signal Oil Company, of Franklin, Pa., as salesman and mechanical expert. Mr. Pape has had quite a long street railway experience, and is well known in that field. In 1892 he was appointed superintendent of the light and power department of the Salem Consolidated Street Railway Company, of Salem, Ore., but resigned from that company in 1894 to become manager of the Franklin Street Railway Company, of Franklin, Pa., with which he was connected for six years. In 1900 he was appointed manager and consulting engineer of the Butler Street Railway Company, of Butler, Pa., and had entire charge of the construction and operation of this line until his resignation to become connected with the Galena Signal Oil Company.

MR. WARREN S. HALL, who has resigned as superintendent of the second district of the electric railway division of the Public Service Corporation of New Jersey, to become general manager of the Lehigh Valley Traction Company at Allentown, Pa., was tendered a farewell dinner on May 5. President Thomas N. McCarter and other officers of the Public Service Corporation were present, and after some very complimentary speeches in his honor, Mr. Hall was presented with a large traveling bag filled with a great variety of silver-mounted articles suitably engraved. Mr. Hall's successor in charge of district No. 2 is Mr. Arthur W. Pratt, formerly the Essex Division road master, and latterly superintendent of the Roseville, South Orange and Maplewood divisions of the corporation's lines. Mr. O. P. Coe has been named as successor to Mr. Pratt. Mr. Coe was formerly air brake instructor of the company.

FOLLOWING THE PURCHASE of the Camden & Suburban Railway, of Camden, N. J., by the Public Service Corporation of New Jersey, noted in the Street Railway Journal a few weeks ago, comes the announcement by President McCarter, of the latter company, of the appointment of Mr. William E. Harrington as general manager of the Camden & Suburban Company to succeed himself, and of Mr. Samuel H. Corliss as secretary of the company. Mr. Harrington has acted as general manager of the Camden & Suburban Railway since 1896. Under him the entire system has been almost entirely rebuilt, and a most efficient operating force has been organized. Mr. Harrington was born in Wilkesbarre, Pa., June 3, 1866, and graduated from the University of Pennsylvania, with the degree of B. S. in 1887. He is a member of the American Institute of Electrical Engineers, and of the Franklin Institute of Philadelphia, and has presented papers on engineering subjects before various technical bodies, including the American Street Railway Association, in which his interest is keen.

WILLIAM E. HARRINGTON

MR. HERMAN A. STRAUSS was appointed general manager of the Sheboygan Light, Power & Railway Company, of Sheboygan, Wis., early this year. The appointment came after about one year's service as engineer of the Construction Company of America, in the design and construction of 10 miles of interurban railway, and a large, modern, fireproof power station for the Sheboygan Light, Power & Railway Company. Mr. Strauss has had a large and varied experience. He was attached to the engineering staff of the Westinghouse Electric & Manufacturing Company for several years. He acted for two years as the assistant electrical engineer for the Manhattan Elevated Railway Company, of New York City, throughout the period of electrification of that system, and has done considerable independent consulting engineering work. The Sheboygan Company operates about 30 miles of city and interurban trackage and the lighting systems of Sheboygan.

INDEXED

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, MAY 21, 1904. No. 21.

Published Every Saturday by the
McGRAW PUBLISHING COMPANY

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues)............................ $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Wooden Gear Cases

Difficulties which are necessarily and frequently met in the use of cast-iron gear cases for the protection of reduction gearing of street railway motors have induced the Philadelphia Rapid Transit Company to introduce the use of protecting cases of wood construction. The trouble met was that when the cast-iron case was broken from accidental contact with street or track obstruction, the broken pieces wedged in the motor gearing in such a way as frequently to absolutely prevent the motor from operation. It is found that, as the wooden gear case can be built at such a low cost as compared with that of a new iron case, if damaged by accident it is feasible to scrap the entire case and substitute a new one with a considerable saving over the cost of repairing an iron case. Repairs have, however, been found to be possible upon the wooden gear case with much greater ease than attends repairs upon the cast-iron case, which even further reduces the cost with the use of the wooden case.

This method of providing for gear case troubles is claimed by those who use the wooden case to be a better solution even than that which was tried by a Western street railway company of placing a light galvanized-iron bottom part upon the lowest portion of the under half of the case in order to withstand the battering effect of stones and street obstructions. This method requires the use of a special lower half of the gear case for bolting the tin bottom piece upon it and, in addition, any accident to the upper part of the case presents the same trouble as heretofore mentioned for the iron case. It is found that not all of the gear case breakages are caused by track obstructions, so that the method of using wood construction throughout seems to be preferable. In cost, also, the wooden gear case has the advantage of that made of cast-iron, or that of the special gear case with the tin bottom.

Gear Ratios

Although it is a subject that has been harped upon many times in the past seven years, it can do no harm to call attention again to the futility to say nothing of the positive waste in using motor equipments geared for high maximum speeds for service where stops are frequent. Whenever a manager finds that he has cars in city service which do not attain maximum speed between stops in ordinary operation when not in the crowded downtown districts, it is time for him to change either the gear ratio or the armature winding of those equipments so that maximum speed will ordinarily be obtained. If there is any one sure way of wasting money in street railway operation, it is in operating cars geared for such a high maximum speed that they do not easily attain it between stops. Some conspicuous mistakes of this kind were made, both on some of the first elevated lines and on surface lines about the same time, before the subject was thoroughly understood. The reason for the loss in economy, when cars are geared for too high a speed, is easy to find. The work of a street railway motor is very largely acceleration. The current required to produce a certain rate of acceleration varies approximately as the speed for which the car is geared during the initial part of acceleration. Thus, a car geared for 15 m. p. h. maximum will start to accelerate at a given rate with half the current of one geared to 30 m. p. h. The extra current required by the car geared to 30 m. p. h., as compared with the one geared to 15 m. p. h. during acceleration, must, of course, be obtained by wasting the surplus energy in the rheostat. While this makes little difference as to the heating of the motor itself, it does make a big difference with the power station; as not only is the actual energy required much greater, but the maximum demand or peak current is much higher. The mistake of selecting too high speed for city equipments is not as common as it used to be, but there are still some places where reform is possible.

Transfer Tables for Repair Shops

The transfer table, which was once very common in large car houses, is now seldom found in car houses of recent design. When it comes to the repair shop, however, the case is different. Steam railroad repair shops have apparently found it better to retain the transfer table in many cases, and there is at least one very prominent example of a repair shop served only by a transfer table among recent electric railway repair shops.

Between the transfer table with short repair tracks, as against no transfer table and long repair tracks, the master mechanic is "between the devil and the deep sea." If he makes his repair tracks short, of just sufficient length to hold the longest cars and serves them with a transfer table, he has the assurance that one car can never block another, and that as soon as the repairs on one car are finished it can be taken out independently of what may be happening to any of the rest. The transfer table has one serious objection in the minds of many, which is that when a dead car is brought in (that is, a car upon which the entire electrical equipment is crippled so that the motors cannot be used) it is a slow and painful operation to get the dead car off of the transfer table into the repair shop. The transfer table takes up considerable room, but it is not a worse offender in this respect than the special work, switches and curves which must be put in to take its place. For a small repair shop, where room is plenty, the shop can be arranged so that each car has a track to itself in the shop, and yet all tracks can be reached without a transfer table by means of switches and curves outside the building. When this method is applied to a very large shop the large amount of yard room required in front of the shop, as well as the amount of special work, becomes somewhat alarming. These are some of the questions that will probably come up in connection with shop design at the next master mechanics' convention. Any arrangement which offers the advantages of both kinds of track arrangement without the present disadvantages would certainly find much favor.

Depreciation

A review of the financial policies of European street railways given in two articles in the STREET RAILWAY JOURNAL of May 7 last, shows how much more thoroughly owners of street railway properties in old cities, like those in Germany, provide for depreciation than is commonly done in this country. The question is frequently discussed in this country, but very few companies have made any provision of this kind, and it is needless to say it is not the general rule. There are two ways of considering the matter. In the first place, it must be admitted that provision for such depreciation is of greater necessity in older countries where conditions are more settled, and where rapid growth and increase of business is not, as here, sufficient to make the depreciation on the original investment seem insignificant by the time the original property is worn out. The rapid development of cities in this country has made possible many financial policies which would be out of the question in older communities, although it is possible that the conservatism in some parts of Europe does not permit apparatus being thrown into the scrap heap when really it should be. As conditions become more settled and growth becomes slower in the United States there will be more necessity for providing depreciation funds.

The street railway manager of the present day in the United States frequently finds himself between two fires as regards the setting aside of sinking funds. On the one hand there are the financial interests backing the property to be appeased with dividends at the earliest possible moment, and on the other hand is the certainty that a day will come when the equipment will wear out and perhaps franchises expire with nothing to show to the investors unless provision is made from year to year for these contingencies. Conditions are yearly becoming more burdensome to public service corporations, and while most street railway directors are inclined to put off the evil day of providing sinking funds as long as possible, that day must come in the future in this country as it has come already in the older countries.

There is no doubt but that part of the municipal ownership agitation and a desire to impose over-burdensome conditions on street railway franchises just now so noticeable, are due partly to failure both on the part of the general public and the directors of street railway companies to recognize the necessity for providing sinking funds. Had such funds been accumulated in years past, at the expense of certain large dividends, many properties would not have got into the public mind as being such extraordinary profitable undertakings. At the same time they would have put themselves on a much sounder and more substantial foundation, and in a better position to secure favorable municipal grants in the future.

The Fire Protection of Car Houses

It is a matter of congratulation that the insurance interests and the owners of electrical apparatus are coming together on the subject of fire insurance and the protection of street railway properties. Undoubtedly at one time the underwriters attempted to impose what seemed to others unnecessary restrictions upon electrical risks, while on the other hand the limited experience of electrical men betrayed them into grave errors of construction or questionable economy, which might just as well have been avoided. Many disastrous fires, particularly of car houses, have occurred recently, and have brought the matter to an acute stage. There is no doubt that in view of the immense capital, in the form of expensive cars, which is stored within the walls of the modern street car house, the question is one of the most important ones in railway operation to-day. The underwriters have always claimed that while any car house was not a particularly desirable risk, ninety-nine out of every hundred could easily be made, not fireproof, for that seems impossible, but much more fire resisting than at present, and that the changes required in the construction would, as a rule, be small and would not interfere with the convenience of the structure for storing cars. Even in the case of car houses that are already built, a few changes can often be made at a trifling expense which would result in a great reduction of the fire hazard, and would frequently change a very undesirable or even impossible risk to one in which the chances of destruction of the whole or greater part of the cars stored within the building from a chance fire would be reduced to a minimum.

Briefly stated, the chief defects of most of the existing car houses lie in the immense area enclosed under a common roof, in defective roof construction and in poor wiring. The inflammable nature of the cars themselves is such that if a fire starts in one car it will often spread to those adjoining and to the building, so that the primary consideration in car house building is the division of any large structure into a number of smaller sections by brick walls carried up through and above the roof. The underwriters recommend the cutting up of car houses into fire areas not exceeding 10,000 sq. ft., and believe that by the use of brick fire walls, as proposed, or even by the erection of wooden fire-resisting walls, if none better can be had, the hazard can easily be reduced.

The usual form of car house roof construction, which consists of steel beams or trusses of a considerable span carrying a wooden and gravel roof, is one which experience has shown to be particularly susceptible to destruction. The thin steel girders will very soon become warped when exposed to a hot fire produced under them by a burning car, and in collapsing will bring down the entire roof upon the remaining cars in the

car house, spreading the fire to all of the contents in the building, and making the removal of the cars impossible. The ordinary mill roof which, although of wood, is slow burning, would be much more desirable from a fire standpoint than the so-called fireproof light steel girder roof construction.

The article which appears elsewhere in this issue on the construction and hazards of electric railway car houses points out other prevalent defects in car house construction, and gives the requirements formulated from the experience of an important body of underwriters. For this reason the article is worthy of careful consideration, though the specifications given by the author in his paper have not been accepted as national standards. In the effort to reduce street railway fire risks the aims of the insurance interests are the same as those of the railway companies, for both are equally concerned in the reduction of fire risks, and an association of representative companies has expressed a willingness to examine without charge the plans of proposed or existing car houses, and make any recommendations possible under the circumstances to reduce the fire hazard. If any such plans are sent to us we will submit them to representatives in this city of this association for this purpose. It should not be overlooked that underwriters know from experience the risks they assume and the cost to insure. Electrical interests have suffered from ignoring this fact, as recent losses bear evidence.

Studies in Locomotive Resistance

A most interesting discussion in the Institution of Mechanical Engineers is reported in a recent number of "The Engineer." It began in a sterile debate over compound locomotives, and then wandered, as discussions often do, into a more fruitful field, that of locomotive resistances and draw-bar pull. The figures which came to light were most instructive, and tended to throw some light on the much-befogged questions of track resistance and air resistance. It is, of course, well known that internal losses by friction of various sorts in a locomotive are rather large compared, for instance, with those in a first-class stationary engine of similar horse-power. There is good reason, too, to believe that the results which are obtained from locomotives on a testing cradle are considerably different from those obtained under ordinary running conditions. In this latter case it is very difficult, indeed, to separate the various sources of loss. This much is certain, that there is a very great discrepancy between the indicated horse-power at the locomotive cylinders and the net horse-power as computed from the draw-bar pull. The total loss thus appearing, of course, varies greatly with the speed and with the type of engine, but the amount varies over a very wide range from 20 per cent or 25 per cent up to 50 per cent or 55 per cent, the latter figures being reached at very high speeds. Of course, in any experiment with trains the locomotive bears the brunt of the air resistance, for which it is difficult to obtain exact figures on account of the irregular shape of the engine front. Undoubtedly a large part of the difference between results at high and low speed must be charged up to air pressure, but this does not account, by any means, for all the observed differences.

Perhaps, the most striking feature of these differences is the variation observed as between engines with few and with many driving wheels and with driving wheels of different diameters. In one series of experiments reported in the discussion a comparison was made between a freight engine with eight coupled drivers and an express engine with a single pair of drivers, and the remarkable fact was brought out that the latter, although unable to show at low speeds a draw-bar pull equal to that of the former, soon surpassed it as the speed rose. At speeds above 30 m. p. h. the express engine had altogether the best of the argument as to effective power, the general running conditions remaining similar. The engines being dissimilar some small portion of the difference might be charged up to air pressure, but the total difference is altogether too great to be shuffled off in this convenient fashion. The freight engine showed a great relative falling off of tractive power as the speed rose, for which some rational explanation must be sought. Even more curious was a comparison between two engines of the express class having driving wheels differing in diameter by about 6 ins., the one having wheels about 6 ft. 6 ins. the other nearly 7 ft. The engine with the larger drivers was inferior to its mate in draw-bar efficiency up to about 60 m. p. h., and then came to the front. At about 60 m. p. h. it was found that 40 per cent of the power of the locomotive, in this case nearly 1000 hp, is used up in propelling it and its tender. As the engines weighed some 80 tons to 90 tons these figures become fairly comparable with those obtained with the electric cars of similar weight in the Zossen trials, and it is at once obvious that there must be sources of loss in the locomotive that require steady and prompt investigation. These losses are far too large to charge to an increase of the engine friction proper, and appear to be distributed in an unknown manner between the engine and the track.

Two causes have been suggested to account for these somewhat mysterious losses. On the one hand, there is a strong opinion that particularly in the engines with coupled drivers there is some way a grave waste of energy, due to the heavy reciprocating parts. On the other hand the concentrated weight of the engine tends to bear down the track and thereby produce the equivalent of a slight continuous grade. If the losses due to reciprocating weights are considerable the difference between several pairs of small coupled drivers and one large pair would be explained, but it is far from easy to see how the reciprocating parts cause any direct loss of energy. If even a small part of the waste energy to be accounted for were to be located in the reciprocating parts and their supports the engine would have to go out of service at the end of its first run. So far as sagging of the track is concerned the engine with single drivers should have altogether the worst of the game, which it evidently does not. The fact is that the mechanical losses which appear are too large to be localized in the moving parts of the machine without results almost immediately destructive. To some extent the racking of the engine by the strains imposed by the reciprocating parts, must measure the frictional losses all through the mechanism, but we incline to the opinion that the real explanation is to be sought in the actions that go on between the driving wheels and the track. It has been found in tests of electrical trains that aside from differences of air resistance there are signs that the motor cars take an abnormal proportion of the total power, signs which point to the existence of a grinding friction between driving wheels and rails very different from the rolling friction of a mere carrying wheel. In the case of a locomotive with several coupled sets of drivers this grinding effect must be far more marked than in a machine with a single pair of large drivers, and the jarring and hammering of the reciprocating parts must produce an inequality of action very likely to aggravate grinding friction. The uniform rotary effort of the driving wheels on an electric locomotive must, on the other hand, tend to minimize this particular difficulty. Certainly all the tests point to the great advantage of electric locomotives in obtaining highly efficient tractive efforts at very high speeds.

TRAIN DESPATCHING ON THE ROCHESTER & EASTERN RAPID RAILWAY

In the STREET RAILWAY JOURNAL of Jan. 16, 1904, an account was given of the Rochester & Eastern Rapid Railway Company's new system between Rochester and Geneva, N. Y. The object of the present article is to give some interesting particulars regarding the telephone despatching system used on that road and the apparatus employed in connection with it, which has some features in its design not heretofore used. The despatching line consists of a pair of No. 12 copper wires, carried on porcelain insulators on brackets below the high and low-tension feed wires. The telephone brackets are placed 12 ins. apart, and both brackets are on the same side of the pole. The line has seven transpositions to the mile. The high-tension transmission line above it is 15,000 volts. The brackets are placed low enough on the pole to permit the use of an emergency telephone-connecting fish pole, which is carried in the car, and which is a special feature of this system, to be described later. At switches and other convenient points along the line, jack boxes are fastened to the poles and connected with waterproof wires to the telephone line, these jack boxes being connected in multiple or bridged across the line. Fig. 1 shows a motorman in the act of plugging in connection to one of these telephone jack boxes at a pole. Where connection is desired in case of emergencies between jack boxes, the connecting pole is used. This pole is shown in operation in Fig. 2, and its end is shown in detail in Fig. 3. This emergency hook pole can be connected to the line at any point, as shown in Fig. 2. The pole is made of maple and joined so as to be stored away in the car when not in use and at the same time be long enough to hook on to the despatcher's wires. As shown in the cross section of the top of the pole, Fig. 3, the upper hook is mounted on a sleeve, which slides up and down over the end of the pole. This sleeve is held in position by a weak spiral spring. When the top hook is hooked over the wire the weight of the pole is sufficient to pull the pole part way out of the sleeve and bring the bottom hook in contact as well as the top hook. In the bottom of the pole is a spring jack, into which the telephone plug is inserted the same as in the jack box. If anything occurs that causes the car to be blocked the motorman has orders to at once get into communication with the train despatcher without waiting to attempt to repair the trouble or find out what is wrong, and while the car is stopped one of the crew must keep within hearing distance of the telephone on the car, so that the train despatcher can get the train crew at any moment.

FIG. 1.—MOTORMAN PLUGGING CONNECTION TO TELEPHONE JACK BOX ON POLE

SWITCHBOARDS

The company has provided two telephone switchboards in its general offices in Canandaigua, N. Y., which is about the center of the line, and where the power plant is located. One of these switchboards, Fig. 4, of fifty-line capacity, is used for connecting the different offices and departments with each other for the general business of the company, and has two trunks from the Inter-Lake Telephone Company's office in Canandaigua connected to it. The object in providing this switchboard is to relieve the despatcher's switchboard of all work other than despatching.

The other switchboard, Fig. 7, is used in the despatcher's office, and is especially designed for this purpose, being what is known as the desk type, with an extra wide table in front of the plugs and cords so as to provide plenty of room for the train sheet directly in front of the despatcher, as he manipulates the switchboard. This switchboard has a capacity for twenty lines, and is equipped at the present time for the operation of five lines. These switchboards are what is known as the magneto call manual restoring drop type.

TELEPHONE INSTRUMENTS

Four designs of telephones are in use in this system. A portable desk type, Fig. 5, is used on the desks in the offices. A compact, or dry battery type, is used in the offices along the line. An iron-box waterproof telephone is used where it is desired to place a telephone in an exposed position. An especially designed type, known as the "Car" telephone, constructed with a reel, which carries a cord and plug for connecting with the emergency pole or jack boxes, is used on each car, as shown in Fig. 6.

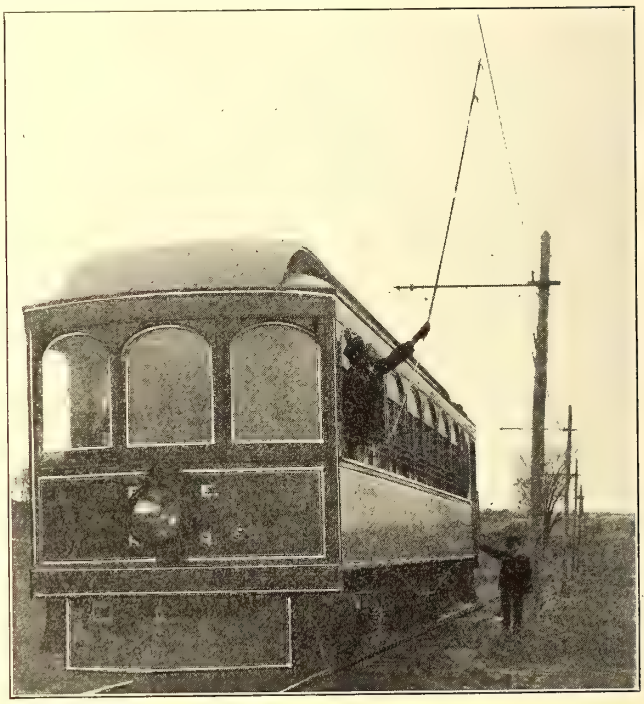


FIG. 2.—EMERGENCY HOOK POLE USED FOR CONNECTING TELEPHONE TO LINE

These telephones are provided with a generator for calling and local batteries for talking. Each telephone is equipped with its own battery, and what is known as the bridging type, being bridged or connected in multiple to the line.

OPERATION

The operation of the despatching system is similar to that which is used by steam railways, with the exception that the order known in steam railway systems as No. 19 is not used.

This is an order which is not vitally important, and no harm is done if the operator for any reason fails to get it to the conductor or engineer when his train passes, as it contains information which the train crew has previously received, or that failure to receive would not result in disaster. The despatcher's train sheet is of the approved type, giving the condition of the weather, the time of day, day of month and year that the sheet is opened and closed, name of motorman and conductor, train number, car number, name of stations and sidings with room at the bottom for remarks and notes of detention and causes, also a summary of regular passenger mileage, special passenger mileage, express mileage, work-train mileage, foreign passenger mileage, foreign express mileage and total of all mileage.

Definite time-tables are used, giving time of arrival and departure of regular trains at regular stops. Express trains stop only at important stations, while local trains stop at road crossings and other points not on the schedule, which may be convenient to the patrons living in the vicinity.

On this road trains in either direction have no superior right over trains in opposite direction, but meet trains as per time-table, unless otherwise ordered by the despatcher. Work trains must clear all regular trains by 5 minutes. A notice is printed on the time-tables that they are for the information of employees only, and the company reserves the right to vary therefrom as circumstances may require. On the back of the time-tables furnished the employees is published the rules for the government and information of employees, which, in the main, are the standard rules adopted by the American Street Railway Association for interurban service.

In this system but two train order blanks are used. The first blank is the same as is used by steam roads, and known as order No. 31, except that the order is receipted for by the conductor only, instead of by the conductor and engineer as on the steam roads. This telephone train order blank is used for all meets and special orders excepting clearance orders.

In case of an "extra" this blank is used, and a copy of the order given to the "extra" is given to every train crew that may meet or pass the "extra" in its trip over the road; thus giving due notice to all train crews that an "extra" has started and to look out for it.

Every car, before starting from a terminal point, must report to the despatcher and receive clearance or other special orders. The conductor must sign a receipt, showing that he received the orders. In no wise can any train get upon the track without at least clearance orders. All orders are issued in triplicate; the motorman, conductor and operator receive a copy and the despatcher preserves the original. When it is necessary to receive orders at intermediate points, that is, between regular stations, the unique telephone system permits of instant communication between the cars and the despatcher's office. To avoid the possibility of mistakes the motorman is compelled to take the order from the despatcher, write it out, and the conductor then repeats the order back to the despatcher for O. K'ing. Orders issued from the despatcher's office must be repeated back before they become effective, and all trains are required to get orders at every station where there is an operator before proceeding, whether running on time or not.

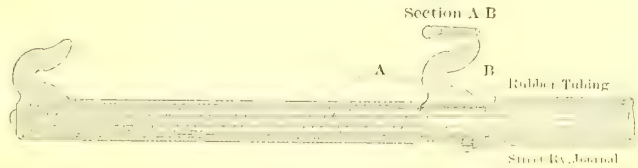


FIG. 3.—DETAILS OF EMERGENCY HOOK POLE

FIG. 4.—THE FIFTY-LINE BOARD FOR GENERAL BUSINESS

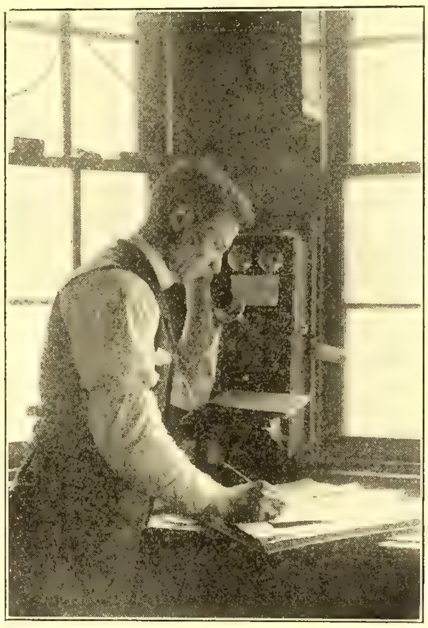


FIG. 5.—RECEIVING TELEPHONE ORDERS AT A DEPOT

FIG. 6.—TAKING ORDERS ON A CAR, SHOWING CAR TELEPHONE USED

A train is not permitted to leave a station where orders are received without at least receiving and receipting for a clearance order, and all trains are reported to the despatcher when arriving and leaving these stations.

The passenger cars are of the heavy type, being 52 ft. in length, having a vestibule in one end for the motorman, 4 ft. 6 ins. in depth, in which the car telephone is located to the left of the motorman, being permanently fastened to the car. This telephone, Fig. 6, is designed especially for this work, being of very compact type, using dry batteries and having connected with it a reel which carries about 75 ft. of waterproof cord, at the end of which is attached a plug. This telephone is used at passing points, and in cases of trouble, by connecting with the plug to a jack box, which is fastened to a pole at each siding where there is not a regular station, and placed at intervals of half a mile throughout the length of the road. Besides this there is the connecting pole on each car.

When a train gets to a passing point and the other train is not in sight, the orders are to connect at once the car telephone to the despatcher's line. The motorman giving his name and train number and location so that if the train he is ordered

to meet is delayed for any reason he can get an order to pass at some other point.

To provide against the possibility of the despatcher's lines being rendered useless for any reason the company has a trunk line from its despatching switchboard direct to the toll switchboard of the Interlake Telephone Company, which, through the independent telephone lines of this locality, connect with all of the stations of the road, so that the despatcher in this way can put himself into communication with all of the train order stations along the road. This pair of trunks is not allowed to be used for any commercial purposes, so that in case of an

FIG. 7.—THE DESPATCHER'S SWITCHBOARD

accident to the despatcher's lines the despatcher can at once get through to the toll switchboard of the Interlake Telephone Company.

The company has adopted two rules which are appreciated very much by the public. One is that the conductors are required to report when leaving and entering the terminal points the number of passengers they are carrying, so that the despatcher can order out extra cars or additional cars to trains leaving if it looks as though the trains would be overcrowded. The other is that ticket agents at regular stations must keep posted on the entertainments that are being presented at the different theaters, as the company sells return tickets, which entitles the holder to a seat in the theater he desires to attend; the seat being reserved the same as though the ticket was sold at the theater office.

The telephone apparatus used throughout this system is manufactured by the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., and Chicago, Ill., and was especially designed for this particular purpose after the Stromberg-Carlson Company had consulted with some of the best electric railway engineers in the country, the object being to eliminate as near as possible faults which have been found in apparatus used for this purpose up to the present time, and the results obtained, as practically demonstrated in this system, show that they have succeeded.

NEW YORK OFFICE FOR THE STATE RAILROAD COMMISSION

The New York State Railroad Commission has established a permanent office in New York City, as there are so many questions calling for the attention of the Board in New York City and vicinity. The office is located at Room 406, Whitehall Building, and Charles R. Barnes, expert of the Board, will make his headquarters at this office.

PRACTICAL HINTS ON INTERURBAN RAILWAY OPERATION

BY A. B. HERRICK

Interurban electric railway construction and practice of to-day is in large part patterned after those of city electric railways, but the question which arises in the minds of many engineers is, Have not many of the methods which are effective in city work been carried beyond their useful limit when applied to interurban work? We do not have to look far for the reason of the great similarity in construction of the interurban roads in this country. Capitalists have been encouraged to build these roads from the results secured in those already in operation, and for this reason engineers have been very loath to introduce anything experimental or depart largely from already accepted practice. But as the methods adopted on the early roads were borrowed largely from city practice they have been applied under conditions very different from those for which they were originally intended. For example, no trolley wheel in city service would often be required to carry from 400 amps. to 600 amps. or over, nor would the manager have to estimate upon a drop between the trolley base and the trolley wire of from 10 volts to 45 volts, depending on the speed of the equipment, the size and type of wheel and trolley wire. These conditions are common in interurban work, and the resultant deterioration of the trolley wire and the line troubles due to arcing at the ear and to variations in the trolley wire alignment, show that we have long passed the economical use of the trolley wheel for this service.

To meet the arduous conditions of current collection, for which the trolley is evidently ill suited, the third rail was devised. But nothing could be more absurd than to use as a conductor a T-rail, whose shape was specially designed for supporting a rolling weight, and which could be used for this purpose only in 30-ft. lengths. If any railroad manager was offered a trolley wire in these lengths, he would immediately refer the salesman to the junk dealer as a more appropriate customer. There also seems to have been no good reason for putting the third rail so close to the ground. This was its location on the early roads, and later engineers have followed the practice because it was operative. A more careful consideration of the problem would have dictated a steel conductor, weighing about 20 lbs. per yard, rolled in convenient lengths, and so supported that the contact-shoe could bear on the bottom and would be protected from rain and sleet by a covering. A copper cable running alongside this structure and soldered to each section of this third rail, would more economically and successfully conduct this current than is at present the case.

An over-running shoe in which the weight of the shoe supplemented by a spring is depended upon for pressure has never been found to be the best form of collector between a movable and stationary collector. This was well demonstrated by the experiments with the over-running trolleys in the early days of electric railroads. The reason for this is that where the shoe is of considerable weight its inertia will prevent it responding rapidly enough to the changes in the surface of the contact-rail where the speeds are high, and at breaks in the third rail at crossings there is a bounding of the shoe when it strikes the slope of the third rail. This not only throws mechanical strain on the shoe hanger and roughens the contact-rail at these points, but these conditions are aggravated by continued use. The same mechanical analogy of under-running and over-running shoe is presented in the case of striking a blow with a hammer in which there is a spring between the head of the hammer and handle and another hammer in which the spring is located between the head of the hammer and anvil. In the first case we get full impact of the weight of the head of the hammer, while in the second we have the impact transmitted through the resilience of the spring. With the under-running shoe we have to deal with nothing but the

resilience of the spring which holds the shoe against the contact, and this is vastly more active than where a dead weight has to be contended with.

The reason for placing the third rail low was evidently so that the shoe hanger could be attached to the truck and thus reduce the sideway oscillation of the shoe to a minimum. But if the weight of the third rail is brought down to only 20 lbs. per yard a structure can be built which need be supported only at intervals of 15 ft., and which will have only a slight flexure. If then the under surface of the rail is of V-shape, and the lateral motion of the body of the car is taken up by springs on the roof of the car, the third rail can be erected 12 ft. or more above the head of the rail and at sufficient distance at the side of the track so that there would be no danger to passengers who should lean out of the windows of the car.

By placing the support for the shoes on the roof of the car and centering it over the pivot of the truck, and by bending the third rail to conform to the curves on the road, no great lateral motion would be required by the contact-shoe in keeping its position on curves of the radius usually employed in interurban work. This construction would permit the use of the third rail on roads paralleling highways, and if each section of the third rail was independently supported and connected to the main feed conductor there would be no strains on the pole line, due to temperature changes.

Passing to the interurban equipment itself, the sizes of wires used in car wiring are usually figured on the mean current taken by the motors, and, as a rule, are too small. The maximum potential that can be obtained across these motors determines the maximum speed of acceleration. Consequently, a wire too small causes a drop in voltage which, if utilized at the brushes of the motor, would decrease the current demand on the line and improve the acceleration condition. In a 45-ft. car body there are nearly 380 ft. of wire between the trolleys and the motors, causing often a drop of from 10 volts to 35 volts, depending upon the type of the equipment and the weight of the car body.

The multiple-unit control was primarily designed for a train control. Several of the interurban roads are using it on single equipments, and have come to its adoption on account of the arcing troubles in the controllers on opening the motor circuit. If the controller was arranged so that it would trip a circuit breaker, one for each motor or pair of motors, and which could be closed only by bringing the controller handle to off position, the controller contact cylinder would be relieved of the function of breaking the circuit. Edwin W. Olds, superintendent of rolling stock of the Milwaukee Railway, has made a very pertinent suggestion along this line—that is to use individual fuses for each motor or pair of motors. This practice automatically cuts out a defective motor and prevents the putting in of new fuses or setting the circuit breaker, and thus further injuring the motor in trouble.

Another cause of trouble with motors and controllers is in raising the voltage on the line at the sub-stations or power stations to between 700 volts and 780 volts, and not tapping back on the trolley wire far enough from the sub-station so the full voltage will not be received by the equipment when adjacent to the stations. At this high voltage motors flash and buck and often the arc, drawn on a controller, cannot be satisfactorily extinguished by a magnetic blow-out device designed for 550 volts to 650 volts service.

It is a common practice in interurban railway work to connect together parallel feeders through the trolley wire, and such length of trolley wire is often interposed between these two feeders that its resistance prevents the full utilization of the multiple feeding effect of the feeders. Where two feeders are connected at the feeder board in the station through the same circuit breaker, they should be joined together at the extremity of the shortest feeder with a circuit breaker having a semaphore attachment which will show when it is open. This is, of course, useful only where the breaker is between the two feeders, but this arrangement will utilize the total copper overhead to the best advantage, except at the time when there is a ground on one of the feeders.

In order that sub-stations on interurban work divide their loads uniformly it is as necessary to have the bonding between the sub-stations in good condition as to have the copper overhead equally distributed between the sub-stations. I have found that defective bonding adjacent to one sub-station threw a 40 per cent overload normally on the next adjacent sub-station, causing momentary overloads greatly in excess of the capacity of the sub-station, and it cost many thousands of dollars to make good the repairs in the sub-station before the difficulty was located.

Another way in which the road engineer often creates an element of danger is by placing curves at the foot of heavy grades. This is done so often that it does not seem that the risk involved can be realized. A number of serious accidents in Ohio can be attributed directly to this unfortunate combination.

A word now regarding signal systems for short interurban roads. The block-in and block-out system, in which two lights are used at the siding ahead and three lights at the siding from which the signal is given, with a switch to throw the danger signal to the siding ahead, is certainly the simplest and requires only one wire between blocking points. The telephone system is also largely in vogue on interurban lines. The telephone is located either alongside the track in a telephone box, or in the car, and a connection is made by a pole to a telephone line adjacent the track at the signal point. A further improvement can be made by connecting the telephone on the car with an auxiliary trolley pole, and attaching the telephone wires at the signal point to the span wires in such a position that they can easily be connected with this pole. As it is important that both motorman and conductor get orders, a duplicate set of telephones could then be used, one in the motorman's cab and the other on the rear platform, so connected that both will be operated only when both receivers are off. In this way both conductor and motorman will hear the message as originally given, and there can be no confusion in transmission from one to another as where only one receives the message. Where there are only a few sidings between despatching points individual wires could be run to each siding, and in this way any car could be called up while passing a signal point, or the drops in the office would indicate what points had been passed by the cars. It has also been found very useful in emergency cases to have a flexible conductor which will reach from the telephone wires to the ground, so that in case of emergency between sidings the central office can be readily communicated with.

Electric magnetic apparatus for signalling and operating safety devices form a theoretically ideal method for signal systems on interurban roads, but experience indicates that the same troubles would be found with them as exist on steam railroads, and that is the difficulty in obtaining perfect service from any system operated by electromagnetic devices. The reason for this is that the speed at which these magnets are required to work does not allow them sufficient time to saturate and operate their armatures, and if wound to operate at 50 m. p. h., when the car passes them when running, they will be burnt out if the same energy is applied while the car happens to stand over the signaling point. These troubles are not unsurmountable, and it is to be hoped that of the many ingenious magnetic signal devices offered some will prove commercially successful. But the large majority of the interurban roads are equipped with two trolley wires insulated from each other, and I should think that if these trolley wires were individually fed betweeen blocks a system of signals or cut outs could be ar-

ranged so that when a car was taking current from one trolley wire the connection between the other and the feeder would be opened. In this way head-on collisions between signaling points would be impossible.

But no signal system is of use unless the discipline is such that to run by orders inevitably means discharge. In the matter of discipline a large number of the interurban roads can be materially improved. Moreover, it is important to have both the motorman and conductor mutually responsible for the proper fulfillment of the despatching orders and interpretations of the rules of the road.

DETAILS OF FLOOR OR BOTTOM FRAMING OF MODERN INTERURBAN CARS

BY EDWARD C. BOYNTON

Many decided changes have been made in the bottom framing plans of modern interurban cars during the past four years. These changes have been brought about by the rapid development of interurban roads, and are due to the use of larger and heavier cars, greater power and higher speeds.

In obtaining the necessary increase in weight and strength the practice employed in the design of steam railway coaches has been followed to a large extent. This is undoubtedly a move in the right direction, for the service required of the interurban car to-day equals, if it does not exceed in severity, that necessary in the average railway coach.

For purposes of comparison Fig. 1 shows in plan and side elevation the bottom frame details of the usual interurban car of four years ago. This car is 28 ft. long over end sills, has center aisle and cross-seats, with a seating capacity of forty passengers. It will be noticed that the strength of the frame lies almost wholly in the two side sills, which are of yellow pine, 4½ ins. x 8 ins., with a ⅝-in. x 8-in. steel plate bolted to the outside of each. The body bolsters are 8 ins. x 10 ins., with two ⅞-in. x 10-in. steel plates sandwiched in, and the end sills are 4½ ins. x 8 ins. There are four cross braces or bridging between bolsters, 2¼ ins. x 7⅛ ins., for the purpose of supporting the floor.

As there are no center sills the side sills have to carry the entire load and transfer it through the bolsters to the center plates. The side sills were sometimes, but not always, supplied with truss rods, which added materially to their strength and gave a slight camber to the frame.

This construction is well adapted to ordinary city traffic, where speeds are low, but when used in comparatively high-speed work the weakness of such a frame soon became apparent. The writer has seen such a car, with trussed side sills, and with needle beams which cleared everything under the car by about 4 ins., merely resting on top of the queen posts, acting simply as a block to extend their length!

Such examples of curious construction are not infrequent, but the car builders are not responsible, for many cars are designed by the purchasers, and the builders must follow their designs and specifications.

The method of supporting the front and rear platforms shown here is that which has been in use for many years, but is now rarely used on interurban cars. Its weakness is very apparent, the separate platform sills, 2¼ ins. x 7½ ins., passing under the end sills, and usually secured to them by a strap and bolted to the side sills, are reinforced by ⅝-in. steel plates on the inside, and form the sole support of the platforms. In the interurban car of to-day the dead weights carried on the platforms, such as heavy controllers, and frequently hot-water heaters, together with the necessity for a collision buffer, render a substantial platform imperative.

The plan and side elevation of the bottom frame of a type of modern interurban car is shown in Fig. 2. This car is 40 ft. long over end sills, and 52 ft. over buffers, and has a seating capacity of fifty-four passengers. It is single ended, that is, intended to run in one direction only.

Each side sill is made of one piece of long-leaf yellow pine, 5 ins. x 8 ins., and one piece, 2 ins. x 6 ins., enclosing a 6-in. x ½-in. steel plate between them, all being securely bolted together. The left-hand side sill is carried from the rear corner post under the front platform to the buffer. The right-hand side sill runs between corner posts only. There are four more longitudinal sills, two center and two intermediate. These consist of 6-in. steel I-beams with yellow pine filling strips on each side, well-bolted together, forming square sills into which the cross sills of wood can be framed. These four sills extend from the rear end sill straight through under the front platform and support the buffer.

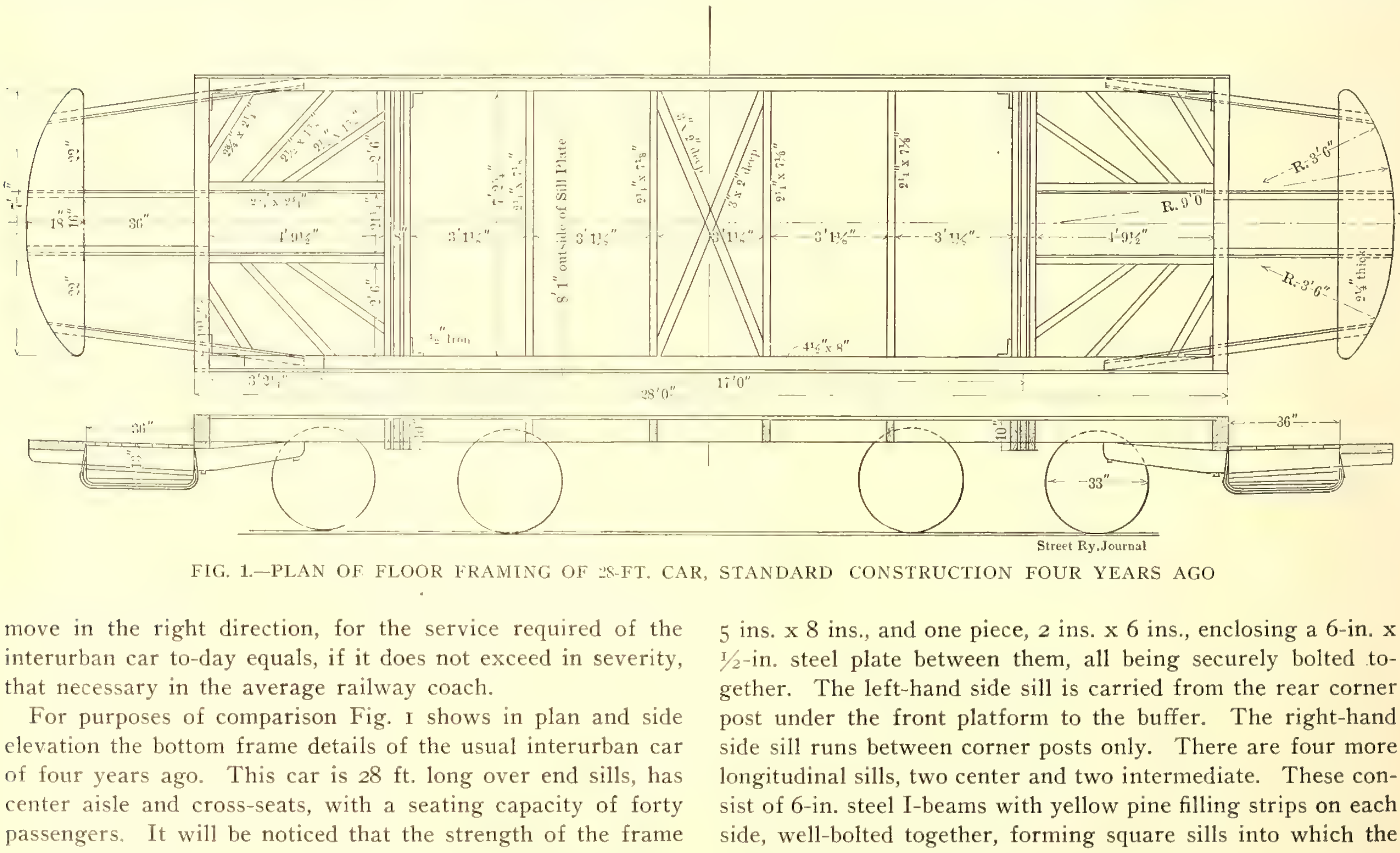


FIG. 1.—PLAN OF FLOOR FRAMING OF 28-FT. CAR, STANDARD CONSTRUCTION FOUR YEARS AGO

The rear platform is supported by four separate sills, each consisting of two 5-in. x ½-in. steel plates, which extend from the rear bolster, enclosing each center and intermediate sill, and securely bolted thereto, back to the end sill under which they are offset, and thence under the rear platform, with suitable filling pieces of wood between them, to the rear buffer.

The end sills are 6-in. x 8-in. oak, strongly reinforced by a heavy angle-iron securely bolted to the lower side.

The rear end sill is solid while the center and intermediate sills pass through the front end sill.

All cross sills are made of 3¾-in. x 6-in. yellow pine, framed in between longitudinal sills, and beside each cross sill is a

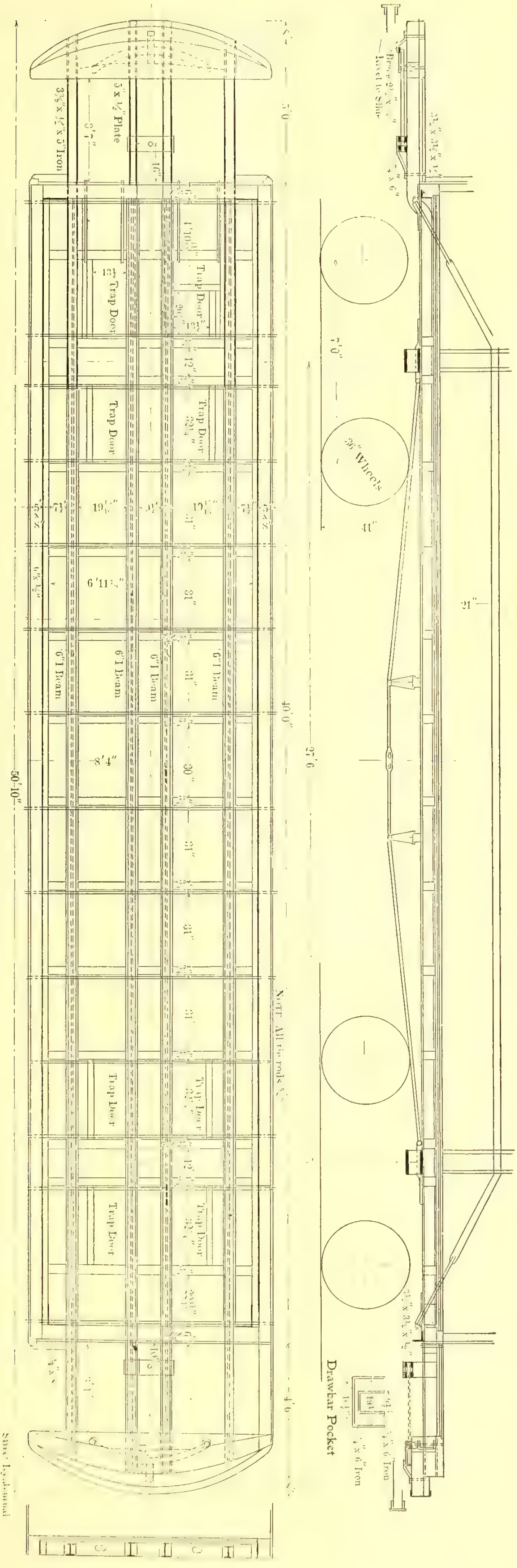


FIG. 2.—PLAN OF FLOOR FRAMING OF A MODERN CAR

⅝-in. tie-rod, extending the full width of the car, with cup washer and nut on each end, which thoroughly ties the frame together. The frame is further strengthened by 1¼-in. truss rods under side sills, carefully anchored at bolsters, with turnbuckle in center, and two needle beams of 4-in. x 6-in. white oak, each trussed by two ⅝-in. rods and supporting all longitudinal sills. The body bolsters are built in the form of a truss of 1-in. and ¾-in. x 12-in. steel plates, with suitable center plate casting, and bolted together with filling pieces in the form of cast-iron sleeves over bolts between the plates.

This type of bottom frame is one of several recently built which differ slightly in detail. It is evident that the left-hand side of the front vestibule is closed, while there are steps at the other three corners of the car. Those in front are chiefly for use of the motormen, while passengers use both sides of the rear vestibule.

The front platform is at the height of the car floor, while the rear is a step lower, thus saving a side step. There is a marked tendency in later cars, however, to carry both center and intermediate sills straight through from buffer to buffer, making both platforms level with floor, and using the steam railway box-type of steps. This makes the strongest and best construction, for it forms a platform and vestibule which will not sag and is a safeguard in collisions.

The style of buffer shown is now quite generally used. It is made of oak, runs the full width of car and is faced with a heavy steel channel-iron. The buffer projects about 8 ins. beyond vestibule sheathing.

There is one detail which does not seem to have kept pace with the other improvements, through it may not be properly a part of the bottom frame—and that is the draft rigging. By this is not meant the draw-bar and its attachments, but the methods of securing it to the frames. Draft sills are rarely seen on interurban frames, but draw-bars, strong enough to pull a freight train, are attached to center sills by means of a weak iron bracket, which supports the pin through the end of the draw-bar. It might be said that interurban cars are not intended to pull freight trains, which is true, but how often we see their draft gear put to a worse test, especially when trying to pull a derailed car back on the track by a chain. The result in a majority of cases can be predicted—the draw-bar pulls out.

There is no reason why the draft rigging should not be designed somewhat after steam railway practice, and made strong enough to hold any load that the tractive power of the motors can put upon it.

THE MASTER MECHANICS' CONVENTION

Formal announcement of the convention of the American Railway Mechanical and Electrical Association has been sent out by Secretary Walter Mower. The convention will be held the two days preceding the American Street Railway Association Convention. The Master Mechanics' Convention will be held at St. Louis, Monday and Tuesday, Oct. 10 and 11, 1904, to be followed by the American Street Railway Association Convention the 12th and 13th, and the Street Railway Accountants' Association of America the 14th and 15th.

The Supreme Court of Ohio has recently handed down a decision in a case in which a conductor on the Cincinnati Traction Company brought a damage suit against a party who had reported him to a superintendent for misconduct. The court held that a patron of a street railway company incurs no liability to a conductor by reporting to the superintendent of such company misconduct on the part of the conductor while on duty, even though in making the report the passenger is prompted by ill will and a desire to secure the conductor's discharge from the service of the company.

TRAIN TESTING

BY SYDNEY W. ASHE

It is realized by the writer in the preparation of this article that it is impossible to include in the limited space at hand all that pertains to train testing. It has, therefore, been con-

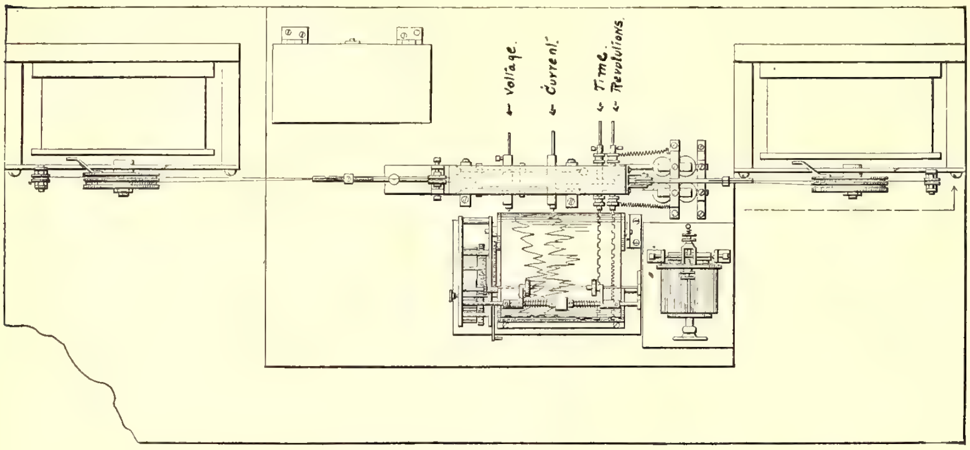


FIG. 1.—PLAN OF RECORDER, SHOWING RECORD SHEET IN POSITION

sidered expedient to omit all methods of tests upon equipment the results of which could be obtained at any time from the respective manufacturing companies. In the case of motors, curves may be obtained from any of these companies, exhibiting all of the principal characteristics, namely, the efficiency and the current, speed, torque, relations. Similarly considering trucks, car bodies, gears, brake apparatus and brake-shoes, all of the data may be secured from their respective manufacturing sources. There are certain tests which it is desirable to make when the car equipment is in an operative condition. These tests are, namely, an insulation test with a high-resistance voltmeter to determine weak points in the insulation and possible future grounds; a test of the capacity of the motors operating normally, determining the rise of temperature of the armature coils and field coils, and, finally, complete speed time curves and power curves should be obtained between successive stations. It is impossible from one series of tests to obtain data which will represent the characteristic performance of a train. With conditions similar in every respect, including the motorman, a difference of power con-

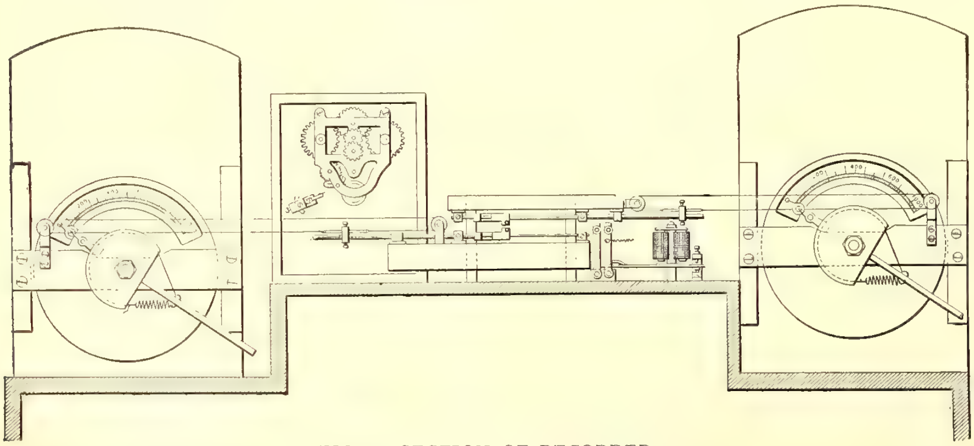


FIG. 2.—SECTION OF RECORDER

sumption amounting to as much as 15 per cent may exist when comparing the data obtained from two tests. Where automatic acceleration is obtained, as with the Westinghouse electro-pneumatic system of control, the personal equation of the motorman is almost eliminated.

THE SPEED-TIME CURVE

A speed-time curve, as its name indicates, is a curve which exhibits the instantaneous speed value at various intervals of some variable. Such a curve when applied to a train, representing its performance between the stations, has a zero value at starting, reaches a maximum value after power has been applied to the train and finally becomes zero after braking, at which time the train has arrived at the second station. There may be several applications of power between stations, the number being determined by the profile and the general contour of the road. By referring to such a curve the speed in miles per hour may be obtained at any time interval between stations.

A convenient method of obtaining data for speed time and also power curves is by means of an instrument (Fig. 1) devised by John D. Keiley, of the New York Central Railroad. This testing set was used in preliminary train tests of the Manhattan Railway Company, and subsequently an improved form was employed in similar work on the Rapid Transit Subway. As this instrument affords the only means of obtaining simultaneous continuous records of speed and power, it was decided by the writer to employ it in train testing. The curves inserted in this article were obtained by one of Mr. Keiley's instruments, and a brief description of the apparatus therefore follows

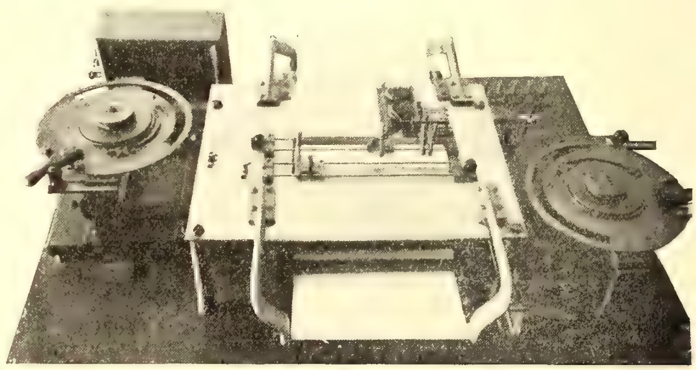


FIG. 3.—LATER TYPE OF RECORDER

The instrument when operative carries a strip of paper in roll form drawn by a spring motor at uniform speed over a drum. The motor was fitted with a delicate governor, by means of which the speed could be changed at will. When operative the paper passes over the drum under three pencils, the pencils pressing the paper against the drum and producing a record of time, current input and wheel revolutions of the car. The pencils recording time and wheel revolutions are actuated by electromagnets, the pencils producing, when the paper is in motion, a serrated line.

A clock mechanism mechanically closes a local storage battery circuit through the time relay magnets at successive half-seconds periods. It is obvious that the length of line produced by the time pencil on the paper will be the same between contacts, providing the paper move at a uniform rate.

Upon one of the axles of the car is fitted a wooden drum containing a metal strip. A brush pressing upon the drum makes contact with the metal strip with each revolution of the wheel, thereby closing a local storage battery circuit through the second pair of magnets. The length of line produced by

the revolutions pencil varies with the car speed between successive contacts. At starting the car wheel may make the first revolution in approximately one-half second. At a speed of 22 m. p. h. approximately four contacts will be made in one-half second. The duration of time per revolution provides the means of plotting a speed-time curve when the tread of the wheel is accurately known.

The third feature of the instrument, and by far the most important, is the device for recording current. It consists of a high-range ammeter connected in series with the power line of the train. The range of this instrument is of sufficient magnitude to permit of a deflection without banking, equivalent to the maximum current imput of the motors. Mounted rigidly upon a spindle in front of the ammeter is an arm with a pointer on one extremity and a handle on the other end. This handle can be moved by the operator with a little practice so that the pointer may accurately follow the variations of the ammeter needle. By means of a fine wire passed several times around a pulley mounted upon the fulcrum of the handle, the motion of the pointer may be transmitted to a sliding rest upon which is situated the current-recording pencil. The wire is kept taut by passing it around two additional pulleys in a similar manner to that of an endless belt (see Fig. 2). The instruments, as now designed by Mr. Keiley, have an additional attachment similar in every respect to the current-recording device, to record voltage (see Fig. 3) requiring the services of an additional operator. In the tests made by the writer, voltmeter readings were obtained by inserting a voltmeter in the lamp circuit with an attachment plug, the drop due to the lamps being allowed for.

PLOTTING OF OBSERVATIONS

Prior to plotting a speed-time curve it is desirable to plot a distance-time curve. This is readily accomplished by counting the number of contacts representing wheel revolutions up to the given time interval and multiplying by the tread of the wheel in feet. Securing points every 5 seconds and plotting the same, a curve is produced (see Fig. 4) which will exhibit any sudden variations of speed, will indicate when a straight line inclined to the axis that the speed is constant, and will serve as a check when plotting the speed-time curve.

It is customary when investigating the results of tests to plot all of the variables upon the same sheet with time as the abscissa, so that at any time interval the distance covered, the speed, the power consumption, the current input, the voltage and the acceleration may be readily compared. The speed curve (Fig. 4) was obtained by drawing tangents to the distance curve.

This particular test was selected because it contained both grades and a curve. The car left station A upon a curve and a slight up-grade. When emerging from the curve the grade suddenly increased. This up-grade continued to within a short distance of the station. The various grades and the curve are represented upon the profile map (Fig. 5).

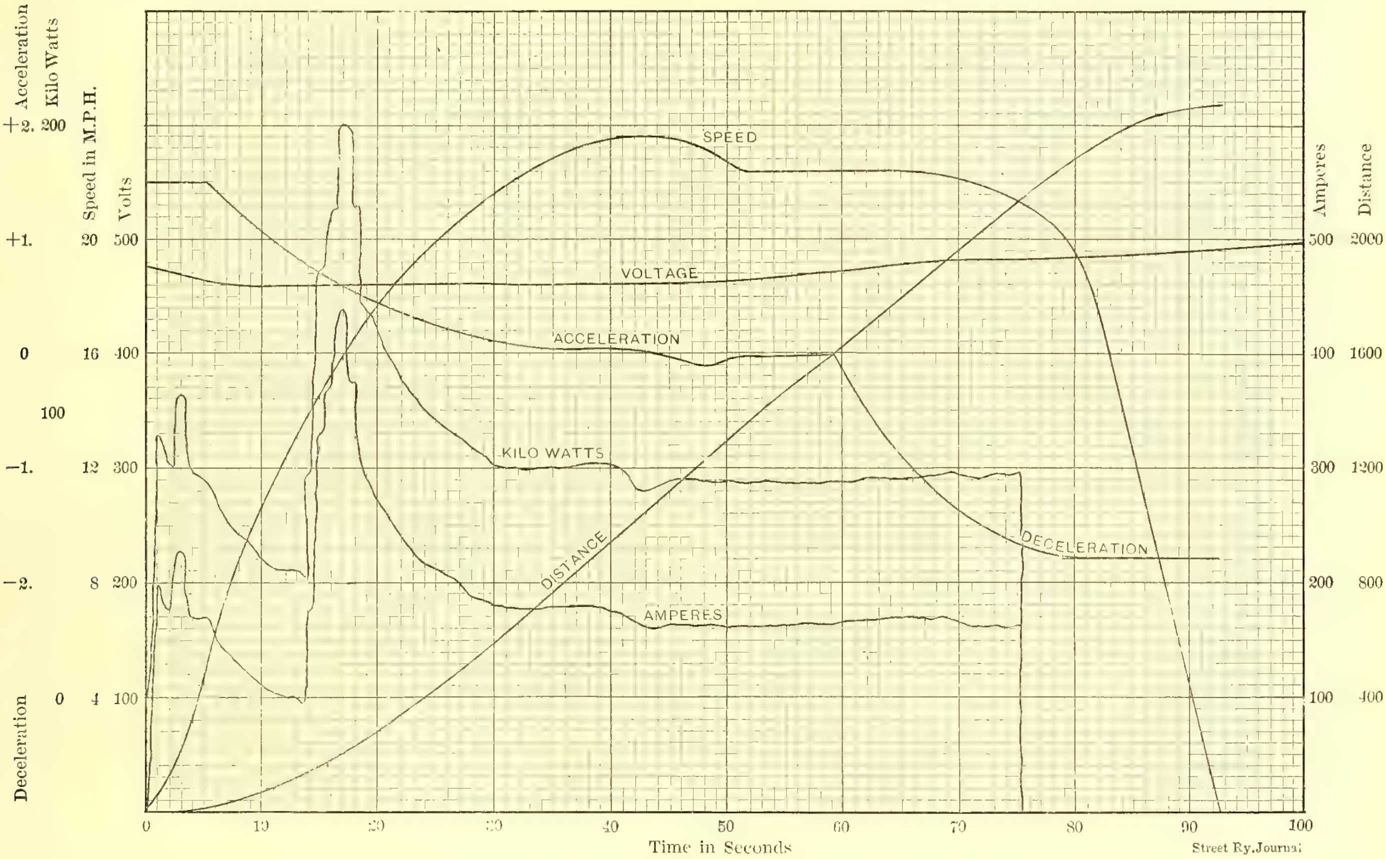


FIG. 4.—TEST DIAGRAM PLOTTED FROM RECORDS MADE BY RECORDER

The test was performed upon a single car, having 33-in. wheels, with a tread of 8.63 ft.; was equipped with automatic multiple-unit control, and was operated by four motors, rated at 60 hp each, the motors being geared in the ratio 21 to 65. The total weight of the car, including passengers, was 67,200 lbs. The total distance covered between starting at station A and stopping at station B was 2480 ft.

To plot the current curve from the test sheet, vertical, parallel lines are drawn across the paper intersecting the current curve, separating it into half-second intervals, as determined from the time record. The current attachment of the instrument is calibrated by placing the pointer on the successive 50-amp. points of the ammeter while the paper is passing under the current-recording pencil. This produces a series of parallel lines, one beginning where the previous one ended, from which a scale may be deduced. A zero current line is then drawn on the test sheet. The amperes equivalent to the height of the current curve above the zero line is readily determined by means of the scale. The various successive current values at every half-second period are then plotted as illustrated in Fig. 4.

The voltage, as observed every 3 seconds, is plotted above the current curve. The voltage curve will fluctuate while the motor is accelerating and by employing one of Mr. Keiley's later instruments, which records voltage, a much more accurate curve may be plotted. In the curve sheet, Fig. 4, for instance, the voltage curve should drop at each notch of the controller instead of remaining practically uniform.

When the current curve and the voltage curve have been plotted a power curve may be obtained by multiplying together the instantaneous values of both curves. The area of this curve in square inches may be obtained with a planimeter. This area may be reduced to watt-hours by a knowledge of the watt-

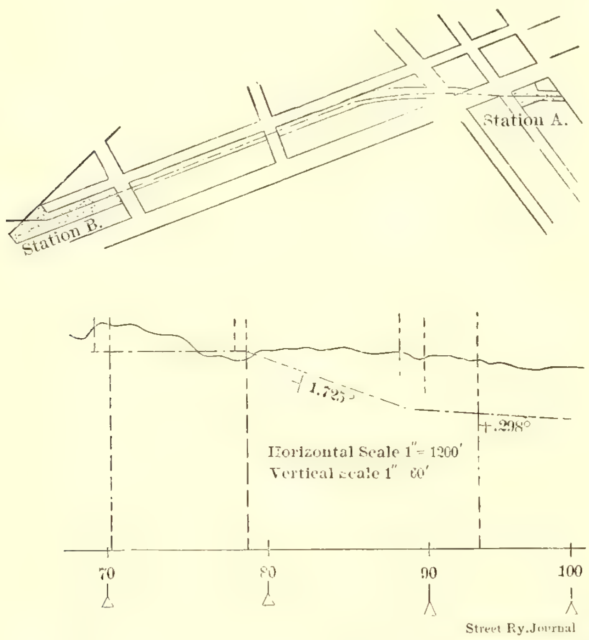


FIG. 5.—PROFILE AND PLAN OF THE SECTION OF ROAD ON WHICH RECORDS SHOWN IN FIG. 4 WERE OBTAINED

hours equivalent to 1 sq. in. of cross-section paper. In the test we are considering, 1 in. of cross-section paper is equal to 10.0 seconds on the abscissa, and it is also equal to 40.0 kw upon the ordinate representing an area of .111 kw-hours per square inch. The total area of the current curve is equal to 15.73 sq. ins., being equivalent to a power consumption between stations A and B of 1.750 kw-hours.

The effective current value representing the square root of the mean square current, or its heating value, may be obtained as follows: The instantaneous current values, represented by the current curve, should be squared, and a curve of current-squared values and time plotted. The area of this curve in square inches should be obtained with a planimeter, and this area, when divided by the base line in inches, will yield the mean ordinate in inches. Plotting this mean ordinate on the current-squared axis will give the mean square current value. Extracting the square root of this quantity the square root of the mean square current value is obtained, or, in other words, the effective current value.

The effective current value will enable the I^2R losses of the armature coils and the field coils to be readily determined when their resistance is known. The combined remaining losses, due to friction, hysteresis, eddy currents, journal friction, windage, etc., may then be determined by comparison with the efficiency curve of the motors.

The schedule speed is obtained by dividing the area of the speed-time curve by the base line following the method previously described. In a similar manner the mean acceleration in miles per hour per second may be deduced by integrating with a planimeter the acceleration curve up to the point where the maximum speed occurs, and then dividing by the base line corresponding to the same time interval. If we divide the area of the acceleration curve by the total time between stations the through acceleration is obtained. The mean rate of deceleration while braking is equivalent to the area of the deceleration curve divided by its base line.

TEMPERATURE TESTS

A standard method of making temperature tests of armature coils and field coils is by means of measuring the increase in resistance during a run. As the motors cool off slowly, especially when slightly above atmospheric conditions, the car must be laid up in the yards for several days before the test is made. A satisfactory method for making this test is to utilize a storage battery with an ammeter in series attached to two long, flexible terminals with good flat contacts on their extremities, so that these contacts may be readily inserted between the brushes and the commutator surface of one of the motors. Attached to these flat contacts must also be the terminals of a low-reading voltmeter. This will enable the IR drop and the current passing through the armature to be observed. Employing Ohm's law, and the temperature coefficient of copper (.0042), the resistance of the coils at zero, R_0, is easily determinable from the formula,

$$R = R_0 (1 + .0042\,t)$$

where R is the resistance before the run at the temperature, t, of the atmosphere. The final temperature, t_1, of the coils is obtained by remeasuring their respective resistances, R_1, after the test and employing the formula

$$R_1 = R_0 (1 + .0042\,t_1)$$

Inserting the value for R_0, as previously determined, and solving for t_1, we obtain the resultant temperature. The temperature of the field coils and armature coils should not be allowed to rise more than 75 degs. C. above the temperature of the atmosphere, which is assumed to be about 25 degs. C. A curve exhibiting the rise of temperature of the field coils may be easily determined from a series of resistance values obtained by shunting the field terminals with a voltmeter, and having a large range ammeter in series with the ground side of the field coils. The resistance may then be determined at any instant when the motors are receiving power and the rise of temperature calculated by the method previously described.

INTERURBAN LINES IN ILLINOIS

The accompanying map of the interurban lines of Illinois shows considerably greater mileage than the map of Northern Illinois published in the STREET RAILWAY JOURNAL of July 5, 1902. Most of the increase in mileage has been in the shape of extensions of roads already in existence. A large number of projected lines are not shown on this map, as it has been the aim to confine it mainly to projects far enough along to seem almost assured and to those under construction and in operation. The greatest activity in this State has been shown by the "McKinley," or "Portland," syndicate. This syndicate has constructed the lines between Urbana and Danville, and between Peru and Marseilles, and has under construction several links in a chain between Danville and St. Louis by way of Decatur and Springfield. The same syndicate also controls the Galesburg and Monmouth line, which is under construction, and has projected lines between Galesburg and Rock Island. There is a considerable mileage tributary to Chicago, and Rockford is another important interurban center. A number of lines have been considered which would connect the Rockford and Chicago networks. A large interurban system also radiates from East St. Louis. The other interurban lines of the State are mainly short, isolated lines between large towns. The Coal Belt Electric Railway is a remarkable little road, serving a belt of coal mining towns tributary to Marion. The population is small, as Marion, the largest town, has a population of only a little over 2000, but the road has been economically constructed and seems to be doing well financially.


INTERURBAN RAILWAYS OF ILLINOIS
In Operation
Under Construction
Projected
SCALES.
0 5 10 20 30 40 50 MILES
0 5 10 20 30 40 50 60 70 80 KILOMETERS
ILLINOIS
LAKE MICHIGAN
MISSISSIPPI RIVER
OHIO RIVER
Wabash River
CHICAGO
JOLIET
ROCKFORD
PEORIA
SPRINGFIELD
DECATUR
BLOOMINGTON
DANVILLE
ST. LOUIS
E. ST. LOUIS
ALTON
GALESBURG
DAVENPORT
ROCK ISLAND
NAMES OF COMPANIES.
1 Elgin, Aurora & Southern Traction Co.
2 Aurora, Elgin & Chicago Ry. Co.
3 Rockford & Interurban Ry. Co.
4 Chicago & Joliet Electric Ry. Co.
5 Rockford, Beloit & Janesville R. R. Co.
6 Illinois Valley Traction Co.
7 Joliet, Plainfield & Aurora R. R. Co.
8 Coal Belt Electric Ry. Co.
9 Chicago & Milwaukee Elec. R. R. Co.
10 Chicago Electric Traction Co.
11 East St. Louis & Suburban Ry. Co.
12 People's Traction Co.
13 DeKalb-Sycamore Electric Co.
14 Chicago, Harvard & Geneva Lake Ry. Co.
15 Moline, East Moline & Watertown Ry. Co.
16 Peoria & Pekin Terminal Ry. Co.
17 Galesburg, Monmouth & Rock Island Ry. Co.
18 Sterling, Dixon & Eastern Ry. Co.
19 Decatur, Springfield & St. Louis Ry.
20 Aurora, DeKalb & Rockford Traction Co.
21 Terre Haute Electric Co.
22 Waukegan, Fox Lake & Western Ry. Co.
23 Danville, Urbana & Champaign Ry. Co.
24 North Kankakee Electric Light & Ry. Co.
25 Galesburg & Kewanee Electric Ry. Co.
26 Granite City & St. Louis Ry. Co.
27 Bloomington & Joliet Electric Ry. Co.
28 Central Traction Co.
29 Bloomington & Normal Ry. Elec. & Heating Co.
30 St. Louis, Granite City & Alton Traction Co.
31 Keokuk & Western Illinois Electric Co.
Street Ry. Journal

ELECTRIC RAILWAY CAR HOUSES—CONSTRUCTION AND HAZARDS*

BY RALPH SWETLAND

A number of articles have appeared in insurance journals on the construction and hazards of the average electric railway car house. Attention has been called to the large areas usually found, to the inflammable nature of the contents, to the great aggregation of value exposed to one fire, to the very poor condition of the wiring of the cars, and to other hazards usually found in this class of risk.

Various suggestions have been offered for the correction of these defects, such as to build the houses with brick division walls between tracks, and roller shutters between the cars on each track, the whole structure being covered with a light iron roof. Or, it has been proposed to build the house of brick with iron partitions between adjacent tracks, the whole covered with a light iron roof; the object being with both forms of construction to stop draughts as much as possible and limit the extent of the fire.

The question of the removal of cars has also received considerable attention, and numerous methods have been proposed to remove the cars provided the building was on fire. One plan proposed contemplates a double trolley, one of which is to be the operating trolley and which is ordinarily used, the other trolley being dead. When the cars are run into the car house the trolley poles are so turned that the cars can be run from the house, the trolley wheel placed in contact with the dead trolley wire, and the controller set to its first position. By means of a switch some distance from the house, in case of trouble, this dead trolley is to be made alive, and as the controllers are on, the cars are supposed to move out of the building. Another method proposed to remove cars from the house has been to have the tracks inclined toward the front of the building, the cars to rest against each other, bumper to bumper, and the car at the front of the house to be blocked. In case of trouble it is proposed to remove this blocking and allow the cars to run by gravity out of the building.

While, undoubtedly, these different schemes have considerable merit, they apparently neglect one thing, and that is—the fact that the railways must operate, and however desirable, from a fire point of view, a certain type of construction may be, if it seriously interferes with the operation of the railway, some other plan would be chosen. It is problematical whether a road would agree to have each car in a pocket, as it were, since the increased cost of construction and the increased cost of operating would more than offset any advantage gained.

While it is desirable that the cars should be removed from the house in case of fire, a construction calling for an incline of the tracks is again very objectionable from an operating point of view, since with cars weighing 15 tons to 30 tons, the liability to accident to employees, and to the cars themselves, is very great, and it would almost be impossible to make any inspection or to do even minor repair work with the cars on an incline. A track scheme which would allow all the cars in a house to be run out at the same time would, to say the least, be very expensive and also require a great deal of space adjacent to a car house.

The New England Insurance Exchange has given considerable study to the question of a standard electric car house and equipment of same, and has recently adopted requirements, as given at the end of this article, for such houses.

Construction.—This standard proposes a wall of a good hard burned brick not less than 16 ins. thick, except when piers are used, when piers shall not be less than 20 ins. thick, with the length of piers at least one-quarter the distance between the center of piers. Cutoffs or division walls are to be not less than 20 ins. thick, to be carried full thickness through and at least 5 ft. above the roof, and arranged to cut cornice and protect doors and windows at either end. Area between cutoff walls to be not over 12,000 sq. ft. with the distance between centers of adjoining tracks not less than 11 ft.

The roof to be of regular mill construction; that is, 3-in. plank supported on single stick timbers spaced not less than 6 ft. nor more than 10 ft. on centers and supported on wooden posts. No monitors to be used, but if light through roof is necessary metal skylights with wired glass to be provided. The height of the roof at eaves to be not over 10 ft. nor more than 25 ft. at the peak, the covering to be of gravel, tin, or approved composition.

The floors to be of brick, concrete, stone or earth. Partitions, if necessary, to be of non-combustible material or of 2-in. matched plank coated with fire-retardant paint. The pits to have brick, stone or concrete retaining walls with steps of stone, concrete or iron, and, in addition, two types of construction are permitted; one allows a pit built in the form of a rectangular box of a width equal to the distance between the inside of the rails—that is, with no space at the sides under the track. The other allows of connecting pits, but requires the rails to be supported directly on brick, stone or concrete piers with brick arch or cement between the outside rails of adjoining tracks, and as often as every second track, a brick wall extending from the floor of the pit to the under side of the brick arch or expanded metal and cement, thus tightly shutting off the space between every second pit. The floors of the pits in all cases to be of cement, brick or stone.

The tracks to run clear from building without transfer table and to terminate at the rear of the building so as to give at least 3 ft. clear space between the end of the car and the building. The doors to be in pairs and swing out against stops, although under certain circumstances metal roller doors are allowed.

In a consideration of the type of construction which has been briefly outlined above, it will be noted that only brick is proposed for construction of the walls, and that these are somewhat thicker than many engineers specify. It is believed that even with a severe fire, there should be considerable salvage on walls constructed in accordance with these requirements, and with good outside protection a fire should not extend beyond a cutoff wall. By limiting the area and at the same time the distance between centers of adjoining tracks, the car storage within a fire section is limited, since if the house is filled with the more expensive type of cars, worth at the rate of $150 per track foot, the total value within the fire section should not exceed $150,000—a very moderate amount, at least as present car houses go.

The roof construction differs from most standards in that all forms of trussed roofs, either of wood or of iron, are eliminated and the roof timbers rest directly on posts. This roof will have a factor of safety of from 4 to 6, and with the height recommended the chance for the spread of the fire above the cars should be greatly reduced over any form of trussed roof. It should be slow in igniting, and as there will be no warp or twist, it should offer as good an opportunity as any to fight the fire from the sides or ends, and if there are skylights from the roof. That an iron trussed roof, with trusses simply strong enough to allow for snow and wind pressure, is not suitable for a car house has been shown when fires have occurred in houses with this type of construction. The recent fire in the car house of the Lewiston, Brunswick & Bath Railway Company, at Lewiston, Me., gives a good example of what may be expected. This house had light iron trusses with 3-in. plank and gravel covering. As near as can be determined, only 6 or 7 minutes elapsed between the discovery of the fire and the falling of the roof, which, crushing the fire around the trucks, prevented the

* By permission from the Quarterly Bulletin of the Committee on Special Hazards and Fire Record of the National Fire Protection Association.

firemen from reaching the seat of the fire with their streams.

The type of floor and pits recommended aims to have everything below the floor of the car fire resisting, so that even if the bodies of the cars are totally destroyed, salvage on the trucks and motors may be expected.

Heating.—The heating to be by direct steam or hot water, boiler for same cut off from car house. Hot air by blower system has been tried, but is not recommended, owing to the necessity, with this method of heating, of having large pipes passing through fire walls requiring automatic dampers, which are difficult to keep in repair.

Electrical Arrangements.—The lighting to be by electricity except that gas is permitted in the office and lobbies. The electrical equipment for the lighting, trolley wires, etc., to be in accordance with the National Electrical Code, except that in addition to the regular trolley cutout switch a switch for the lighting circuits is required outside the building, so that both trolley and lighting circuits can be controlled independently.

Hazards.—The hazards of car houses are somewhat varied, but perhaps that of pits might be first mentioned. These are receptacles for waste, blocking, sweeping from cars, etc. With the construction proposed for these pits it would seem by providing proper receptacles for waste and with ordinary care these should give but little trouble. Sawdust has been quite extensively used to absorb grease and oil which drips from the motors, but it is perfectly feasible to substitute sand, which is not as hazardous as the oil and sawdust. Employees' tool and other closets might also be mentioned, but in the better class of car houses the former are now made of metal, so that the hazard from them is practically eliminated. The tool closets would require the ordinary care that such closets in a machine shop need.

Oils and grease constitute quite a serious hazard, but can be well taken care of, provided the main supply is kept in a detached building and only a day's supply brought into the car house. Headlights were originally of the kerosene oil type, but on most roads these have been given up and the incandescent or arc headlight substituted. Signal lights, especially on heavy interurban cars, use oil, and should be cared for in oil house or in detached oil room. The hazard of the electric light and the trolley installation will be small, provided they are installed in conformity with the National Electrical Code.

The principal hazard of any car house is undoubtedly the cars themselves. During the past few years the equipment on the average railway has increased enormously as regards to power, since, where originally it was customary to install one or two 15-hp or 20-hp motors on a car, to-day it is of common occurrence to have an ordinary street car equipped with motors of 150 hp or 200 hp in capacity. The cars themselves have increased in size and the lighting and heating have also increased proportionately. No radical change has been made in the wiring except in minor details as regards fittings. The history of practically every car house fire seems to show that the fire originated in a car. Oftentimes it has been impossible to determine exactly what caused the fire, but presumably it was from overheated resistances, from the heater circuits, poor switches or cutouts, and loose contacts, which ignited the insulation of the conductor and thus communicated fire to the woodwork of the car. The Underwriters' National Electric Association have realized for some time that the wiring of cars was not covered by the Code, and not long since appointed a special committee to draw up rules and submit to the association for approval.

This committee, recognizing the fact that the American Street Railway Association was a member of the National Conference, and that the members of this organization would be the ones chiefly affected by any rules which might be drawn up, suggested a conference committee to consider the whole matter. This committee was appointed, a number of meetings have been held, and while no definite rules have actually been agreed upon, it is fair to assume that they will embody requirements covering the following points:

1. The protection of that part of the under side of the car over all electrical apparatus by some form of fire-resisting material. This has been tried on certain cars using very heavy equipment, and while it is hard to obtain a material which is really fire resisting, an insulator, and at the same time will not absorb moisture, certain asbestos compounds satisfying these requirements to a large extent are now on the market.

2. The use of standard conductors with flame-proof braided outer covering and an improvement in the design of terminals. Owing to the severe jar and straining that practically every car is subjected to, there is a tendency for a solid wire to crystallize and break off, giving a loose connection, or for a screw in a terminal to loosen, and thus a poor contact result. Both of these will cause heating which may set the insulation on fire. Flame-proof covering for wires has been tried somewhat extensively by certain roads, and although there are objections on the part of the manufacturers to its use, owing to the poor insulating qualities of any flame-proof material, since these materials are usually good conductors when wet, its use must help to prevent the carrying back and spread of the fire.

3. The use of an approved line of switches, cutouts, etc. The fittings which have been used on many of the cars have given considerable trouble through loose contacts, etc., owing to the fact that the jar and constant use of these fittings have caused them to deteriorate rapidly. It seems to be essential that these fittings should be more rugged than those usually found, and it is expected that a line of fittings will be designed especially for use on cars.

4. An approved method for running the wires between the various parts of the car. The wires to be run in metal conduit, fire-resisting moulding, under certain circumstances in ordinary hardwood moulding, or cleated directly to the fire-resisting material. The space underneath the ordinary car is very much taken up with brake rods, air motor and pump, resistances, etc. It is oftentimes almost impossible to find a place to run the wires even when but little cars is taken with their supports and the easiest path is chosen. The height of the floor of the car above ground also adds to the complication, since if this height exceeds a certain fixed amount it is necessary in the ordinary closed car to provide two steps for the passenger to enter the car, which is quite objectionable from an operating point of view. The same thing applies to the open car, as one designed to run over city streets can only have one step on a side, since with two or more the width over all is too great. With the floor of the car well down, there is but little room between the top of the wheel and the under side of the car, and this further reduces the space available. It may be necessary to provide channels or raceways when the car is constructed for the conductors.

5. To do away as far as practicable with the use of clusters for lighting and the substitution of individual lamps at all outlets. In the ordinary cluster having three or five lamps, the difference of potential at the fixture is from 300 to 500, so that considerable difficulty has been experienced in providing insulation which will be suitable. Trouble has also been experienced from lightning, as these circuits seem to be especially susceptible to lightning damage, even if the car is well protected by lightning arresters.

6. To have the heaters so designed and located that the current-carrying parts will be kept away from all combustible material. The heaters on the ordinary street car, having longitudinal seats, are usually placed in the panel work underneath the seat, the wires being run behind this panel work in more or less of a slip-shop manner. This space becomes a receptacle for dirt and rubbish, and is but seldom looked after. Considerable moisture also gets in here through the floor of the car and so rots the insulation. Apparently many of the fires have

started from these heaters. While they should be treated as stoves, it seems almost impossible to do this owing to the limited space available.

Protection.—The internal protection has usually consisted of fire pails, both water and sand, small hose, and in certain cases automatic sprinklers. Probably no piece of apparatus is harder to keep in a car house even with the best of management than the ordinary metal pail, owing to the fact that sand pails are extensively used on practically all cars at some season of the year, and it becomes a great temptation for the ordinary motorman to grab the first pail that comes handy. It apparently makes but little difference even if the pail is of the round bottom pattern, since one kick makes it a flat bottom one.

With pails well located, about half the number water pails and half sand pails, the latter being provided with scoops, these should be valuable in extinguishing slight fires, although with a fire on the underside of a car it is rather hard to use them to an advantage.

Standpipes with 1½-in. linen hose and ⅜-in. nozzle are valuable, as they can be used either inside or under a car, and owing to their size are easy to carry around. With a car house full of cars, however, it requires a very much larger number than in the same area in a mill or factory, since in order to reach many of the cars it will probably be necessary to make a good many bends and crooks in the hose and thus cut down the pressure, unless a standpipe happens to be handy to the car on fire.

Portable chemical extinguishers within the past few years have been extensively used and seem to give ideal protection, since they are not difficult to carry around, and can easily be used for a fire under or inside a car.

Automatic sprinklers have been installed in a number of car houses in New England, and when properly installed are looked upon by many underwriters as a valuable aid in preventing the spread of fire. It is recognized that the sprinklers in a car house cannot be installed so as to reach where it is expected a fire will naturally start; that is, inside or under a car, and further that the water from the sprinklers must fall on a roof of a small house, as it were, about 8 ft. wide and from 30 ft. to 45 ft. long, made to shed water. What is hoped for, however, is that with a considerable amount of water falling on a car the fire can be kept from spreading to other cars and opportunity thus offered for its extinguishment by external means.

If the sprinklers are to be of assistance it would seem that the following conditions are absolutely necessary:

First.—That the roof of the car house shall be as near the top of the car as possible, and one allowing for the best distribution of water from the sprinklers.

Second.—That the roof shall be so constructed and supported that it will not warp or twist, and one that will remain in its original condition as long as possible.

Third.—That the volume and pressure of the water shall be such that even with a large number of heads open, say fifty to sixty, all sprinklers can give good distribution.

It will be noted that the first two conditions are cared for in the construction which has been proposed for the roof. To meet the third condition will require the pipe sizes to be larger than that ordinarily used, and a water supply capable of maintaining a pressure of not less than 75 lbs. at the base of the riser with 750 gals. to 800 gals. of water flowing.

Unfortunately, but little data are to be had on fires in car houses equipped with sprinklers, and in these the conditions were not what they should have been. A car house in Newtonville equipped with sprinklers burned in 1895, but at the time of the fire the water was off owing to a freeze of the street main. A few years later a car house in New York City equipped with sprinklers took fire from the under running trolley, and although the fire was in the space for the trolley under the main floor, which was not equipped with sprinklers, the report on this fire states that the sprinklers assisted to prevent its spread.

In 1901 there was a fire in a car house at Pawtucket, the house being equipped with sprinklers. In this case the fire was confined to the car in which the fire originated, the sprinklers being a material aid in preventing the spread of the fire. In St. Louis in 1902 a car house completely equipped with sprinklers was totally destroyed, the report on this fire stating that the sprinklers were of no value in preventing the spread of the fire. The supply of water here was poor, being two 3-in. connections from a 6-in. main through Crown meters. The water pressure was low and there was a long feed through the 6-in. pipe.

The external protection should be of such volume that even in a section of the car house, with a total loss on the car bodies, the trucks can be kept so cool that the motors will be but little damaged. This will require a system capable of furnishing a large volume of water, necessitating liberal sized mains and numerous hydrants well located. Where the house is not under the best of city protection an ample supply of private hydrants housed with hose attached should be provided. With the large number of men usually found around the ordinary car house, there should be nothing to prevent these men from getting a number of streams on a fire and under many conditions hold it in check until the arrival of help.

The value of good outside protection for a car house was well illustrated in a fire at Quincy, Mass., a few years ago. The house was small, holding seventeen cars and two snowplows, and was part brick and part frame, with joist graveled roof, construction. The department used eleven streams, and although the bodies of the cars were totally destroyed, the damage to the equipment was slight and the fire went through the roof in only one place.

It would seem that a minimum protection should be the following. A double hydrant for each 6000 sq. ft. of ground area connected through not less than 6-in. pipe, with not less than a 6-in. street main. Hydrants to be ordinarily not farther than 100 ft. from building or nearer than 50 ft., and to be so located that with 200 ft. of hose connected with hydrants all parts of the building could be reached by hose from at least two hydrants. The water supply to be of such pressure and capacity that at least the number of hose streams as given by the following table will be available:

Area of Building	No. of Streams
Up to 12,000 sq. ft.	3
12,000 to 18,000 sq. ft.	4
18,000 to 24,000 sq. ft.	5
Over 24,000 sq. ft.	6

With the area as given by the above table, it is assumed that the houses will be divided according to the standard—that is, into sections of not over 12,000 sq. ft. of ground area. Where these sections are over this amount, or where the houses are exposed, the number of streams required will necessarily be increased.

Care and Attendance.—Too much stress cannot be laid upon the necessity of good care of car houses and their equipments, and probably there is no class of risk where this care counts for more than it does in these houses. Cars at the end of their day's run should have inspection so that the condition of resistances, heaters, etc., will be known, and no car put away when same is not in good order. Fires have apparently started in cars having no connection with the trolley, some time after they have been housed, due probably to a fire which originated while the car was in service, but did not break out until some time after the car was stored away.

With any considerable amount of fire appliances, such as fire pails, small hose, sprinklers, outside hydrants, etc., self-inspection by the insured becomes an absolute necessity and should be insisted upon. The tendency of the time seems to be

towards consolidation of smaller roads into quite large systems, and with these larger systems this requirement does not seem to be a hardship, many railways being more than willing to go to the slight extra expense which this inspection incurs when the matter has been brought to their attention.

Requirements for Standard Electric Car Houses of New England Insurance Exchange.

BUILDING

Walls.—(a) To be of good hard-burned brick, laid in best lime or lime and cement mortar.

(b) Outside Walls.—When of pier construction, piers to be not less than 20 ins. thick, the face of pier to measure not less than one-fourth as much as the space between centers of piers, and the wall between piers to be not less than 12 ins. thick. When without piers, to be not less than 16 ins. thick.

Where exposed, to be carried full thickness of wall at least 5 ft. above roof, to be provided with durable and non-combustible coping, and to have no openings.

(c) Cut-off or Division Walls.—To have no openings.

To be not less than 16 ins. thick, and when walls are over 60 ft. in length to be not less than 20 ins. thick, to be strengthened by equivalent piers or pilasters, spaced not over 20 ft. center to center, the walls between piers being not less than 16 ins. thick.

To be not less than 5 ft. parapet, carried full thickness of wall, projecting through and beyond cornice 8 ins. (metal roofing not to be carried over wall) with a durable and non-combustible coping.

Where doors or windows in end walls are within 7½ ft. of cut-off or division wall, cut-off wall to extend 5 feet beyond end walls.

Where roof timbers enter walls at opposite sides, there must be at least 8 ins. of brick work between ends of beams, which shall be self-releasing.

Height.—One story, without basement or space below, except at pits. (See requirements pertaining to roofs.)

Area.—Sections between standard cut-off or division walls to contain not over 12,000 sq. ft. of floor area. Distance between centers of adjoining tracks to be not less than 11 ft.

Roofs.—To be not less than 3-in. splined plank. To have timbers (preferably single stick) not less than 6 ins. by 12 ins., spaced not less than 6 ft., or more than 10 ft. on centers, supported by wooden posts, not less than 10 ins. by 10 ins., and without trusses. To be without monitors; skylights, if any, to have standard metal frames with wire glass. To be not more than 19 ft. at eaves, nor more than 25 ft. at peak above the floor level, the slope being from ½ in. to 1 in. per foot. To be covered with gravel, tin, or approved composition.

Cornice.—To be of brick, or of non-combustible material.

Floors.—To be of brick, concrete, stone, or earth, except as noted in requirements for pits.

Finish.—If any, to be non-combustible and without concealed spaces.

Partitions Other Than Cut-off or Division Walls.—To be constructed of non-combustible material, or 2-in. matched plank coated with fire retardent paint.

Doors to be of substantial construction and hung with heavy hardware. Window openings to be glazed with wire glass.

Pits.—To have brick, stone or concrete retaining walls; brick or concrete floors; steps of stone, concrete or iron; the rails supported directly on brick, stone or concrete piers, and in addition to follow construction as given under a or b—

(a) The space between outside rails of adjoining tracks to be filled in solid.

(b) The space between adjoining tracks to be floored over either by brick, arched, or expanded metal and cement; as often as between every second track there shall be a brick wall parallel with track, not less than 8 ins. thick, extending from floor of pit to under side of brick, arched, or expanded metal and cement, tightly shutting off space between adjoining pits.

Earth floors are not acceptable as standard.

Tracks.—To run clear from building, without break or transfer table. To be terminated by suitable bumpers, so that there will be a clear space of not less than 3 ft. between bumpers and wall of building. Special track work in front of building to be provided with guard rails when necessary.

Track Doors.—To be of wood, in pairs, swinging outward, and so hung as to clear all span, pull-off, trolley, and other wires and each other; i. e., to have stops to prevent swinging over each other, either when closed or open. When within 10 ft. of cut-off wall, to be covered and hung as for a standard swinging fire door.

Metal roller doors are acceptable, and specifications will be furnished on application.

Note.—Concrete construction may be accepted for walls, roofs, and posts, provided plans showing construction proposed are submitted and approved.

HEATING, LIGHTING AND OCCUPANCY

Heating.—To be by direct steam or hot water, piping being supported on iron hangers and kept free from woodwork.

Boiler.—To be outside or cut off by standard cut-off wall, except that parapet need not be over 3 ft., and one opening into car house will be permitted provided same is protected by standard automatic fire doors on both sides.

Lighting.—To be by electricity.

Secondary lighting by gas of offices and lobbies will be permitted, provided supply of gas is from public system, piping and jets being properly arranged.

Occupancy.—No woodworking, painting, varnishing, finishing or general repair work to be allowed in building. Cars heated by anything other than electricity not to be stored in building.

ELECTRICAL ARRANGEMENTS

Trolley Wires.—Trolley wires or irons to be thoroughly insulated from building, and so supported that in case of break contact cannot be made with floor.

Cut-Out Switch.—To be located at proper place outside of building, so that all trolley circuits in building can be cut out at one point, and line circuit breakers installed so that when cut-off switch is open the trolley wire will be dead at all points within 100 ft. of building.

Where building is divided into several sections by cut-off walls, cut-out switch for each section should be provided so that sections can be controlled independently.

Wiring.—Electric light and power equipment to be installed in strict conformity with the National Electrical Code Standard, approved wire, switches, cut-outs, etc., being provided.

Main switch located in box on pole at least 50 ft. from building to be provided, so that entire lighting and power installations (except trolley) can be controlled independently of trolley cut-out switch.

In General.—No system of feeder distribution to center in building. Rails to be thoroughly bonded at each joint. Cars not to be left in electrical connection with trolley wires.

CARE AND ATTENDANCE

Superintendence, Watchman.—During such time as building is not in charge of a regular foreman, a watchman to be maintained. An approved electric clock to be provided, on which the watchman shall record hourly rounds during nights, and bi-hourly rounds during days.

Waste Cans.—A proper supply of approved metal waste cans to be provided. Cans to be emptied daily.

The number of cans required will depend on the occupancy, but where building contains pits or is used for cleaning, at least two cans, not less than 24 ins. diameter and 36 ins. high, will be required for each 6000 sq. ft. or fraction thereof of floor area.

Oils, Gasolene, Etc.—Main supply of oil to be kept in detached oil house so constructed and located as not to be an exposure to the car house.

No gasolene, benzine, lacquer, or other inflammable material, to be kept in or near the car house.

Storerooms.—To be kept in a clean and orderly manner.

FIRE PROTECTION—INTERNAL

Extinguishers.—One approved 3-gal. chemical fire extinguisher for each 2000 sq. ft. of floor area. Extinguishers to be uniformly distributed in permanent locations.

Pails.—In rooms containing pits, or where any wiping up or cleaning is done, one pail to each 1000 sq. ft. of floor area.

Pails to be galvanized iron, painted red, with the word "fire" in black letters 2 ins. long. To be filled with dry sand and to be provided with scoops.

Small Hose.—50 ft of 1½-in. linen hose to each 6000 sq. ft. of floor area. Hose to be provided with ⅜-in. nozzle, and to be in lengths of not over 50 ft., and to be kept folded and attached to not less than 2-in. standpipes, which shall have an adequate supply of water at not less than 50 lbs. pressure.

Where an approved water supply is not available and building is not 12,000 sq. ft. floor area, three additional approved chemical extinguishers may be accepted in place of each hose connection.

EXTERNAL

Water Supply.—There must be for each 6000 sq. ft. or fraction thereof of area an approved double hydrant, connected through not less than 6-in. pipe with not less than 6-in. street main. Hydrants should be within 100 ft. of building, but under ordinary circumstances not nearer than 50 ft., and must be so located that with 200 ft. of hose connected to hydrants, all parts of building can be reached by hose from at least two hydrants.

Water supply must be of such pressure and capacity that not less than 55 lbs. will be maintained at hydrants when same are discharging through 50 ft. of National Standard 2⅝-in. rubber-lined hose with 1⅛-in. Underwriters' playpipes, the number of streams required varying with the area, exposure and other conditions, but not to be of less efficiency than is indicated by the following table:

Area of Building	No. of Streams
Up to 12,000 sq. ft.	3
12,000 to 18,000 sq. ft.	4
18,000 to 24,000 sq. ft.	5
Over 24,000 sq. ft.	6

Private hydrants are strongly recommended and should be installed where possible. When so installed they should be provided with outside gate valves for each pipe, have standard hose house equipped with not less than 250 ft. National Standard 2⅝-in. rubber-lined hose, three 1⅛-in. Underwriters' clay pipes, having 1⅛-in. smooth nozzles, two axes, one bar, one hydrant wrench, six spanner wrenches, six spare washers.

Fire Department.—There must be a fire department house within one-half mile, having men and horses permanently stationed therein, and an equipment of at least one hose wagon and 1000 ft. of hose.

Fire Alarm.—A fire-alarm box connected with city or town fire-alarm system to be located within 200 ft. of building. Unless the box is of the keyless type a key must be kept at box.

PROGRAM OF THE ELECTRIC RAILWAY TESTS AT THE ST. LOUIS FAIR

A full meeting of the executive committee, which, as mentioned in a recent issue, was appointed to determine the nature and scope of the lectric railway tests to be made at St. Louis and elsewhere during the coming summer, was held at St. Louis on Friday and Saturday, May 6 and 7. The committee consists of Professor W. E. Goldsborough, chief of the department of electricity, chairman; Professor H. H. Norris, Cornell University, superintendent of electric railway tests, and Professors B. V. Swenson, University of Wisconsin, and H. T. Plumb, Purdue University, assistant superintendents of electric railway tests.

After careful study of the reports of the engineering committees, of the suggestions of the advisory committee, and of the excellent facilities afforded by the Exposition officials, the executive committee decided to undertake the following series of tests:

(a) TESTS ON THE SERVICE CAPACITIES OF ELECTRIC RAILWAY MOTORS

Equipments will be operated upon the special tracks at different rates and durations of acceleration, coasting and braking, with different lengths of stops, in order to determine the heating of the motors under conditions approaching as nearly as possible those of commercial practice. The motors will also be tested separately for heating and for the determination of their torque curves and accelerating power. This will render possible the comparison of the performance of the same equipment upon the track and upon the test stand.

(b) ACCELERATION TESTS

Acceleration tests upon single cars and upon multiple-equipped trains will be made to determine the ability of the equipment to bring the cars to speed quickly and economically.

(c) BRAKING TESTS

Braking tests upon single cars and multiple-equipped trains will be conducted in order to determine the quickness of action, the shapes of the braking curves, the relation between the braking forces and the applied pressures and the best methods of application of the braking forces.

(d) TESTS UPON TRAIN RESISTANCE

Determinations of the resistances due to the rails, to the journals and gearing and to the air will be made by systematic and complete series of runs. The effect of the shape of the car body will be carefully investigated. The methods to be used in measuring train resistance comprise the use of calibrated motors as the sources of power, the hauling of the car under test by calibrated dynamometers, and by noting the falling off in speed while the cars are coasting. The pressure of the air upon different parts of the car will be recorded by means of self-registering pressure gages.

In addition to this definite series a number of other tests will be conducted upon various exhibits in the Palace of Electricity in order to determine their efficiency and reliability.

Sections (a), (b) and (c) of the tests will be carried on upon the tracks which have been built for the purpose by the Exposition. These are of substantial construction, conveniently located, and of a total length of about 4500 ft. For the tests described under section (d) the Indiana Union Traction Company has provided a stretch of 8 miles of straight and heavily ballasted track. The resistance tests will be made after the completion of the St. Louis programme.

In all of the above work graphical records of the measurements will be obtained by the use of autographic instruments, which will be either built for the purpose or supplied through the co-operation of the manfacturing and operating companies and the technical colleges. The National Bureau of Standards will materially aid in this work by providing facilities for the calibration of all of the instruments.

For the purpose of comparison the various railway equipments will be divided into several classes, including car weights up to 45 tons, as follows:

(a) Light city service equipments.

(b) Heavy city service equipments.

(c) Light interurban service equipments,

(d) Heavy interurban service equipments.

The actual work of observation and calculation will be carried on under the personal supervision of the superintendents by a corps of young men carefully selected from among the graduates of leading technical schools, the total number of observers being between thirty and forty. The Exposition management is co-operating enthusiastically with the Railway Test Commission in providing ample facilities for the tests, and substantial results of permanent value to the profession are confidently expected.

At the present time a large part of the equipment is already at St. Louis, the organization is complete, and the ranks of the testing corps have been filled with earnest young men who mean business, and who are already fitting themselves for the tasks before them.

In conjunction with the five interurban roads radiating from Columbus, Ohio, the Columbus Merchants' Association recently conducted a most successful trade excursion. There are about 100 merchants in the association, including concerns in practically every line of business. On purchases from members of the association of $5 worth of goods the transportation of a customer was paid one way within a radius of 50 miles of Columbus. On purchases amounting to $10 or more the purchaser was given round trip transportation. Excursion tickets were sold at all stations bearing a Merchants' Excursion Coupon. In places where there were no ticket offices the cash fare receipts given by the conductor were honored. The tickets issued by the association were gocd for thirty days, and in cases where round trip tickets were given it was an inducement for the customer to make another trip to Columbus. The excursion proved so successful that the plan will be continued at monthly periods hereafter.

NARRAGANSETT CAR FOR ST. LOUIS EXPOSITION

One of the three patented types of cars which the J. G. Brill Company is exhibiting at the St. Louis Exposition is the thirteen-bench "Narragansett" type shown in the accompanying illustration. Since the introduction of the "Narragansett" car four years ago it has been built for quite a large number of roads in various parts of the country, and appears to have in every way substantiated the claims of the builders as to the solution of the double-step open car problem. The photograph clearly shows the double-step arrangement, and how by the use of Z-bar sills with the upper step on the middle web, the width over all is confined to the limits of the usual single-step double-truck car. The seats are the full standard length. The treads which are to be seen upon the Z-bar are iron plates, which extend a trifle over the edge to form a wider step than the web of the Z-bar itself, and have corrugated surfaces to prevent slipping. It is claimed that with the deep setting of the posts in brackets, through which they are bolted to the sills, together with the form of the sills, an unusually firm support is given to the upper structure. The round-corner seat-end panels, which rest on the brackets and enclose the posts, are an additional support, and by increasing the space at the entrances have much to do with the success of the plan.

The car is finished entirely in ash, with vertical ceiling

NARRAGANSETT CAR FOR ST. LOUIS EXPOSITION

painted light green and decorated in gold. The guard rails slide behind the grab handles, and are held under the water boards by patented gravity catches. Other patented specialties of the builder's make with which the car is equipped are angle-iron bumpers, ratchet brake handles, radial draw-bars, "Dumpit" sand-boxes, folding gates, "Dedenda" gongs, etc.

The length of the car over crown pieces is 36 ft. $8\frac{3}{8}$ ins.; from center of corner posts over crown pieces, 4 ft.; from corner posts to first side posts, 3 ft. 5 ins.; from center to center of side posts, 2 ft. 8 ins. The trucks are Brill No. 27-G. E.-1, with 33-in. wheels and $4\frac{1}{2}$-in. axles.

Practically all the cars in Brooklyn were tied up for an hour on May 18, because of a fire in the new power house on Third Avenue and First Street.

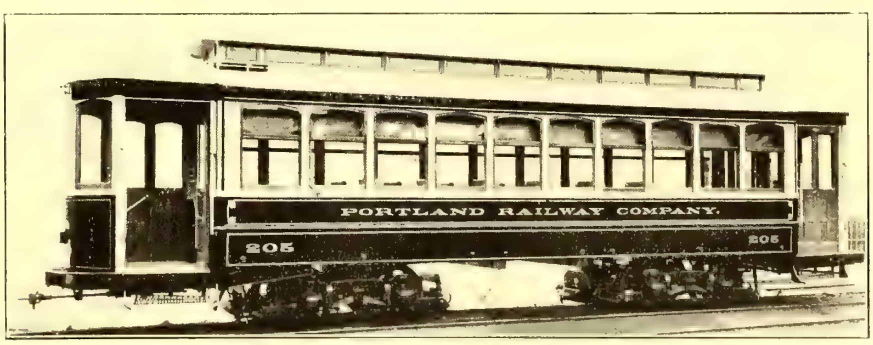
SEMI-CONVERTIBLE CARS FOR PORTLAND, ORE.

The Portland Railway Company, of Portland, Ore., has lately received ten semi-convertible cars of the Brill type from the American Car Company, of St. Louis. This railway com-

INTERIOR OF PORTLAND SEMI-CONVERTIBLE CAR

pany operates lines between Portland and Vancouver, Wash., a distance of 20 miles. Thirteen miles of new single track have been recently constructed, so that now the company is operating some 52 miles of lines. The seating arrangement of the cars provides for forty passengers. At the corners are placed longitudinal seats for four passengers each; the hand rails only extend over these seats. The transverse seats are 33 ins. in length, and the aisles are $19\frac{1}{2}$ ins. wide. The interiors are handsomely finished in quartered oak with ceilings of the same neatly decorated.

The length of the bodies is 28 ft. and the width 7 ft. $3\frac{1}{2}$ ins. over the sills and panels, and 7 ft. 6 ins. over posts at belt; sweep of posts, $1\frac{3}{4}$ ins., from center to center of posts, 2 ft. 8 ins. The platforms are vestibuled, and are 5 ft. $2\frac{1}{2}$ ins. from panel over crown piece. From rails to platform steps is $15\frac{1}{2}$ ins., and from steps to platforms, 14 ins. The side sills are 4 ins. x $7\frac{3}{4}$ ins., with 12-in. x $\frac{3}{8}$-in. plates on the inside, which do away with the necessity of upper and lower trusses, and at the same time stiffen the posts, which are each



SEMI-CONVERTIBLE CAR USED BY PORTLAND RAILWAY COMPANY.

secured to them with two large screws. The end sills are $5\frac{1}{4}$ ins. x $6\frac{7}{8}$ ins.; thickness of side posts, $3\frac{1}{4}$ ins., and end posts, $3\frac{3}{4}$ ins. The platform timbers are reinforced with angle-iron and angle-iron center knees, extending well back of the body bolsters, give ample support to the heavy loads which the large

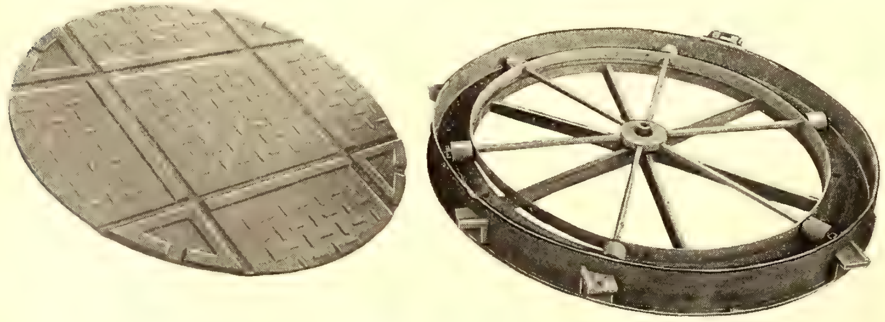
platforms may carry. Angle-iron bumpers, "Dedenda" gongs, "Dumpit" sand-boxes, ratchet brake handles and conductor's bells of Brill manufacture are included in the equipment. The cars are mounted on No. 27-G trucks, with 4-ft. wheel base and 30-in. wheels. The operating equipment includes four 37-hp motors.

AN IMPROVED ROLLER-BEARING TURN-TABLE FOR INDUSTRIAL RAILWAYS

The increasing use of the industrial railway as an auxiliary in railway repair shop work is causing more than usual care to be given to the selection and installation of track equipment for this purpose. Industrial railways are now depended upon in many shops to such an extent as to cause practice to compare favorably with that of the standard gage work. One of the hardest problems, however, in the maintenance of industrial railway tracks is the turn-table, which is so necessary for facility in handling cars through congested shops and yards where space for curves is prohibited, so that right-angle turns, by means of turn-tables, are necessary. The small-sized turn-table as used in this work is usually a source of a great deal of trouble by becoming clogged from dirt, shifting out of grade by action of frost or otherwise, etc., which tends to cause rapid wear, and generally results in a marked inefficiency of the entire system.

The New York Switch & Crossing Company, Hoboken, N. J., has recognized these shortcomings of the ordinary pivot turn-table, and has recently placed on the market a new design of turn-table for this work which it is thought will obviate the more serious difficulties that are now encountered. This turn-table, which is illustrated in the accompanying engraving, does not embody radically new principles but effects a most desirable combination, resulting in a free and easy action of the table with any load that may be brought upon it. As may be seen from the accompanying illustration of this device, it is a combined pivot and roller-bearing turn-table, the track plate not only resting on a center pivot but also having six rollers at its outer edge for ease of revolving under load.

The important feature of this turn-table is the arrangement of the roller bearings so that they cannot easily become clogged from accumulations of dirt or other disturbing influences. These rollers are carried upon a simple spider frame, which merely acts to keep them properly spaced under the table. The rollers are not fitted with bearings upon the guiding arms, but are merely placed very loosely thereupon, the idea being that of guiding their movement as above stated. The runway for the rollers is arranged upon the bottom surface of the circular frame casting within which the table revolves; a raised portion is cast smooth, upon which the rollers will turn freely. This circular frame is stiffened by six arms radiating from the center portion, which serves also to carry the table pivot.



VIEW OF THE TURNTABLE, WITH TABLE REMOVED TO SHOW ARRANGEMENT OF ROLLERS AND PIVOT

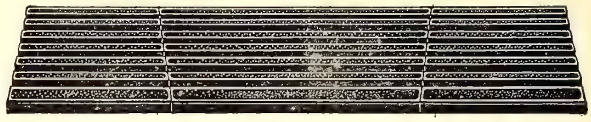
Provision is made for the connecting tracks by lugs riveted to the outside of the frame so that the track may be fastened to them and thus easily brought to gage. The usual locking device for holding the table in line of the tracks is provided by a hinged bracket at one side, which is arranged to drop into grooves provided for it at the edge of the table, as is shown. This turn-table has been applied in various important industrial railway systems and has given the best of satisfaction. The table is universally found to work very freely, and accumulations of dirt do not render it ineffective. It is one of the simplest and most easily maintained devices of the kind that has been developed.

The use of the table is not confined to narrow-gage work. It is built in various sizes, including standard gage, and is very well adapted to turn-table use for double trucks in repair shop work.

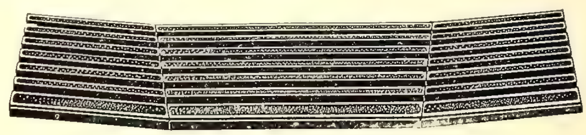
CARBORUNDUM SAFETY TREAD

Safety tread steps on railway cars have long been recognized as absolutely necessary for securing to passengers the greatest possible safety in boarding and leaving cars, thereby eliminating one of the most fruitful sources of expensive accidents.

The tread shown in the accompanying cuts is composed of a rolled steel plate foundation, formed with a series of channels, and has every other channel filled with carborundum.



THREE-PIECE TREAD, FOR STRAIGHT STEP



THREE-PIECE TREAD, WITH ENDS REVERSED, FOR CURVED STEP

This material is ideal for treads, as it is the hardest grit known, and its surface cannot be smoothed by any known process. The Empire Safety Tread Company, of Brooklyn, N. Y., makes car steps of this material in all widths, from 4 ins. to 12 ins., and in any desired length whether straight or curved. This composition can, of course, be employed in any other places where good tread is required.

The "Cincinnati Enquirer" has arranged with the Toledo, Bowling Green & Southern Traction Company, the Toledo, Fostoria & Findlay Railway Company, and the Tiffin, Fostoria & Eastern Railway Company to carry morning papers to Toledo, Fostoria, Findlay, Bowling Green and other points in their district, so that papers are now distributed from three to four hours earlier than heretofore. The same paper has special arrangements with interurban lines reaching Dayton, Springfield, Urbana, Bellefontaine, London, Columbus and other cities in Central and Western Ohio.

Trainmen of the Pacific Electric Railway Company, of Los Angeles, are soon to appear in new uniforms. The suits will be regulation blue, but in place of an unsightly badge each man will wear his number on the band of his cap. On the coat lapels initials of the company will appear in gold thread. The cap bands are to have the man's number on each side, while his position, motorman or conductor, will be designated in front. From either side of the car passengers will thus be able to see the number of the trainman. Similar uniforms will also soon be worn by Los Angeles Railway employees.

LEGAL DEPARTMENT*

OVERLAPPING OF RAILROAD PLATFORMS BY PASSING CARS

In the recent decision of the Court of Appeals of Maryland in State to use of Egner vs. United Railways Electric Company, of Baltimore (56 Atl. 79), which was an action against a street railway company for damages for death, it appeared that the deceased was struck by the footboard of a car while it was passing a platform on which he was waiting. He had ample space to stand on without coming in contact with the footboard. The car passed in perfect safety four other passengers on the same platform before it reached the decedent. He had an uninterrupted view of the approaching car and had had an opportunity from the passing of two previous cars, to notice the portion of the platform which would be covered by the footboard. The platform has been in use for years and had accommodated ten or twelve persons at a time in entire security. There was no evidence that the motorman in charge of the car acted in a negligent or unlawful manner, although the car came up and passed at the rate of 30 or 35 miles an hour and did not stop on signal to do so. The Court very soundly and justly held that the facts did not establish negligence on the part of the street railway company and that no recovery could be had against it. Of course this decision should not lead to the adoption of a policy of having footboards overlap platforms upon which passengers are to wait for cars, if the same can be avoided. Wherever, however, such practice is unavoidable or very convenient, the cited case lays down a proper rule for the exemption of companies from liability. If a platform be insufficient in area to accommodate the number of waiting passengers ordinarily to be expected; or if a platform be suffered to become improperly crowded a different question would arise. In Dittmar vs. Brooklyn Heights Railway Company, in the New York Supreme Court, Appellate Division, Second Department (March, 1904, 86 N. Y. Supp. 878), it was held that where a street railway company had entire charge of a platform from which access was obtained to its cars and permitted passengers to go on the platform only after having paid their fare, the company was guilty of negligence in permitting the platform to become so overcrowded that passengers could not enter the cars in safety, and was therefore liable to a passenger who was injured through being pushed by the crowd against the side of a car and then thrown violently into it. But certainly it is little short of preposterous to hold that a waiting passenger with ample space to stand in safety, may hug the edge of the platform when cars are passing and the company be held responsible if he happens to be injured.

The Maryland case cited was a street railroad case, and another recent decision in a steam railroad case is closely in point. In Lehigh Valley Railroad Company vs. Dupont in the United States Circuit Court of Appeals, Second Circuit (New York Law Journal, March 7, 1904) Judge Lacombe in concurring in a judgment against the defendant records "a strenuous protest" against the proposition which he apprehends might be deduced from the opinion of the other members of the Court, that a railroad company may be found negligent, and therefore liable for personal injuries solely because its passing cars overlapped the edge of a platform. Judge Lacombe remarks:

"It does not seem to me that it can be held to be negligence on the part of a railroad company to place its platform so close to the track that some of its cars will overlap its edge. Such a construction is a reasonable one, because it brings the platform and track so near together that there is no open space left between them when cars of other types with shallower steps and less overhang are passing. Certainly it must be patent to any one of intelligence enough to be left loose on a railway platform that the strip of platform nearest the track, while very necessary for a person getting on or off the train, is not intended for people to stand on when a train is passing; the suction alone would make it a dangerous place, even if no car or car step overlapped. Of course, the platform may be so narrow that it should be sent to the jury to say whether the defendant was negligent in not providing a sufficiently safe place to wait on, and such is the case here."

Judge Lacombe concedes that there was sufficient in other elements of the case to hold the defendant liable. An embarassing feature was that his associates in the decision in the Lehigh Valley case cited two cases in the New York Court of Appeals, one of which upholds the proposition against which Judge Lacomb's protest is made. The New York cases are Dobiecki vs. Sharp (88 N. Y. 203) and Archer vs. New York etc., Railway (106 N. Y. 589). As to the latter of these it appears that, as in the Lehigh Valley Railroad case, there were other factors involved which, together with the overlapping, constituted negligence on the part of the defendant. Dobiecki vs. Sharp, however, would seem to sustain the contention that the mere overlapping in itself amounted to negligence. The Court says:

"Assuming that they (the cars) did extend beyond the platform to the smallest extent proven, and in this form may have caused the death of the deceased or injured persons upon the platforms, some evidence was presented that the cars were improperly constructed, and it was a question of fact for the jury whether this negligence was on the part of the defendant.

* * * *

"The request to charge the jury: 'That if the jury believed that the deceased was standing on the platform as the train approached, and with knowledge of its approach, placed himself in such a position as to be struck by the train, the plaintiff cannot recover,' was properly refused. It was covered by the charge made, and the request, if granted, would have required the deceased not only to exercise proper care and vigilance, but to guard against the improper construction of the defendant's cars, of which he had no knowledge. If he had been out of the reach of the cars if constructed in the usual manner, under the request the company would be exonerated from negligence arising from the defective construction which, it is claimed, caused the testator's death. No such vigilance is demanded by the law."

It is a matter of considerable significance that two of the members of the New York Court of Appeals dissented from the decision in the Dobiecki case, and we much doubt whether its doctrine would be accepted as good law in other forums. It is believed that the sound policy, both as to street railroads and steam railroads, is that laid down in the Maryland case cited and in the language of Judge Lacombe above quoted.

* Conducted by Wilbur Larremore, of the New York Bar, 32 Nassau Street, New York, to whom all correspondence concerning this department should be addressed.

CHARTERS, ORDINANCES AND FRANCHISES

MISSOURI.—Street Railroads—Use of Street—Track Above Grade—Rights of Property-Owners—Obstructing Access to Property—Measure of Damages—Benefit to Property—Pleading—Evidence—Cause of Action—Departure.

1. Plaintiff alleged that defendant constructed and maintained its street railway along the street in front of plaintiff's property, with the track and roadbed several feet higher than the street grade, thereby shutting off plaintiff's ingress to and egress from such property. It appeared that defendant's predecessor had originally constructed a track on the grade of the street, which defendant subsequently raised above such grade. Held, that this did not require plaintiff to aver that such latter work was a reconstruction or change of a prior existing grade of defendant's roadbed and the track thereon, and, in the absence of such averment, testimony as to such fact did not constitute a departure from the cause of action pleaded.

2. Where a street railway constructed its track on the street in front of plaintiff's property, and thereafter raised the track above the street grade, thereby shutting off his ingress to and egress from such property, the measure of damages was the difference between the fair market value of the property immediately before the track was so raised and such value after it was raised.

3. In estimating damages caused to abutting property by the construction of a street railway above the street grade, no deduction for any benefit from the railway to the property is permissible.

4. Where the right to lay its track on a highway is conferred

on a street railway corporation by municipal authorities, such track must conform to the grade or level of the highway, and, if not so constructed, the corporations is liable to the owners of abutting property for damages resulting from the obstruction of access thereto.—(Farrar vs. Midland Electric Ry. Co., 74 S. W. Rep., 500.)

ALABAMA.—Street Railways—Tickets and Money Fare—Reasonable Regulations—Ejection.

1. A regulation of a street railway company requiring a higher rate where cash is paid the conductor than is charged for a ticket is not reasonable and furnishes no justification for ejection of a passenger tendering only the price of a ticket, where he is taken on at a place where tickets are not for sale, though they are for sale at a station 1,000 ft. away.—(Kennedy vs. Birmingham Ry., Light & Power Company, 35 Southern Rep., 108.)

NEBRASKA.—Street Railway Companies—Mortgages—Special Assessments — Lien—Priority—Stipulations—Conclusiveness—Debtor and Creditor—Payments—Application.

1. One party to a stipulation or an agreement cannot be released from a part of it on the ground of a mistake, and still leave the other party bound thereby. His remedy is not by motion to withdraw from a part of the stipulation, but by a proceeding to reform the agreement, or to set it aside altogether.

2. Where a party waits until near the close of a second trial before asking to withdraw from a stipulation of facts used by both parties on both trials, the court may, in its discretion, refuse such request.

3. A street railway company authorized to construct, equip, and operate lines of electric street railway may purchase lines already constructed, and fit and suitable for the extension and completion of its system, as well as construct the same; and a recital contained in a mortgage executed by such company that it has power to borrow any sum or sums of money which may be necessary for the purchase, construction, and equipment of its electric street railway will not render the mortgage void upon its face.

4. The charters of all street railway companies in this State are created by general law. Cities have no power to grant such charters or impose any limitations thereon; and the act of 1889, authorizing street railway companies to borrow money for certain purposes, and secure the payment of the same by mortgaging their property and franchises, applies to all street railway companies in this State, whether chartered before or after the passage of that act.

5. Where it is claimed that a mortgage executed by a street railway company is for an amount in excess of that permitted by law and its charter, such alleged fact must be proven, so that an examination of the record will disclose it. Otherwise it will be presumed that the mortgage was not for an excessive amount.

6. Where a street railway company mortgaged its property and franchises to secure the sum of $600,000 for the purpose of purchasing, constructing, and equipping its lines of electric street railway, and it is shown that it expended for that purpose about $900,000, it cannot be said that the mortgage was given to create a fictitious indebtedness.

7. A series of bonds secured by a mortgage or trust deed on the property of a street railway company are negotiable, and, as between bona fide purchasers thereof for value, are equal in priority; the lien of each bond dating from the recording of the mortgage that secured it, and not from the time it was issued.

8. Such a mortgage is a first lien upon the property of the street railway described therein, fias against all special assessments for paving taxes, except such as were assessed for paving already done, or as were in contemplation at the time it was recorded.

9. Section 77 of chapter 11 of the Laws of 1887, which creates a lien for paving taxes against the lines of street railway companies, does not make such special taxes a lien on their personal property.

10. Under the statutes the taxes levied as special assessments in cities of the first class draw interest at the rate of 12 per cent per annum from the time of delinquency, and a decree enforcing a tax lien arising thereon will draw interest at the same rate. A computation of the amount due on special assessments upon that basis will be sustained. Lincoln Street Railway Company vs. The City of Lincoln, 8[illegible] N. W. 802, 61 Neb., 109.

11. A creditor cannot divert a payment by his debtor from the appropriation made by him upon mere equitable considerations. that do not amount to an agreement between the parties giving the creditor a right to appropriate the payment otherwise than directed by the debtor, though mere equitable considerations may control where the payment is made without designating its application.

12. The direction given by defendant to the city treasurer, as shown by the evidence in this case, was specific enough to require him to credit the payment of the $5,000 deposited with him on the taxes which were a first lien upon the defendant's line of street railway.

13. One purchasing property and retaining title to it under a decree of foreclosure will not be permitted to challenge the validity of such decree.

14. The sale and purchase of property under a decree of foreclosure devests the property of the lien of the decree; but, where the decree is also a third lien upon other property, such proceedings do not operate to cancel the lien thereon for the amount of the deficiency arising upon such sale.

15. "Where street improvements are made, and the cost of paving that portion of the same occupied by street railway companies is levied as special assessments against the property of the several street railways as separate properties, and the different street railways are afterwards consolidated and merged into one property, and operated as one street railway system, the old companies losing their individuality and identity, and the new company assuming the burdens and obligations of the constituent companies, held that, as between the consolidated company and the municipal authorities levying such special assessments, the liens arising by reason of the several assessments against the different constituent companies and properties attach to the new property owned and operated by the substituted company as one property in its entirety." Lincoln Street Railway Company vs. The City of Lincoln, supra.

16. "Where, however, a mortgage was placed upon a street railway property, and afterwards another company, against which certain liens for taxes levied as special assessments existed, was consolidated with the mortgagor company, held, that the lien of the mortgage on the property covered thereby, without the consent of the mortgagee, could not be impaired by the agrements and acts of consolidation, and that the tax lien on property consolidated and merged into the new company, and with the property mortgaged, could not be made prior to the mortgage lien on all the property after consolidation; that the tax and mortgage liens attached to the specific properties embraced in the levy and the mortgage, respectively," in accordance with their original priorities. Lincoln Street Railway Company vs. The City of Lincoln, supra.

17. Where the trial court finds, on sufficient evidence, that certain assessments for paving taxes were in contemplation at the time of the execution of a mortgage by the street railway upon its property, it follows, as a matter of law, that the lien of such taxes is superior to the lien of the mortgage.

18. Assessments for paving one foot outside of the rails of street car lines will not be held void where such paving was done while the statutes were in force providing that street railway companies should be required to pave between their tracks and one foot outside of the rail thereof.

19. The district court, in its discretion, may refuse to render a personal judgment against defendants at the time of the rendition of its decree in a suit to foreclose tax liens, and may defer such action until after the execution thereof.—(City of Lincoln vs. Lincoln Street Railway Company et al., 93 N. W. Rep., 766.)

NEBRASKA.—Appeal Bond—Action—Petition.

1. In an action on a bond executed after judgment, and pending the transfer of the cause to this court by proceedings in error, conditioned that the obligors "shall pay whatever judgment may be rendered by the court upon dismissal or trial of said appeal," a petition which merely alleges that the original judgment of the lower court was affirmed, and is unpaid, fails to state a breach of the bond.—(German National Bank of Beatrice vs. Beatrice Rapid Transit & Power Company et al., 95 N. W. Rep., 49.)

NEW HAMPSHIRE.—Carriers—Street Railways—Passengers—Platform—Evidence—Negligence—Question for Jury.

1. Where a person was injured by falling off a platform which was built by the side of a street railway, and used by it, and at which the company regularly stopped its cars to take on and discharge passengers, a finding that the company had adopted the platform, and invited the public to use it in getting on and off the cars, was justified.

2. Where a street railway company has adopted a platform, and invited the public to use it in getting on and off the cars, it is its duty to keep the platform in a reasonably safe condition for that purpose; and it is immaterial whether or not the platform was built by the company, or is in a public street.

3. Where a person, for the purpose of taking a street car, went to the platform at which the car stopped, and, after assisting his aged companion to a seat, walked along the platform to take the next seat, and fell off the unguarded end of the platform, which did not extend back to such seat, he was a passenger, and entitled to the care due to that relation, though he had not come in physical contact with the car.

4. The questions whether the platform was in a reasonably safe condition, and, if not, whether plaintiff was injured in consequence of his own negligence, were for the jury.—(Haselton vs. Portsmouth, K. & Y. Street Railway, 53 Atlantic Rep., 1016.)

NEW JERSEY.—Mortgages—After-Acquired Property—Lien—Priority.

1. Where a corporation, after giving a mortgage covering existing and after-acquired property, which was duly recorded, placed poles and wires belonging to it on the land of another by agreement with him, the mortgage was a lien prior to any claim of the landowner.—(Monmouth County Electric Co. vs. Central Co., of New Jersey, et al, 54 Atlantic Rep., 140.)

NEW JERSEY.—Carriers—Street Railways—Ejection of Passenger—Transfers—Time Limit—Errors of Issuing—Conductor—Actions Ex Delicto.

1. Where a passenger on a street car was entitled to continue his journey for the same fare on a connecting line within ten minutes after leaving the original car at the junction, and he was ejected from the connecting car, which he had boarded within the time, by reason of the failure of the conductor of the first car to correctly punch the time of plaintiff's leaving the car on his transfer, such passenger was not limited to an action for breach of contract, but was entitled to recover for his expulsion in an action of tort, unless by his own fault or negligence he aided in producing the situation which led to the expulsion.—(Perrine vs. North Jersey Street Railway Company, 54 Atlantic Rep., 799.)

NEW YORK.—Sewers—Right to Maintain—Easements—Verbal Consent—License—Trespass—Injunction.

1. The right to maintain a sewer through the land of another is an easement in real estate, and can be only acquired by written conveyance.

2. A landowner's verbal consent to the maintenance through his land of a sewer by another is a mere revocable license, which may be terminated by reasonable notice.

3. Where one carries on a system of various petty tresspasses on the property of another, the latter is entitled to an injunction.—(Fonda, J. & G. R. Co. vs. Olmstead, 81 N. Y. Supp., 1041.)

NEW YORK.—Attorney's Lien—Enforcement—Equitable Action—Exclusive Remedy.

1. Where a claim and cause of action are extinguished by a settlement made before judgment, or even trial, Code Civ. Proc., Sect. 66, giving an attorney a lien on his client's claim and cause of action upon the commencement of the action, impliedly provides that the lien shall extend to the proceeds, and it attaches to the fund created by the settlement, so that, where a party with actual notice of the lien pays the fund over to the other, he is liable to the attorney for the amount of his lien, in an equitable action to enforce it, where it cannot be collected from the client.

2. That Code Civ. Proc. Sec. 66, relating to an attorney's lien, provides a remedy by petition for the enforcement of the lien, does not exclude the right to bring an equitable action to enforce it; showing that plaintiff is within the provisions of such section, and subject to the defense that no lien ever existed, or that it has been waived or discharged.—(Fischer-Hansen vs. Brooklyn Heights Ry. Co. et al, 66 N. E. Rep., 395.)

LIABILITY FOR NEGLIGENCE

NEW YORK.—Trial—Instructions—Street Railways—Contributory Negligence—Effect—Instructions—Expert Testimony—Competency—Excessive Damages.

1. Where the questions of defendant's negligence and plaintiff's contributory negligence were, under the evidence, for the jury, the court was not required to charge, as matter of law, that, if the jury believed the testimony of a particular witness as to a particular fact, they should find for defendant.

2. A traveler, though turning on a street car track when an approaching car was 30 ft. away, was entitled to recover for injuries sustained by being struck by the car, notwithstanding his own negligence, unless the motorman did what he could to avoid the accident.

3. In an action against a street railway for injuries received by a traveler, an instruction that if the accident happened by reason of the traveler starting to drive across the tracks when the car was 30 ft. away, and if the motorman could not, by the exercise of ordinary care, have stopped the car in time to avoid the accident, then defendant was not liable, was properly refused, as authorizing a verdict for defendant though the motorman might have so checked the car that the force of the collision would not have been sufficient to throw the traveler off his wagon and injure him.

4. Where plaintiff's right shoulder, previously in good condition, was injured in a collision with a street car in which he was thrown from his wagon, it was not error to permit a physician, who testified that about three months before the trial, which occurred some two years after the accident, he had examined plaintiff, and found a condition indicating an old inflammation of the shoulder joint, to answer a question whether the condition could have been caused by a severe contusion of the shoulder nearly two years before, caused by his being thrown out of a wagon.

5. Where plaintiff's evidence in an action against a street railway company for injuries received in a collision with a car tended to show that the use of his arm was impaired, a verdict for $1,000 was not excessive.—(Wagner vs. Metropolitan St. Ry. Co., 80 New York Suppl., 191.)

NEW YORK.—Negligence—Care Required of Infant—Evidence of Incapacity.

1. An infant of the age of 12 years, or above, is chargeable with the measure of care demanded by an adult, unless he shows as a fact that he does not have the capacity sufficient to exercise the care of an adult.—(Charlton vs. Forty-Second St., M. & St. N. Ave. R. Co., 80 New York Suppl., 174.)

NEW YORK.—Carriers—Negligence—Evidence—Question for Jury—Street Cars—Invitation to Board—Instructions.

1. Where, in an action against a street railway company for injury to a passenger who was thrown down by the sudden starting of the car as he was getting on, there was no evidence relating to the conductor, except that plaintiff did not see him, it was error to leave the question of the conductor's negligence to the jury.

2. Where, in an action against a street railway company, plaintiff, while stepping onto a slowly moving car, which he had signaled, was thrown off by its starting forward with a jerk, the refusal of the court to charge that "the slowing up of the car as it approached the street crossing was not an invitation to the plaintiff to board it before it stopped," was error.—(Monroe vs. Metropolitan St. Ry. Co., 80 New York Suppl., 177.)

NEW YORK.—Street Railroads—Person on Track—Driver of Wagon—Negligence—Question for Jury—Contributory Negligence—Right to Use Track Space.

1. Evidence in an action by the driver of a wagon for injuries occasioned by a collision with street cars passing each other considered, and held to require the submission of the question of the street car company's negligence to the jury.

2. Evidence in an action by a wagon driver for injuries from a collision with a street car, occasioned by his turning onto the track to avoid approaching trucks, considered, and held not to warrant withdrawing the issue of contributory negligence from the jury, though there was no proof that plaintiff looked for cars.

3. It is not negligence, as a matter of law, for a wagon driver to turn onto the street car track in front of an approaching car which is so far away that by proper care it can be stopped so as to avoid a collision.—(Blum vs. Metropolitan St. Ry. Co., 80 New York Suppl., 157.)

NEW YORK.—Carriers — Crowded Street Car — Contibutory Negligence—Arguments of Counsel.

1. Where a street car company fails to provide seats or standing room, so that a passenger must stand on the platform, and the company permits him to ride there, the question of its negligence is for the jury where the platform is so crowded that he is liable to be pushed off by an employee operating the car.

2. The plaintiff was a passenger in a street car, the seats of which were occupied, and he rode on the front platform, with seven others. In going fast on a down grade, the driver, in his efforts to apply the brakes, jostled the crowd, and decedent was thrown off and instantly killed. Held, that the questions of negligence and contributory negligence were for the jury.

3. A passenger on a street car is not chargeable with contributory negligence as a matter of law, because he stood on the platform of the car with knowledge of its overcrowded condition, where there was no evidence that he was ever on a street car before, or that he knew of any fact, other than the crowded condition of the platform, which would expose him to danger.

4. Calling attention to an improper statement of counsel in summing up for the first time after the instructions, and the taking exceptions to the language used by counsel present no question that can be reviewed by the Court of Appeals.

5. An exception to the denial of a motion to withdraw a juror because of improper remarks of counsel in summing up presents no question for review, the denial resting in the discretion of the trial court.—(Cattano vs. Metropolitan St. Ry. Co., 66 N. E. Rep., 563.)

NEW YORK.—Guardian Ad Litem for Infant—Execution—Giving Security.

1. Under Code Civ. Proc. Sec. 474, providing that a guardian ad litem for an infant may not receive money of the infant till he has given security, and general rules of practice No. 51, to the same effect, she or her attorney may not proceed by execution to collect a judgment till the security be given.—(Wileman vs. Metropolitan St. Ry. Co., 80 New York Suppl., 233.)

NEW YORK.—Children—Negligence of Parents—Imputed Negligence—Street Railroads—Injuries to Pedestrians—Duty to Look—Witnesses—Duty to Produce—Presumptions.

1. Parents of a child 6½ years of age were not guilty of negligence in permitting the child to accompany his brother, 12 years

of age, well acquainted with the city, on a visit to their aunt, in a different portion thereof.

2. Where a child 6½ years of age was killed by a street railway car while accompanying his brother, 12 years of age, from one part of the city to another, the negligence if any, of the elder brother, would be imputable to the child in an action to recover for his death.

3. A boy 12 years of age, accompanied by decedent, his younger brother, left a northbound street car after it, with other cars, had become blockaded, and waited on the curb until the cars had passed, when he started to cross the street, after looking and seeing a southbound car by which his brother was struck a block away, but was himself compelled to jump out of the way of the car, which approached at an unusual and negligent rate of speed, without ringing the gong. Held, that the elder boy was not guilty of negligence, as a matter of law, which, being imputed to deceased, would preclude a recovery for his death.

4. Where decedent, in custody of his elder brother, attempted to cross a street in front of a street car which was a block away when they started from the curb where they looked, and saw the car, which approached at a high and negligent rate of speed, of between 14 and 15 miles per hour, without ringing the bell, whether decedent's brother was negligent in not looking a second time before reaching a point of danger was a question for the jury.

5. Defendant requested the court to charge that, by plaintiff's failure to produce certain witnesses claimed to have been witnesses for plaintiff on a former trial, the jury might infer that their testimony would have been unfavorable to plaintiff. It did not appear that the witnesses named had been witnesses on the former trial, and the court declined the request, and charged that if either side had under control witnesses who could testify to any material facts connected with the accident, and did not produce them, that fact might be considered by the jury, and added that it did not appear that both of the persons named in the request were witnesses at the former trial, but that the witnesses mentioned by defendant were under its control. Held, that such instruction was not error.—(Levine vs. Metropolitan St. Ry. Co., 80 New York Suppl., 48.)

NEW YORK.—Res Judicata—Formal Appeal—Subsequent Trial —Appeal—Review—Weight of Evidence—Contributory Negligence—Instructions—Exceptions—Sufficiency.

1. The decision, on appeal from a non-suit in an action for personal injuries; that the questions of defendant's negligence and plaintiff's contributory negligence are for the jury, is res judicata on the subsequent trial of the action, where plaintiff's evidence is the same as on the former trial.

2. A verdict for plaintiff on a question of fact will not be disturbed as against the weight of the evidence, though the evidence on defendant's part is sustained by a greater number of witnesses.

3. A pedestrian, after signaling an approaching car about half a block away to stop at the place passengers are customarily taken on, is not negligent, as a matter of law, in proceeding diagonally across the tracks to such place, and in assuming that the motorman, as the car approaches the stopping place, will use reasonable care to permit her to cross in safety.

4. The pedestrian was not guilty of negligence, as a matter of law, for failing to look behind her after she had started in her diagonal course across the tracks.

5. Where, in an action for personal injuries, the evidence justifies a finding that plaintiff will suffer pain from the injuries in the future, an exception generally to an instruction permitting an award of damages for future pain, mental and physical, on the ground that there is no proof warranting the jury in allowing damages for future pain, does not present the question of the correctness of the instruction so far as it allows damages for future mental pain.—(Copeland vs. Metropolitan St. Ry. Co., 79 New York Suppl., 1054.)

NEW YORK.—Street Railways—Injury to Passenger—Contributory Negligence—Negligence.

1. It is not negligence per se for a passenger on a crowded car to stand on the running board.

2. Testimony that street car crossed a street without stopping, then slowed up a little, and then suddenly started quickly, with a jerk sufficient to throw standing passengers off their footing and against the seats, and that, coincident with the sudden jerk and accelerated speed, plaintiff's intestate, a passenger standing on the running board, fell from the car, makes a case of negligence for the jury.—(Sheeron vs. Coney Island & B. R. Co., 79 New York Suppl., 752.)

NEW YORK.—Personal Injury—Damages—Earning Capacity—Evidence—Admissibility—Excessive Damages.

1. Plaintiff, injured while alighting from one of defendant's cars, was at the time a licensed pilot, and belonged to a corporation known as the Sandy Hook Pilots' Association. His earnings consisted of fees received for boarding incoming vessels and bringing them into port, the fees being regulated by law. All of the fees received by the various pilots were turned into a common fund held by the association, from which plaintiff received $200 monthly. Held, that proof of the receipt by plaintiff of such sum was admissible to show his earning capacity.

2. The accident resulted in a fracture of plaintiff's thigh, with permanent disablement. He was entitled, under the rules of the association, to $75 a month pension. Held, that a verdict for $10,000 was not excessive.—(Waldie vs. Brooklyn Heights Ry. Co., 79 New York Suppl., 922.)

NEW YORK.—Street Railroads—Injuries to Pedestrians—Contributory Negligence—Duty of Motormen—Instructions—Intervening Cause.

1. When plaintiff started to cross a street, he saw a southbound car approaching about a block away. He crossed the southbound track, and did not discover a northbound car approaching until he was about to step on the northbound track, and in order to avoid a collision he stepped back on the southbound track, and was struck by the southbound car. Held, that it was plaintiff's duty to have looked both ways before starting to cross the street, and his failure to do so constituted contributory negligence.

2. The motorman on the southbound car was not bound to anticipate that plaintiff, after crossing the southbound track would retrace his steps in order to avoid a collision with the northbound car.

3. Where, in an action for injuries while crossing a street railway track, there was no evidence of any intervening cause, and the evidence would have justified a finding that plaintiff's injuries were due to his own negligence, a charge that, though plaintiff was guilty of contributory negligence, yet if defendant, by reasonable care, could have avoided the consequences of such negligence, and if plaintiff's negligence was not the direct cause of the accident, plaintiff was entitled to recover if defendant was guilty of negligence, was error.—(Trauber vs. Third Ave. Ry. Co., 80 New York Suppl., 231.)

NEW YORK.—Identity of Person—Evidence—Sufficiency as Affected by Other Testimony—Ejection of Passengers—Damages.

1. Testimony of plaintiff in an action for forcible ejection from a street car, given twelve months after the event, that he would not know the conductor, does not affect his positive testimony that the conductor to whom he gave his transfer at Thirty-Fourth Street was the one who ejected him at Ninety-Fourth Street, so as to allow the question to go to the jury, though the conductor who ejected him testified that he did not take charge of the car till it reached Fiftieth Street.

2. A verdict of $1,500 for ejection of a passenger from a street car by the conductor, who insisted that he had not paid his fare, is not excessive, considering the element of humiliation; the conductor having repeatedly struck and kicked him, and endeavored to assault him with a piece of iron, which he was prevented by plaintiff's companion from doing, and it not appearing plaintiff's resistance was such as in any way to mitigate or palliate the unprovoked violence.—(Foley vs. Metropolitan St. Ry. Co., 80 New York Suppl., 249.)

NEW YORK—Res Ipsa Loquitur—Burden of Proof—Derailment of Street Car.

1. The doctrine of res ipsa loquitur operates to raise a presumption of negligence against the defendant, but does not shift the burden of proof.

2. The doctrine of res ipsa loquitur applies to cases of injuries to passengers caused by derailment of a street car operated by mechanical or by mechanical and electrical power.—(Adams vs. Union Ry. Co. of New York City, 80 New York Suppl., 264.)

NEW YORK.—Servant — Injuries — Elevation — Inspection—Question for Jury.

1. Where defendant maintained an elevator in its street car barn for the purpose of lifting street cars from one floor to another, and the only evidence of inspection was that of one of defendant's witnesses, who testified that he was in the habit every week of going around the elevator and looking at it, and going on a ladder and observing the wheels and the drums and oiling the machinery, but had not used the hammer test on the gear wheel, which subsequently broke, for more than a year prior to the accident, a finding that the inspection was inadequate was proper.

2. Defendant street railway company maintained a car elevator in its barns, the elevator being provided with a track connecting with other tracks on the different floors, and the cars being moved by defendant's employees. Plaintiff, an employee, was injured by the fall of the elevator, caused by the breaking of a cable and a gear wheel. It was shown that if the cable alone had broken, the elevator would simply have sagged a few inches, and defendant contended that the breaking of the gear wheel was the result of a

blow-hole in the metal constituting a hidden defect. Plaintiff, however, contended that the break was due to a crack in the wheel, which was patent, and might have been ascertained by a proper inspection. Held, that the cause of the break was for the jury.—(Swenson vs. Metropolitan St. Ry. Co., 80 New York Suppl., 281.)

NEW YORK.—Street Railways—Injuries—Contributory Negligence—Instructions.

1. As plaintiff left the sidewalk to cross a street there was a car approaching, 75 ft. to 100 ft. away, moving 5 miles or 6 miles an hour. There was a truck in advance of the car. Just as the car came opposite the head of the horses hitched to the truck, plaintiff ran in front of both vehicles, and was struck by the car before the motorman could stop it. Held, not to warrant a charge that, even if plaintiff was guilty of contributory negligence, the question remained whether the motorman might have avoided the consequence of plaintiff's negligence; only the simple questions of negligence and contributory negligence being presented.—(Phelan vs. Forty-Second St., M. & St. N. Ave. Ry. Co., 80 New York Suppl., 333.)

NEW YORK.—Master and Servant—Negligence—Care Required of Servant—Tools—Choice of Tools—Inspection by Servant—Inspection by Defendant—Proximate Cause—Notice of Defect.

1. A servant who, in the discharge of his duties, ascends a telegraph pole, is not bound to fasten the pole with guy ropes, braces, etc., unless the danger of proceeding otherwise is known and obvious.

2. An electric lineman, who ascends a telegraph pole for the purpose of cutting wires, has a right to use such of the appliances furnished as appear to him to be reasonably safe for the performance of the task.

3. Where an electric lineman, in the discharge of his duties, ascends a telegraph pole, it is not incumbent on him to make an inspection of the pole, where the defect is not obvious.

4. It is the duty of an employer, who sends a servant to the top of a telegraph pole, to inspect the pole in order to see whether it is safe.

5. Where an electric lineman was injured owing to a pole on which he was at work falling when the wires were cut, and it appeared that the pole had deteriorated from dry rot, so that it was supported by only a small portion of good material, the proximate cause of the injury was the defect in the pole.

6. Where an electric lineman is injured by a pole on which he is working breaking with him, owing to it having deteriorated from dry rot, that the wires were being removed from wooden to iron poles did not amount to notice that the wooden poles were defective.—(Walsh vs. New York & Q. C. Ry. Co., 80 New York Suppl., 767.)

NEW YORK.—Carriers—Injuries to Passengers—Trial—Misconduct of Counsel—Reversible Error.

1. In an action for injuries to a passenger, after an objection had been sustained to a question asked of defendant's witness on cross-examination as to whom a doctor, who accompanied the witness on a visit to plaintiff, represented, plaintiff's counsel asked witness whether such doctor did not go to settle with plaintiff, and whether he was not representing an insurance company back of defendant, to which defendant's counsel at once objected, and which was not allowed to be answered. Held, that the asking of such question constituted reversible error, where it did not affirmatively appear that it did not affect the verdict, though the court instructed the jury that they should not regard it.—(Manigold vs. Black River Traction Co., 80 New York Suppl., 861.)

NEW YORK.—Personal Injury Case—Failure to subpoena Attending Physician—Instructions.

1. There being no evidence that the physician who attended plaintiff for the injury for which she sues was subpœnaed, and she admitting that he had testified on a former trial that he found nothing to indicate that she had been injured, except what she told him, defendant is entitled to an instruction that the jury may consider his absence as a fact bearing on plaintiff's right to recover.—(Minck vs. New York & Q. C. Ry. Co., 80 New York Suppl., 712.)

NEW YORK.—Street Car Conductor—Assault on Passenger—Credibility of Evidence—Assault Provoked by Passenger—Evidence—Arrest of Conductor—Discharge.

1. Where defendant's version of an assault made on plaintiff by a conductor on one of its cars, uncontradicted by any testimony except that of plaintiff, is to the effect that plaintiff fell in jumping off the car while in motion, and the conductor stopped the car, and went back to make inquiries, whereupon, after some conversation, plaintiff, who was suffering from a broken ankle, followed and struck him, and was dealt a blow in return, a verdict for defendant will not be disturbed on the ground that the story is too incredible to justify it.

2. A street railway company is not liable for an assault on a passenger by a conductor, provoked by the passenger's violence.

3. Where, in an action against a street railway company for assault on a passenger by a conductor, plaintiff elicits evidence that the conductor was arrested for the assault, the admission of evidence by the defendant that he was discharged after arraignment was not error.—(James vs. Metropolitan St. Ry. Co., 80 New York Suppl., 710.)

NEW YORK.—Injury to Employee—Contributory Negligence.

1. The evidence showed that plaintiff's intestate was excavating under defendant's street railway, over which the cars were continually passing; that while working in the trench he was struck by a car; that he saw it approach, and leaned back to be out of the way; and that there was plenty of room in the trench for him to remain at a safe distance from the car as it passed, but that he raised up so as to bring his face near the car, and was struck by the step. Held, that he was guilty of contributory negligence, preventing recovery.—(Riddle vs. Forty-Second St., M. & St. N. Ave. Ry. Co., 66 N. E. Rep., 22.)

NEW YORK.—Appeal—Dismissal Before Verdict—Motion for New Trial—Review—Street Railroad—Starting Car Without Warning—Negligence—Question for Jury.

1. Where, subsequent to the coming in of the jury the court decides a motion to dismiss the complaint favorably, so that the case is left without a verdict, a motion for a new trial is not before the Supreme Court for review.

2. Where a street car comes to a full stop on reaching a crossing, the conductor having announced a transfer point, the act of the motorman in starting the car without signal received therefor, and without looking around to discover whether any one is in the act of alighting, whereby a passenger, partially alighted, is thrown and injured, may constitute negligence; the question being for the jury.—(Bessenger vs. Metropolitan St. Ry. Co., 79 New York Suppl., 1017.)

NEW YORK.—Witnesses—Impeachment—Cross - Examination as to Matter not Subject of Direct Examination—Street Railroads—Personal Injuries—Rules of Company—Admissibility.

1. In an action for personal injuries, a physician called by defendant testified merely that he knew plaintiff, and had treated her several times; his other testimony being excluded. On cross-examination he testified that he had never told plaintiff that defendant had offered him money to testify against her. Held, that, as the testimony was with relation to a matter not brought out on the direct examination, plaintiff was bound by it, and could not afterwards herself go on the stand and testify to the contrary.

2. In an action against a street railroad company for injuries to plaintiff, caused by the sudden starting of the car while she was attempting to board it, it was reversible error to permit plaintiff to introduce in evidence a rule of the company having no relation to the question involved; it tending to confuse the jury.—(Deutschmann vs. Third Ave. R. Co., 79 New York Suppl., 1043.)

NEW YORK.—Street Railroads—Injuries on Tracks—Continuous Negligence of Driver—Contributory Negligence—Issue for Jury.

1. Where the only evidence of the negligence of the driver of a horse car in running into a child on the track was his continuous negligent conduct in not looking forward—he having been aware that any one was on or near the track—it was error to take a clear issue of contributory negligence from the jury.—(Bortz vs. Dry Dock, E. B. & B. R. Co., 79 New York Suppl., 1046.)

NEW YORK.—Street Railroads—Improper Conduct of Party and Counsel—New Trial—Persons Driving near Tracks—Contributory Negligence.

1. Where, in an action against a street railroad for personal injuries, defendant, after unsuccessfully attempting to introduce in evidence and have rung before the jury a gong which could not be identified, took advantage of the absence of the court during recess, and rang it in the presence of most of the jurors, plaintiff was entitled to a new trial, though the jury was charged to disregard the sounding of the gong, and affidavits were made by seven of the jurors that they had done so.

2. In an action for injuries received by being hit by a street car while driving near the tracks, it was prejudicial error to refuse, at plaintiff's request, to charge that it is not negligence, as a matter of law, for a man to drive on the tracks of a street railway or near the tracks, where the court had not charged on this phase of the case, and the jury were left to infer that plaintiff was negligent, as a matter of law, in so driving.—(Bronk vs. Binghamton R. Co., 79 New York Suppl., 577.)

NEW YORK.—Carriers—Street Railroads—Injury to Passenger—Contributory Negligence—Negligence of Carrier—Defective Track—Pleading—Allegation of Injuries—Proof—Appeal—Harmless Error.

1. Where, at the time of a passenger's injury by the derailment of

a street car in which she was riding, she was seated in the car, the question of contributory negligence did not arise.

2. At the time of the derailment of a street car the road was being changed to be operated by electricity. The pavement had been removed, and sand was piled and barrels of gravel had been left along the track. The car struck one of these barrels, and was derailed, throwing plaintiff, a passenger, to the floor, causing her injuries. Held, to justify a finding of negligence on the part of the carrier.

3. Where a complaint alleged that plaintiff, a passenger, was thrown against a car and severely injured "in and around the head and body, and that by reason of the premises plaintiff was made sick, sore, and lame, and was caused to suffer, and still suffers, great bodily pain, and by reason of the permanent character of such injuries she may never recover therefrom," it was insufficient to justify evidence that such accident created a physical condition in plaintiff known as "retroversion," which rendered her incapable of bearing children.

4. A judgment in favor of plaintiff in an action for injuries amply sustained by competent evidence will not be reversed for the erroneous admission of evidence concerning an injury not pleaded, where plaintiff and her physician were permitted by defendant to testify thereto without objection, and no objection was made on the ground that the evidence was incompetent under the pleadings, until, on cross-examination of another physician, such objection was made to a question relating to such injury, the answer to which did not positively show that the accident caused the particular injury objected to.—(Ramson vs. Metropolitan St. Ry. Co., 79 New York Suppl., 588.)

NEW YORK.—Streets on Private Grounds—Street Railways—Construction on Private Grounds—Maintenance—Negligence—Liability—Right of Action—Assignment.

1. A street located on the campus of a university, and on ground owned and controlled by the university, the use of which by the public has not been inconsistent with the university's private ownership thereof, is not a public street.

2. Cornell University authorized defendant street railway company to construct its tracks on a street within the university campus on an agreement by which defendant contracted to keep in thorough order all the construction necessary for its road. Plaintiff, a servant of one of the professors, living in the university with her sister, who was also employed in the university, had been driving in the country with a livery rig, and on returning the cutter was overturned by a defect in defendant's track on the college campus. The horse ran away and was killed, and the cutter injured. Held that, plaintiff having been impliedly invited to use the premises by the university, the latter owed her the duty of reasonable care to keep the street in repair, and that defendant, under its contract, was liable for the exercise of the same duty.

3. The fact that the horse and cutter did not belong to plaintiff was immaterial, since the owner thereof had all the rights which plaintiff would have against defendant for their negligent injury, and on his assignment thereof to plaintiff she was entitled to recover therefor.—(Bolster vs. Ithaca St. Ry Co., 79 New York Suppl., 597.)

NEW YORK.—Street Railway—Personal Injuries—Opinion of Court on Reversal—Right of Plaintiff on Second Trial—Evidence—Verdict—Conduct of Jury.

1. Though the court, on appeal, in reversing a judgment for plaintiff in an action against a street railway for injuries received while attempting to cross the track, by reason of the negligence of the driver in failing to stop the car and defendant's negligence in failing to supply the car with an efficient brake, intimated that no recovery could be had for the driver's negligence, plaintiff on a new trial might introduce evidence to support both allegations, and was entitled to have both issues submitted to the jury, if sustained by sufficient evidence.

2. In an action against a street railway company for injuries to a person on the track, the only evidence of a defective brake was testimony of the driver. His evidence was contradictory to that given by him on a former trial, and he admitted that he had given false evidence in several respects. The jury returned a verdict for plaintiff, and did not answer the question whether the brake was defective, and, on being interrogated by the judge, stated that they did not answer it because the jurors had decided to throw out the driver's evidence. They were instructed if they did so, to answer the question in favor of defendant. They retired, and returned with an affirmative answer to such question. Held, that the verdict should be set aside, as the result either of prejudice or misapprehension.—(Csatlos vs. Metropolitan St. Ry. Co., 79 New York Suppl., 653.)

NEW YORK.—Personal Injuries—Complaint—Nature of Injury—Dementia.

1. Under a complaint alleging that plaintiff was severely injured in her person; that her skull was fractured, and she was severely wounded, bruised, and contused in various parts of her person; that she received severe internal injuries, was greatly shocked, and sustained permanent injuries, incapacitating her from attending to her duties—proof that plaintiff was suffering from dementia, caused by the accident, was inadmissible.—(Sealey vs. Metropolitan St. Ry. Co., 79 New York Suppl., 677.)

NEW YORK.—Trial—Personal Injuries—Physical Demonstration—Propriety—Personal Injury Action—Amount of Damages—Amendment of Complaint—Harmless Error—Excessive Verdict.

1. On the trial of a personal injury action it is proper to permit plaintiff to attempt to write his name and to drink a glass of water in the jury's presence, for the purpose of demonstrating the extent of his injuries.

2. On the trial of a personal injury case, the testimony being concluded, it is not an abuse of discretion to permit an amendment of the complaint increasing the claim for damages from ten to twenty thousand dollars.

3. Any error in permitting an amendment of a complaint increasing the claim for damages for personal injuries is harmless where the recovery did not exceed the amount originally claimed.

4. A verdict of $10,000 for personal injuries is not excessive, the evidence showing that plaintiff had sustained a fracture of two ribs, contusion on the whole chest, bruises on the back and head and hand, and had developed pleurisy from the rib fracture, and a nervous tremor, indicating chronic sclerosis of the spinal cord and brain, which was progressive and incurable.—(Clark vs. Brooklyn Heights Railway Company, 79 New York Suppl., 811.)

NEW YORK.—Mortgages—Foreclosure—Action by Trustee—Request by Holders of Bonds Secured—Necessity—Detachment of Coupons—Effect—Foreclosure for Interest Alone—Demand for Payment—Necessity—Time when Interest Begins to Run—Costs—Additional Allowance—Amendment to Statutes.

1. A mortgage securing bonds provided in section 5 that, in case of default in the payment of any half year's interest on any of the bonds, the trustee might elect, on the request in writing of the owners of one-half of the bonds outstanding, to make the principal sum immediately due and payable. Section 7 provided: "In case of default as hereinbefore defined, the said trustee may adopt any legal or equitable method for foreclosing this mortgage and enforcing the trusts herein contained, or for collecting the principal and interest of the bonds secured hereby," etc. Held, that under section 7 the trustee could sue in foreclosure to compel a sale of the mortgaged premises, so far as might be necessary to pay interest represented by unpaid coupons without any request in writing by the bondholders.

2. The detachment of the interest coupons from the bonds did not deprive those holding them of the security of the mortgage.

3. The mortgage could be foreclosed for the interest alone.

4. The abandonment by the mortgagor of its office where, under the terms of the mortgage, the interest was payable, released the holders of the coupons from obligation to make demand for payment, even if such demand was necessary.

5. The holders of the coupons were entitled to interest thereon from the time they were detached from the bonds and passed into separate ownership, thus becoming distinct negotiable instruments.

6. Code Civ. Proc. Sec. 3253, provided prior to 1898, that the court might award to any party, in addition to costs, in an action brought to foreclose a mortgage on real property, or in a difficult and extraordinary case, a further sum, as follows: "(1) In an action to foreclose a mortgage, a sum not exceeding * * * the aggregate sum of two hundred dollars. (2) In any other case or special proceeding specified in this section, a sum not exceeding five per centum on the sum recovered or claimed, or the value of the subject-matter involved." In 1898 the second subdivision of the section was amended by striking out the word "other" after the words "in any." Held, that the effect of the amendment was to permit the court to allow more than $200 additional costs in a mortgage foreclosure suit of a difficult and extraordinary nature.—Long Island Loan & Trust Co. vs. Long Island City & N. Ry. Co. et al., 82 New York Suppl., 644.)

NEW YORK.—Evidence—Expert Witnesses—Personal Injuries—Evidence—Sufficiency.

1. Opinions of expert witnesses must be disregarded, if formed without the aid of facts necessary to enable the witnesses to come to a conclusion.

2. In an action for death alleged to have been caused by inflammation of the brain, resulting from the lodgment in that organ of pus formed in the wrist, which was injured by the negligence of defendant, evidence of expert witnesses considered, and held insufficient to show that pus found in the brain was carried there from the injury at the wrist.—McQuade vs. Metropolitan St. Ry. Co., 82 New York Suppl., 720.)

NEW YORK.—Street Railroads—Street Intersection—Accident —Negligence.

1. The wagon in which plaintiff was riding was struck in broad daylight by defendant's car at a street intersection, and carried a distance of 20 ft. Both plaintiff and the one with whom he was riding testified that they looked and saw the car 200 ft. away, when the horses were 4 ft. from the track, and again 40 ft. away, when the horses were about to step on the track, and that no warning signal was given by the motorman. Held, that the question of defendant's negligence was for the jury.—(Andres vs. Brooklyn Heights R. Co., 82 New York Suppl., 729.)

NEW YORK.—Street Cars—Personal Injuries—Contributory Negligence—Wrongful Death—Damages—Excessive Verdict.

1. Decedent, while seeing, some distance away, a southbound car approaching, started, at a street crossing, to walk diagonally across the street in order to board an approaching northbound car. He signaled the latter to stop, which it did. Its conductor called to him to hurry. When in the center of the track on which the southbound car was running he was warned by a companion of its approach, and stepped back, but was struck and killed. There was evidence that the southbound car was proceeding at a speed of 20 or 25 miles an hour, and that no signal of its approach was given. Held, that the issue of contributory negligence was for the jury.

2. A verdict for $10,000 for causing the death of a man seventy-three years of age, successful in business, apparently in good financial circumstances, leaving a wife and adult children, to none of whom he gave financial aid, except to the wife, was excessive, and should be reduced to $5,000.—(Stillings vs. Metropolitan St. Ry. Co., 82 New York Suppl., 726.

NEW YORK.—Abatement—Pendency of Another Action—What Constitutes Pendency of Other Action—Waiver of Plea—Suit by Plaintiff's Testator—Elevated Railroad—Damages—Devisee's Right to Recover—Assignment of Claim for Damages—Waiver of Objection to Recovery in Equitable Action.

1. The plea of the pendency of another action can only be supported by a showing that the former action was pending when the second action was begun.

2. A mere showing that a summons in another action has been served is not sufficient to support of plea of the pendency of another action.

3. A plea of the pendency of another action will be deemed waived where a reliance thereon was in no way indicated by objection or motion during the trial, and defendant's motion to dismiss was based on entirely different grounds.

4. The pendency of an action commenced by a testator to enjoin the operation of an elevated railroad in front of his premises is no bar to a suit by testator's devisee for injunctive relief and the recovery of damages sustained since he acquired title.

5. The mere fact that a devisee has a right to maintain an action to enjoin the operation of an elevated railroad in front of his premises does not entitle him to recover damages accrued during the life of his testator.

6. Where a devisee had acquired by assignment the claims of his testator's estate to damages for the operation of an elevated railroad in front of the devised premises, he was entitled to have these past damages included in the recovery in a suit to enjoin the operation of the road.

7. Where a devisee who had taken an assignment of the claims of his testator's estate to damages for the operation of an elevated railroad in front of the devised premises asked recovery for the past damages sustained by him and the testator, in a suit to enjoin the maintenance of the road, and no objection was made to plaintiff's right to recover for the assigned damages, and proof thereof was received without objection, defendent waived any right it may have had to have these damages ascertained in an action at law.—(Hirsch vs. Manhattan Ry. Co., 82 New York Suppl., 754.)

NEW YORK.—Street Railroads—Injuries to Vehicles—Negligence—Evidence—Curing Error.

1. In an action for injuries to a horse and wagon in a collision with a street car, evidence as to the motorman's negligence, held to present a question of fact for the determination of the trial judge as a trier of the facts, and not to authorize a finding that the motorman was not guilty of negligence as a matter of law.

2. In an action for injuries to a horse and vehicle in a collision with a street car, error, if any, in refusing to permit the motorman to testify as to the purpose of certain "stop" and "slow" signs, was cured, where he was subsequently permitted to testify that every motorman slowed up when he reached a sign of that character, and that witness slowed up at the place where the sign was.—(Strauss et al. vs. Brooklyn Heights Ry. Co., 82 New York Suppl., 767.)

NEW YORK.—Street Railroads—Use of Streets—Injuries to Vehicles—Negligence of Driver—Negligence of Railroad Company—Evidence—Damages.

1. Where the space left between certain vans and an elevated railroad pillar in a street was estimated at from 7 ft. to 8 ft., and other witnesses testified that there was not sufficient room to permit defendant's servant to drive a wagon five feet wide through such space, whether the servant was guilty of negligence in not atempting to drive through the space, instead of driving around the pillar onto a street railway track, where the wagon was struck by a street car, was for the jury.

2. Where, at the time plaintiff's servant drove on a street railway track, a car was approaching from 100 ft. to 125 ft. away, at from 6 miles to 8 miles an hour, and when the car was 80 ft. from the wagon, the motorman rang the gong hard, but did not attempt to stop the car, and the wagon was demolished by the collision, the motorman's failure to stop the car constituted negligence on the part of the railroad company.

3. Where plaintiff's wagon was wrecked in a collision with a street car in one of the streets of the city of New York, plaintiff was entitled to recover, in addition to the reasonable cost of repairs, expenses paid in removing the remains of the wagon from the street and storing the same during such time as arrangements could be made for repairs, together with the reasonable value of the use of the wagon while it was being repaired.—(Moore vs. Metropolitan St. Ry. Co., 83 N. Y. Suppl., 778.)

NEW YORK.—Railroads—New York City—Statutes—Construction—Rapid Transit Act—Application—Payment for Stock—Cash—Certificate of Incorporation—Subsequent Certificate—Validity—Board of Railroad Commissioners—Review of Discretion.

1. Laws 1860, p. 16, ch. 10, provided that it should not be lawful to construct any railroad along the streets of New York City, except under the authority and subject to restrictions thereafter granted and provided by the Legislature. Since that time three acts (laws 1875, p. 740, ch. 606; laws 1880, p. 874, ch. 583, and laws 1884, p. 872, ch. 252) have been passed, under which street railroads could be built in the city. In 1890 most of the provisions of the railroad act of 1850 (laws 1850, p. 211, ch. 140), and the three acts above referred to, were merged in one act (laws 1890, p. 1082, ch. 565); those three acts being expressly repealed. The act of 1890 extended the general provisions of the railroad law of 1850 to New York City, imposing special provisions for the protection of the city when a railroad invaded its streets. Held, that the act of 1890 was not merely a codification of the pre-existing laws, but gave authority for the construction of railroads in New York City without reference to the provision of the act of 1860.

2. Rapid Transit Act 1891 (laws 1891, p. 3, ch. 4) applies only to roads to be built exclusively within New York City, and is not intended to exclude the application of railroad law 1890 (laws 1890, p. 1082, ch. 565) to the city.

3. Payment for stock in a railroad company by an uncertified check on bank is not a payment in cash, such as is specified by laws 1890, p. 1082, ch. 565, sec. 2, requiring 10 per cent of the minimum amount of capital stock of a proposed railroad company to be paid in cash at the time of the filing of the certificate of incorporation.

4. Where a certificate of incorporation of a railroad company is void because 10 per cent of the capital stock has not been paid in cash at the time of filing such certificate, as required by laws 1890, p. 1082, ch. 565, sec. 2, the filing of an additional certificate after payment has been made, containing all that the statute requires an original certificate to contain, will operate as a valid original certicate, though it be called an "amended certificate" by the applicants for incorporation.

5. Under laws 1892, p. 1395, ch. 676, sec. 59, requiring the Board of Railroad Commissioners to certify that public convenience and necessity require the construction of a proposed railroad, the action of the Board in so determining is not a subject for judicial revision.—(People ex rel. New York, N. H. & H. R. Co. vs. Board of R. Com'rs of State of New York et al., 81 New York Suppl., 20.)

NEW YORK.—Railroads—Pass—Limitation of Liability—Consideration—Construction of Limitation—Sufficiency.

1. Where, by agreement between a railroad company and a landowner, the railroad agreed, in consideration of a grant of right of way, to give the landowner transportation for life, on the sole condition that her right to transportation should be forfeited if tickets were presented by anyone save herself, and the tickets given the landowner bore a provision exempting the railroad from liability for injuries, such condition was not binding on the landowner in an action by her for injuries owing to the road's negligence, since it was without consideration, and her acceptance of

the tickets did not indicate an intention on her part to assent to the terms thereof.

2. Where tickets issued by a railroad company bear a condition providing that the company shall be released "from all claims for damages for personal injuries from whatever cause," the language is not sufficiently plain and unequivocal to release the railroad from liability for injuries resulting to a passenger from its negligence.—(Dow vs. Syracuse, L. & B. Ry., 80 N. Y. Suppl., 941.)

NEW YORK.—Carriers—Injuries to Passengers—Inadequate Damages—Inconsistent Statements.

1. The flesh of one plaintiff's fingers was torn while he was attempting to alight from one of defendant's trolley cars, by his finger-ring catching in the handle-bar of the car, which was started with a sudden jerk as he was attempting to alight. Plaintiff's wound was very painful, and was dressed by a physician twenty or twenty-five times, for which plaintiff incurred a bill of $150 for medical services. Held, that a verdict for plaintiff for 6 cents damages was inadequate.

2. In an action for injuries to a passenger, his sworn statement that he was not thrown by the force of the car, but had a ring on the third finger of his left hand that got caught on the brass car-handle, lacerating the finger, was not inconsistent with his claim at the trial that the sudden forward movement of the car caused the laceration of his finger.—(Tooker vs. Brooklyn Heights R. Co., 80 N. Y. Suppl., 969.)

NEW YORK.—Street Railways—Injury to Pedestrian—Crossing Behind Car—Contributory Negligence—Construction of Testimony.

1. A pedestrian, struck by a downtown car immediately after having crossed onto the track behind an uptown car, testified that the car was about 40 ft. away when he first saw it, and that he was standing on the downtown side, waiting to get across the avenue, and that he waited to let an uptown car pass, which was 40 ft. away when he first saw it. He later testified that he looked and did not see the downtown car, but it did not appear when he looked. Held, that his testimony disclosed contributory negligence as a matter of law.—(Little vs. Third Ave. R. Co., 82 N. Y. Suppl., 55.

NEW YORK.—Street Railways—Injury to Pedestrian—Contributory Negligence—Reliance on Slackening of Speed—Sufficiency of Evidence.

1. While a pedestrian who reaches a street car track in time to cross safely if the speed of an approaching car is not increased is not negligent in proceeding, yet, if it would be apparent to a person of ordinary prudence that the car will overtake him unless the speed is slackened, it is negligent for him to proceed, though he have an equal right with the company to the use of the street.

2. Evidence in an action by the administratrix of a pedestrian killed by a street car construed, and held insufficient to sustain a verdict for plaintiff, based on the theory that decedent was not guilty of contributory negligence in crossing in front of an approaching car.—(Du Frane vs. Metropolitan St. Ry. Co., 82 N. Y. Suppl., 1.)

NEW YORK.—Street Railroads—Person Using Tracks—Injury to Teams—Contributory Negligence.

1. In an action for negligent injury to property, caused by defendant's car overtaking and running into plaintiff's horse and wagon, evidence of plaintiff's servant that he was driving on defendant's track, which was straight, and afforded a clear view back of him for an eighth of a mile, and that he did not look back at all—there being no testimony that he even listened for the approach of a car, or that there was anything to prevent him from driving at the side of the road, free from the track—showed that he was guilty of contributory negligence, as a matter of law.—(Reynolds vs. Larchmont Horse Ry. Co., 82 N. Y. Suppl., 185.)

NEW YORK.—Street Railroads—Injuries to Pedestrians—Crossings—Instructions.

As plaintiff left a curbstone at a street corner, which was 14 ft. from the first rail of a street car track on which he was injured, he saw the car 40 ft. or 50 ft. away from him, coming at reduced speed. He saw the car suddenly jump forward as he was just at the track, at which time the car was but 15 ft. away. From this point plaintiff had about 5 ft. to go to carry him across the track but before he left the further rail he was struck. Defendant's evidence was that the car was approaching slowly to stop at the further corner of the street, when plaintiff ran in front of the car, when but a few feet ahead of it, and, though the gripman endeavored to stop the car, he was unable to avoid striking plaintiff. Held, that under such evidence it was error to charge that though plaintiff was negligent if, after his negligence occurred, defendant's motorman in the exercise of ordinary care could have avoided colliding with him, plaintiff might recover.—(Poole vs. Metropolitan St. Ry. Co., 82 New York Suppl., 150.)

NEW YORK.—Trial—Nonsuit—Insufficiency of Evidence—Incredibility.

The court is justified in non-suiting a plaintiff, although there is slight evidence to support his position, where such evidence is incredible and averse to well-known physical laws.—(Walter vs. Syracuse Rapid Transit Ry. Co., 82 New York Suppl., 82.)

NEW YORK.—Carriers—Injuries to Passenger—Street Cars—Negligence—Assumption of Risk—Duty to Call Witness—Failure to Call—Presumptions.

1. Decedent attempted to board a combination street car moving between 4 and 6 miles per hour. Deceased lost his hold, fell under the car, and received injuries from which he died. There was no evidence that the motorman saw deceased. The conductor was inside the closed portion of the car, collecting fares, at the time of the accident. The motorman testified that after a blockade which had occurred they had orders to pass streets without taking passengers to equalize the traffic; that he did not slow up for passengers at the street where decedent attempted to board the car, and was not aware that any one attempted to do so. Held, that such facts were insufficient to establish negligence on the part of the railway company.

2. Decendent, in attempting to board the car under such circumstances, in the absence of an invitation by signal or otherwise from the conductor or motorman, assumed the risk of a change in the speed of the car and of his ability to get on in safety.

3. Where in an action against a street railway company for the killing of a passenger, it was shown that the conductor in charge of the car had left defendant's employ, and had gone to another State, and had refused to appear as a witness for defendant, and it did not appear that he saw the accident, or could have given any material evidence, it was error to charge that no adverse inference should be drawn from the absence of the conductor, except that the jury might consider defendant's failure to procure the conductor's testimony by commission as a circumstance bearing on the facts in the case.—(Fremont vs. Metropolitan St. Ry. Co., 82 New York Suppl., 307.)

NEW YORK.—Evidence—Handwriting—Standard of Comparison—Proof of Genuineness.

1. Under laws 1880, p. 141, ch. 36, as amended by laws 1888, p. 911, ch. 555, authorizing the introduction of standards for comparison of disputed handwritings where such standards are proved to be genuine, it was not error to rule that a contract for the sale of certain real estate in controversy, alleged to have been signed by deceased, was not sufficiently proved to contain decedent's genuine signature to authorize its use as a standard for comparison where the only proof thereof was that the contract was found among decedent's papers; decendent's son having refused to testify that his father's signature thereon was genuine.

2. Where the only evidence of genuineness of decedent's signature to a consent for the construction of an elevated railway in front of his property was that of decendent's son who testified that, though the signature on the consent looked like his father's signature, he could not tell that it was, for the reason that a long time had elapsed since he had seen his father's signature, the exclusion of the consent for want of proof of the genuineness of such signature was not error.—(Farrell vs. Manhattan Ry. Co. et al., 82 New York Suppl., 334.)

NEW YORK.—Carriers—Horse Railroads—Injuries to Passengers—Speed—Negligence—Evidence—Riding on Platform—Assumption of Risk.

1. Plaintiff, a passenger on a horse car, during an altercation with the driver on the front platform fell or was thrown therefrom, as the car was rounding a curve. He contended that he was thrown off by the excessive speed of the car while rounding the curve, and testified that the car was going at "full speed," and at a "terrific rate," while rounding the curve. Plaintiff's witness, who saw the accident, testified that the car was going 3 or 4 miles an hour, which was substantiated by other witnesses, and it was undisputed that the car stopped within 5 ft. of the place where plaintiff fell. Held, that the evidence was insufficient to sustain a verdict for plaintiff on the ground of excessive speed.

2. Where a passenger on a street railroad elects to ride on the front platform when there is room inside the car, he thereby assumes the additional risks of injury incident to such position, and defendant owes him no higher duty than to operate the car with reasonable care in the practical discharge of its duty to the public as a carrier of passengers.—(Vogler vs. Central Crosstown Ry. Co., 82 New York Suppl., 485.)

NEW YORK.—Street Railroads—Iujuries to Teamster—Contributory Negligence.

Where plaintiff drove on a street railway track to cross it at a curve as it entered another street, without looking to the rear to ascertain whether it was safe to cross the track or whether a car was approaching, and his wagon was struck by a car coming di-

rectly behind him on the curve, from which plaintiff was injured, he was guilty of contributory negligence.—(Schmidt vs. Interurban St. Ry Co., 81 New York Suppl., 832.)

NEW YORK.—Street Railroads—Injuries to Pedestrians—Crossings—Contributory Negligence.

Plaintiff saw a street car approaching him as he left the curb to cross the track two doors from the opposite corner of the street, and again near the corner as he reached the first rail of the track. He testified that he thought he could get across, as he thought the car would stop at one of the crossings to give him a chance to cross; but there was no proof that the car was bound to stop at the crossing, or that plaintiff had reasonable grounds for his belief that it would do so. Held, that plaintiff was guilty of contributory negligence.—(Freeman vs. Brooklyn Heights Ry. Co., 81 New York Suppl., 828.)

NEW YORK.—Electricity—Falling of Wires—Injuries—Liability of Company—Res Ipsa Loquitur—Explanation of Cause of Fall—Effect.

1. Whether plaintiff was injured by physical contact with a trolley wire as it fell, or by one of the currents caused by the wires coming in contact with the ground and with the rails, thereby forming a completed circuit, was immaterial; the company being liable in either event.

2. The doctrine of res ipsa loquitur applied to a case where defendant's trolley wire fell into the street, injuring plaintiff; and this though plaintiff introduced evidence showing that the fall was caused by the trolley slipping off and striking some of the supporting wires.—(Clancy vs. New York & Q. C. Ry. Co. (two cases) 81 N. Y. Supp., 875.)

NEW YORK.—Actions — Negligence — Amendment — Adding Party Defendant.

Under Code Civ. Proc. section 723, providing that the court may at any stage of an action amend a pleading or proceeding by adding the name of a person as a party, etc., where an action was brought against a city and one railroad company for injury resulting from a defect in a street at the crossing of two railroads, the defect being claimed to be owing to the negligence of the city and of both railroad companies, the court, on petition of the plaintiff, may order that the other company be made a defendant. —(Schun vs. Brooklyn Heights R. Co. et al., 81 N. Y. Supp., 859.)

NEW YORK.—Evidence—Medical Works—Admissibility.

In an action for personal injuries it was error to allow counsel to read from a medical book a statement as to the symptoms of a certain disease, and ask plaintiff's physician if he subscribed thereto.—(Pahl vs. Troy City Ry. Co., 81 N. Y. Supp., 46.)

NEW YORK.—Municipal Corporations—Ice in Streets—Drippings from Elevated Trains—Unusual Accident—Negligence—Failure to Provide Drip Pans.

1. The rule that where an accident is of unusual and extraordinary character, which could not have been reasonably prevented, defendant is not bound to foresee or make provision against it, did not apply to a case where the dripping of water from the trains of an elevated railroad company, standing at its station, caused the formation of ice in the street below, on which a pedestrian slipped, where it affrmatively appeared that the company had reason to know of the formation of the ice, and that it employed men for the express purpose of looking after ice forming, and one of these employees testified that before the accident occurred, and at the very place, he had found ice formed several times, and that once when a train was standing at this place he saw the drip, and that it came from the train.

2. While walking along a public street at night, plaintiff slipped on ice formed by drippings from the "exhaust" on steam hose connected with trains on defendant's elevated railroad. There was evidence that at other points on the line drip pans were furnished, into which the water was collected and retained; that a drip pan under the structure at the place of the accident would have prevented the ice from forming. Held, negligence on the part of the defendant not to provide such an appliance.—(White vs. Manhattan Ry. Co., 81 N. Y. Supp., 1011.)

NEW YORK.—Carriers—Injuries to Passenger—Negligence—Contributory Negligence—Evidence—Question for Jury.

In an action against a carrier for injuries received by a passenger on its train, where a jury might have inferred from defendant's evidence, though of a negative character, that no accident had occurred to plaintiff in the manner stated by his witnesses, either through any negligence of defendant, or without contributory negligence on plaintiff's part, it was error to take from the jury the question whether plaintiff had established his freedom from contributory negligence.—(Wimpelberg vs. Yonkers Ry. Co., 81 N. Y. Supp., 963.)

NEW YORK.—Carriers—Injury to Passenger—Res Ipsa Loquitur.

The fact that a passenger on a trolley car, injured by reason of the escape of electricity in the car, undertook to show that the accident was due to defective insulation, and failed, did not necessarily take away from the company the legal obligation of giving an explanation of the occurrence, and showing that it was not due to its negligence.—(D'Arcy vs. Westchester Electric Ry. Co., 81 N. Y. Supp., 952.)

NEW YORK.—Appeal—Disposition of Cause—Judgment Erroneous in Part.

Where the property alleged to have been injured by the construction of a railroad tunnel consisted of two lots, one of them undoubtedly injured to some extent, but the other suffering only nominal damage, and the damages awarded were in a lump sum, and the decision of the trial judge did not show how much he assessed as the damage to each lot, reversal of the entire judgment was necessary.—(Peak vs. Kings County Electric Ry. Co. et al., 81 N. Y. Supp., 926.)

NEW YORK.—Carriers—Injury to Passenger—Measure of Care—Instructions.

In an action against a street car company for personal injuries sustained by a passenger from a collision between the car and a wagon, it appeared that the wagon was approaching from the direction towards which the car was going, and that because of the heavy load the driver was unable to turn out as quickly as he might ordinarily have done, as a result of which the stanchions at the middle of the car struck the rear bags of cotton with which the wagon was loaded, shattering the handles, and injuring plaintiff by the flying splinters. Held, that the situation was not one from which grave injury might have been expected, and hence a charge that the street car company was bound to exercise the highest degree of care and skill which human foresight could provide was erroneous.—(Conway vs. Brooklyn Heights R. Co. et al., 81 N. Y. Supp.)

NEW YORK.—Street Railways—Injury to Passenger Alighting—Negligence—Pleading and Proof.

The only negligence alleged by a complaint stating that, while plaintiff was a passenger on defendant's street car, and when it came to a complete stop, and while she was in the act of alighting from it, it was started up with great suddenness and velocity, throwing her, is in starting the car without giving plaintiff an opportunity to alight after it had come to a full stop, so that, if she stepped off the car while it was in motion at all, the negligence alleged is not established.—(Coleman vs. Metropolitan St. Ry. Co., 81 N. Y. Supp., 836.)

NEW YORK.—Use of City Streets—Live Electric Wire—Cause of Injury—Jury Question—Operation of Electric Railway—Admission in Pleadings—Requirement of Due Care—Res Ipsa Loquitur.

1. The absence of evidence that a live electric wire came into actual contact with plaintiff or his horse will not, as a matter of law, preclude recovery for injuries to them, the evidence showing that the horse had fallen into a pool of water and that plaintiff had gone to its assistance, when a loose wire, blown against a trolley pole, caused a series of electric discharges, resembling explosions, and lighting the pole from top to bottom.

2. Plaintiff, injured by a live trolley wire, alleged, and defendant admitted, that on a day named defendant "was operating a surface or street railroad propelled and worked by electric power" on a certain street. Held, an admission by defendant that it was using the appliances and mechanical devices necessary for the operation of its electric railway.

3. A company merely operating an electric railway is required to use the appliances with the same degree of care as if they had been built, and were actually owned, by it.

4. The doctrine of res ipsa loquitur is applicable to an injury from a broken live wire belonging to an electric railway system.—(Smith vs. Brooklyn Heights R. Co., 81 N. Y. Supp., 838.)

NEW YORK.—Street Railways—Safe Stopping Place—Excavation in Street.

Plaintiff signaled one of defendant's southbound cars on a rainy and foggy night. The motorman immediately attempted to stop, but did not succeed till the car was some distance past the crossing, and just beyond an excavation in the street, extending from the track to the west curb, and protected by a light at the end towards the track, and by embankments on the two sides. As the car stopped, the conductor cried, "Come on!" and plaintiff started for the car, going out into the roadway, diagonally towards the rear platform, but fell into the intervening excavation. Defendant was in no way connected with the digging or maintenance of the excavation, and was not shown to be charged with any duty

to the public with respect to the street. Held, that there was no showing that the car did not stop at a safe place, nor that the conductor was negligent in failing to warn plaintiff, and defendant was not liable.—MacKenzie vs. Union Ry. Co. of New York City, 81 New York Suppl., 748.)

NEW YORK.—Street Railways—Crossing Collision—Evidence —Question for Jury—Injuries—Pleading—Evidence—Absence of Allegation—Waiver.

1. In an action against a street railroad for injuries, plaintiff testified that as he started to drive across the street he looked and saw an approaching car a block away; that as he drove on the track he saw the car 25 ft. away, and tried to hurry, but the rear wheels of the wagon were stuck. The evidence upon the part of the defendant tended to establish that the plaintiff drove directly in front of the car in such close proximity to it that the motorman was unable to stop, and that the horse was struck by the fender just as it entered on the crossing. Held, that there was a case for the jury.

2. In an action for injuries, evidence of injuries to plaintiff's ribs is inadmissible where not pleaded.

3. In an action for injuries the complaint did not allege injuries to plaintiff's ribs, and he testified he knew his ribs were broken because of certain symptoms, which he described, and which might not have indicated broken ribs, and a physician testified that a tumor in plaintiff's side might have been caused by a broken rib. Held, that the latter testimony should have been excluded on defendant's objection, since plaintiff's testimony had not established the injury claimed.—(Cronin vs. Metropolitan St. Ry. Co., 81 N. Y. Supp., 752.

NEW YORK.—Carriers—Passengers—Ejection—Misconduct—Issues—Submission—Evidence—Damages—Evidence.

1. Where, in an action for ejecting a passenger, plaintiff alleged that the ejection was without any fault or negligence on his part, which was denied by the answer, and proof of misconduct of plaintiff was introduced, it was error to refuse to sumbit the issue on the ground that the only defense alleged or stated in defendant's opening was that plaintiff was not a passenger at the time of his ejection.

2. Where plaintiff alleged that he was ejected from defendant's street car without any fault on his part, which was denied by the answer, it was error to exclude evidence that complaint was made to the conductor by a passenger in the car as to the language plaintiff used before ejection, on the ground that the only defense pleaded was that plaintiff was not a passenger by reason of his failure to pay fare.

3. In an action for ejection of a passenger, evidence of improper conduct by plaintiff was admissible in mitigation of damages.—(Bough vs. Metropolitan St. Ry. Co., 81 New York Suppl., 771.)

NEW YORK.—Carriers—Elevated Railroads—Injuries to Passengers—Evidence—Withdrawal of Juror—Instructions.

1. Plaintiff attempted to board one of defendant's trains at a station, but before she could do so the guard slammed the gates together, which caught her dress while she was still on the platform, and, the train being immediately started, she was dragged along, and her foot crushed between the platform and the car. Held, that the facts were sufficient to sustain a verdict in favor of plaintiff.

2. Where, in an action for injuries to a passenger, her physician testified that the injury had nothing to do with a subsequent operation for the removal of one of plaintiff's ovaries, and there was no allegation in the complaint respecting such injury, it was error to refuse to strike out evidence relating thereto.

3. Where, in an action for injuries to a passenger, the complaint made no claim that plaintiff's ovarian trouble was occasioned by her injuries, and no evidence relating thereto being introduced, and defendant's motion to strike out the same having been denied, defendant requested the court to permit the withdrawal of a juror on the ground that it had no notice of a claim for such injuries, and had no opportunity to show that such trouble was not due to the injury, the application was erroneously denied.

4. Where, in an action for injuries to a passenger, an injury to plaintiff's ovaries was not pleaded, but the court submitted such injury to the jury in an instruction that they should not allow damages therefor unless it was necessarily occasioned by the injury and was a direct result thereof, it was error to refuse to charge at defendant's request that if the injury to plaintiff's ovary was merely a possible result of her injury on defendant's railroad, and she had failed to show by a preponderance of the evidence that the ovarian trouble was caused by such injury, the evidence relating thereto should be disregarded.

5. Where, in an action for injuries to a passenger on an elevated railroad, the court, at plaintiff's request, charged that such railroads were required not to start their cars until the gates had been firmly closed, and that no train should be started until every passenger on the platform desiring to board the same had actually boarded the cars, and that plaintiff had a right to assume that the train, when she started to board it, would not be prematurely started, it was error to refuse, at defendant's request, to charge that when the people who desired to stop at the station at which plaintiff was injured had left the train, and the persons who were, in a manner apparent to the guards, actually evincing a desire to board the train had entered, defendant had a right to close the gates and start the train.

6. Requested instructions that plaintiff, when on the station platform, was in a place of safety, and was not under such stress of circumstances as would justify her in attempting to get on a moving train after it had started, and that if the guard had closed the gates and started the train before plaintiff had time to board same, and even while she was walking toward it, this would not justify her in attempting from a place of safety to board the train after it had started, were improperly refused.—(Brown vs. Manhattan Ry. Co., 81 New York Suppl., 755.)

NEW YORK.—Servant—Injury—Negligence of Master or Third Person—Verdict—Release of Master.

Plaintiff's decedent, while employed as driver of an express wagon, was caught between his wagon and a street car, and killed. Plaintiff's evidence tended to show that as decedent was crossing the track a wheel came off his wagon, and the car came on, and caught and killed him. Defendant's evidence tended to show that the car had stopped, or almost stopped, and that while the wagon was passing the car the wheel came off and threw the wagon against the car, and that he was caught between the wagon and car and killed. There was no evidence as to how or why the wheel came off, or that it was the result of the negligence of defendant's employer. The court charged that, "if the coming off of the wheel was what caused the accident, there must be a verdict for the defendant." There was no request for a charge based on the assumption that the accident was occasioned in part by the coming off of the wheel, irrespective of any question of negligence in that regard. Held, that the verdict for plaintiff was on the theory that the accident was caused solely by the negligence of defendant's motorman; hence a release executed by plaintiff of decedent's employer did not discharge defendant.—(O'Brien vs. Brooklyn Heights R. Co., 81 New York Suppl., 127.)

NEW YORK.—Carriers—Transportation of Employees—Passengers — Assault — Rules —Application—Witnesses—Cross-Examination—Harmless Error.

1. Rules of a street car company, providing that employees, while riding free, must not occupy seats to the exclusion of paying passengers, and, on open cars, employees riding free must not ride on the front seat, and that employees in uniform may ride free, to the number of five, on a car, provided that if more than that number insist on riding the conductors shall collect fare, applied only to employees riding free; and did not justify an assault on an employee riding in uniform, but paying fare, in ejecting him from the front seat on his refusal to vacate the same.

2. Where a street railway inspector, in ejecting an employee from a seat in a car, acted under a mistaken impression that such employee was not entitled to ride in such seat, under a rule of the company, his act could not be justified on the ground that he had authority to make rules, which the employee was bound to obey.

3. Where it was claimed that plaintiff gave two versions of his ejection from a street car, and, on his attention being called thereto, testified that, in his opinion, both versions were the same, error, if any, in excluding a question as to whether it was not possible that plaintiff's statement at the trial was not the correct version, and that what he said the day after the occurrence was correct, was harmless.—(Rowe vs. Brooklyn Heights R. Co., 81 New York Suppl., 106.)

NEW YORK.—Street Railways—Collision with Team—Negligence.

1. Plaintiff, a boy twelve years old, while riding on the rear of a wagon, was injured by its being struck by an electric car. He testified that when the wagon was on the track the car was a block away, and that the horse was going slowly. The motorman (in business for himself at the time of the trial) testified that as he approached the crossing, going 4 or 5 miles an hour, the horse was going rapidly, and when first seen was 18 ft. ahead of the car; that as soon as he saw it he reversed, and the car, after striking the rear wheel of the wagon without injuring it, went only 5 ft. further. He was corroborated by the motorman of another car, and the driver of the wagon testified that his horse took fright, he was unable to control it, and it dashed in front of the car. Held, that there was nothing to show negligence of the street railway company.—(Summerman vs. Interurban St. Ry. Co., 87 N. Y. Suppl., 427.)

FINANCIAL INTELLIGENCE

Wall Street, May 18, 1904.

The Money Market

Gold to the amount of $53,000,000 is the grand total taken for export to France since the movement began six weeks ago. Had it not been for the $30,000,000 odd arriving, Japanese specie, this enormous output would have before now exhausted the local bank surplus. As it is, the surplus has been reduced from $34,203,000—the high level of the season April 23—to $12,827,000. Loans have risen during this period $53,000,000, showing that the gold exports are not the only cause for the drain on reserve holdings. Large sums have been lent to syndicates floating new bond issues, expanding both loans and deposits and consequently raising the legal requirements against which cash must be held in bank. Nevertheless the extraordinary withdrawals of gold for Europe have been the overshadowing factor in the change which has come over money conditions during the last few weeks. As already pointed out in these articles the $40,000,000 Panama Canal payment and the $25,000,000 American subscription to the new Japanese loan, are the two main reasons for the expulsion of specie from this country. The routine commercial operations of exchange, as the latest figures of exports and imports prove, can have added only slightly to the volume of the movement. Our exports for April, thanks to an increase in shipments of manufactured articles, exceeded, for the first time in several months, last year's corresponding total. Imports meanwhile decreased $4,200,000, leaving a net trade balance in our favor $4,400,000 larger than was recorded in April, 1903. In this quarter, therefore, the situation has greatly improved as compared with last winter. But the immediate facts which the market must face are that $10,000,000 more gold has been engaged for export than was included in the bank statement last Saturday, and that the coming return will necessarily show the surplus item brought down pretty low. Under the circumstances the sharp advance in money rates which has occurred during the last few days, is certainly not surprising. Call money, which sank as low as ½ of 1 per cent a fortnight ago, has risen to 2¼ per cent, sixty day rates from 2½ to 3 per cent, and six months rates from 3¾ tom 4 per cent. The belief in banking circles at the moment is that this upturn is enough to put a stop to the excessive loss of gold.

The Stock Market

The intense dullness of a week ago has been followed during the past week by a general movement in the direction of lower prices. Trading, while not very active, has shown a decided increase over what it was before; in other words enough actual liquidation has set in to change the character of the market and to give it a rather positive downward tendency. Three groups of stocks have been particularly affected, the Steel shares, the Eries and the shares of the Gould Southwestern roads. In these instances the weakness has been more apparent than it has in other parts of the list. Heavy selling of the granger railways has occurred and prices have yielded. But the market in this quarter has displayed a certain buying power which, in the quarters just alluded to, has been almost entirely absent. It cannot be said that sentiment in high financial circles is bearish on the situation, but what amounts to almost the same thing according to professional calculations, the exponents of capital are not willing to take a decided stand in favor of higher prices, but are simply content that the market be left to take its own course. Under these circumstances, so long as the outside public, both investors and speculators, are resolutely holding aloof, there is more encouragement offered to speculation for the short than for the long account. The only check on the declining tendency at such a time is that imposed by an overcrowded short interest. It can hardly be said that outside developments have played much of a part in the Stock Exchange movement of the week. Crop news has not been as good as it was a week ago, railroad and trade reports are no better. The enormous gold engagements and the consequent drain upon the local bank reserves may have had some sentimental bearing on the market, but they are not a mark of weakness, and this fact is well understood. To sum up the outlook in a few words, the present is a time of caution and inactivity in trade and financial circles, no great forward movement is at all likely for some time to come, and the market is feeling the effects of occasional liquidation by speculators who are not alarmed over their position, but merely tired of holding on.

The local traction stocks have presented an altogether better appearance than almost any other part of the market in the week's dealings. The speculative position in Metropolitan is considered by well informed observers to be particularly strong. Manhattan is being bought all the time by investors, their purchases serving to hold the stock steady without advancing it. A strong speculative contingent, bearish on the rest of the list, is giving out bullish expressions on Brooklyn Rapid Transit. It is taking its stand mainly on the knowledge that earnings now are and are expected to continue very satisfactory by comparison with previous years.

Philadelphia

The active traction issues on the Philadelphia Exchange have as a rule gone lower in the week's trading, but the losses are comparatively small. Philadelphia Company common declined the most, yet its loss was only a point, from 38⅞ to 37⅞. Some large blocks of Rapid Transit came out at 13¼ after which the stock touched 13 and then 13⅛. Union Traction after reaching 50⅛ eased to 49¾. Philadelphia Traction was active from 96 to 95¾. Philadelphia Company preferred was dealt in between 44½ and 44¼. On the other hand, Philadelphia Electric—one of the weakest on the list in the previous dealings—recovered on rather heavy buying from 5¼ to 5 9-16. The rally was attributed to disbelief in the recent rumors that the company is about to levy an assessment. Consolidated Traction, of New Jersey, was also exceptionally strong, 600 shares selling at an advance from 65 to 65¼. Odd lot transactions were reported in American Railways at 44½, Fairmount Park Transportation at 26, Pittsburg Traction preferred at 49¾, United Railways, of San Francisco, preferred at 45, Rochester Passenger at 101⅞ and Second and Third Streets Passenger at 295.

Chicago

Selling of the street railway stocks—a part undoubtedly of the general market weakness—has gone on steadily throughout the week in Chicago. Fifty shares of City Railway went at 157, after which 600 were sold at 155. Union Traction preferred declined from 30¼ to 29 on unusually active trading, while large blocks of the common were passed over at 5½. North Chicago, on sales of a few odd lots dropped off to 66½ rallying later to 68. West Chicago declined from 40 to 39½, and then went back again, on sales altogether of 50 shares. Scarcely anything was done in the elevated securities. One hundred Metropolitan preferred changed hands at 45, and a few lots of Lake Street receipts between 3⅛ and 3⅜. Great progress is being made in the preparations for finishing the Metropolitan's downtown terminal and officials of the road say that earnings will begin to feel the benefit of the improvement in July. Leading interests in the stock yards district believe that construction of the elevated line in that section will be commenced next fall. Nothing, however, can be learned from officials of the South Side Elevated Company on the subject.

Other Traction Securities

Liquidation has depressed prices in Boston, especially the Massachusetts Electric shares. The common declined from 19¾ to 17⅝ on active trading; the preferred, after first selling down from 72½ to 70½, broke to 69 on sales of only 100 shares. This is the lowest the stock has sold at all on the year's general downfall. Speculative rumors adverse to the dividend-paying ability of the company have circulated, but none of them has been serious enough to bear repeating. West End common lost a point from 91 to 90, then rallied to 90½, while the preferred fell from 112 to 111. Boston Elevated has held comparatively selling, touching 140 at one time, but recovering promptly to 141. All the securities of the United Railways Company, of Baltimore, have been very weak on talk that the June coupon on the income bonds is to be defaulted. These bonds, which sold as high as 53 only a few weeks ago, went as low as 46⅞ during the past week. Ten of them sold at the low figure, after which 27 were bought in, apparently by short sellers, on a scale up to 47⅞. The general 4 per cents lost a point from 91 to 90, while 2000 shares of the stock were thrown over at 6½, the low-water mark of the season. Some declines occurred in outside traction bonds dealt in on the Baltimore Exchange, notably in Anacostia & Potomac 5s, which dropped from 98 to 97½, and City & Suburban, of Washing-

ton 5s, which fell from 99 to 98½. Other sales comprised City & Suburban, of Baltimore, 5s at 114, North Baltimore Traction 5s at 114, North Baltimore Traction 5s at 117⅞, Lexington Street Railway 5s at 100¾ to 101, Augusta Street Railway 5s at 101½, Knoxville Traction 5s at 101½, and Atlanta Street Railway 5s at 106. On the New York curb Interborough Rapid Transit broke sharply from 110⅜ to 107½ on sales of about 2000 shares, but afterwards rebounded to 110. New Orleans common sold at 8⅛ and 8 for 200 shares. Nassau Electric 4s, after rising as high as 80⅝, weakened to 80⅛. New Jersey Street Railway 4s went at 71⅛, and Washington Electric 4s at 76½ to 76⅞.

Cincinnati, Covington & Newport issues were very active at Cincinnati last week. The common sold to the extent of about 1000 shares with a range of from 29½ to 30 and the preferred to the extent of 700 shares at 85 and 85½. Cincinnati, Dayton & Toledo came in for a run and 650 shares in small lots sold at 19½ and 19¾. Detroit United sold at 62, and Cincinnati Street Railway at 137½ to 138½; small sales.

Northern Ohio Traction & Light bonds were the active issues in Cleveland last week. The 4s sold at 58 and the 5s at 72¼ to 72¾; about $30,000 worth changing hands in small lots. Cleveland Electric was firm at 72¾, and Northern Texas Traction at 35½, these being the only stock transactions and both small lots. Northern Texas bonds sold to the extent of $13,000 worth for 78 and 78½.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid May 10	Closing Bid May 17
American Railways	44½	44½
Aurora, Elgin & Chicago	a14	—
Boston Elevated	140	140
Brooklyn Rapid Transit	45¾	45⅝
Chicago City	158	155
Chicago Union Traction (common)	5½	5¼
Chicago Union Traction (preferred)	30½	29
Cleveland Electric	72½	—
Consolidated Traction of New Jersey	64¾	65
Consolidated Traction of New Jersey 5s	106⅝	107½
Detroit United	61½	61⅜
Interborough Rapid Transit	110	110⅜
Lake Shore Electric (preferred)	a30	—
Lake Street Elevated	3¼	3
Manhattan Railway	143	142¾
Massachusetts Electric Cos. (common)	18½	17½
Massachusetts Electric Cos. (preferred)	72	69½
Metropolitan Elevated, Chicago (common)	15	15
Metropolitan Elevated, Chicago (preferred)	46	46
Metropolitan Street	108¾	110
Metropolitan Securities	75	75
New Orleans Railways (common)	8¼	8
New Orleans Railways (preferred)	25	26
New Orleans Railways 4½s	76	76
North American	84	83½
Northern Ohio Traction & Light	13	—
Philadelphia Company (common)	38⅞	37⅝
Philadelphia Rapid Transit	13¼	a13½
Philadelphia Traction	95⅞	95¾
St. Louis (common)	13	13
South Side Elevated (Chicago)	91	91
Third Avenue	116	116
Twin City, Minneapolis (common)	94½	93½
Union Traction (Philadelphia)	50	49⅞
United Railways, St. Louis (preferred)	57½	57
West End (common)	91	90
West End (preferred)	111¾	a111

a Asked.

Iron and Steel

Business in the iron market is reported as very dull. New tonnage is coming in slowly, and buyers uncertain as to the continuance of present prices, continue to act very cautiously. Prices of pig iron have eased a trifle in the South, and it is anticipated that the makers will have to grant further concessions before they obtain any large orders. In the finished branches of the trade, business is light, and reports of price-cutting in the plate industry are beginning to come in. Structural steel shows a decided reaction from its activity a few weeks ago. Quotations are as follows: Bessemer pig iron $13.50 and $13.75, Bessemer steel $23, steel rails $28.

Metals.

Quotations for the leading metals are as follows: Copper 13¾ and 13½ cents, tin 27¾ cents, lead 4½ cents, and spelter 5¼ cents.

EARNINGS OF THE INTERBOROUGH RAPID TRANSIT

The Interborough Rapid Transit Company, controlling all the elevated railway lines in New York, reports earnings as follows:

March 31 quarter	1904	1903	1902	1901
Gross receipts	$3,845,121	$3,230,064	$2,878,236	$2,502,043
Operating expenses	1,609,823	1,464,128	1,400,378	1,348,136
Net earnings	$2,235,298	$1,765,936	$1,477,858	$1,153,907
Other income	93,850	110,097	121,937	200,287
Total income	$2,329,148	$1,876,033	$1,599,795	$1,354,194
Charges	2,127,136	1,709,572	1,138,335	1,133,357
Surplus	$202,012	$166,461	$461,460	$220,837
Cash on hand	3,449,345			
Profit and loss surplus	1,714,613			
Nine months ending March 31	1904	1903	1902	1901
Gross receipts	$10,441,583	$8,936,549	$7,808,661	$6,917,680
Expenses and taxes	4,313,839	4,158,704	4,117,479	3,925,544
Net earnings	$6,127,744	$4,777,845	$3,691,182	$2,992,136
Other income	259,736	256,672	514,513	595,211
Total income	$6,387,480	$5,034,517	$4,205,695	$3,587,347
†Charges	5,220,190	4,854,295	3,483,821	3,470,138
Surplus	$1,167,290	$180,222	$721,874	$117,209

†This includes dividends on Manhattan Railway.

The balance sheet as of March 31, 1904, follows:

Assets—	
Cost of lease and equipment	$13,430,200
Stocks and bonds	15,555,113
Other permanent investments, real estate	1,409,934
Supplies on hand	690,742
Due by agents	64
Due by others	9,747
Open accounts	669,440
Cash on hand	3,449,346
Manhattan guaranteed fund	4,018,812
Prepaid insurance	94,229
Sundries	22,956
Total	$39,350,586
Liabilities—	
Capital stock	$35,000,000
Taxes in litigation	763,129
Interest due and accrued	165,585
Manhattan Railway Company lease account	394,948
Sundries	64,381
Interest and premiums on capital stock	580,307
Due for wages	128,711
Due for supplies and taxes	530,946
Open accounts	7,964
Profit and loss (surplus)	1,714,614
Total	$39,350,586

NEW HAVEN BRINGING TROLLEYS TOGETHER UNDER ONE MANAGEMENT

A meeting of stockholders of the Fair Haven & Westville Railroad Company, of New Haven, which is controlled by the New York, New Haven & Hartford Railroad, has been called for Friday, May 20, to transfer the property and franchises to the Worcester & Connecticut Eastern Railway Company in northeastern Connecticut, which also is controlled by the New York, New Haven & Hartford Railroad. It is very evident that the plan of the New York, New Haven & Hartford Railroad is to bring all its electric railway interests together under the charter of the Worcester & Connecticut Eastern Company. Already the charter for the line from Wallingford to Montowese has been transferred to the Worcester & Connecticut Eastern, and quite recently application was made for permission to change the name of the Worcester & Connecticut Company to the Consolidated Railway Company. Authority to make this change of name was given by the Superior Court at New Haven on May 18, and at that time it was announced that the plan of consolidation involved the bringing together of the Meriden Street Railway, Wallingford Tramway, the Fair Haven & Westville Railroad, and the Stamford Company.

PERMIT FOR ANOTHER HUDSON RIVER TUNNEL

The Hudson & Manhattan Railroad Company, which is to build an electric railway tunnel from Exchange Place, Jersey City, to Church and Cortlandt Streets, New York, has been granted a formal permit by the New York State Board of Railroad Commissioners. William G. McAdoo, president of the company, is also president of the New York & New Jersey Railroad Company, which is completing the old Hudson River tunnel from Fourteenth Street, Jersey City, to Morton Street, New York. The proposed tunnels will relieve the congested ferry traffic at the lower end of New York. At present practically the whole of the downtown traffic from New Jersey is delivered between Liberty and Chambers Streets, distance of less than half a mile. There will be twin tunnels, each 1¼ miles in length, and each will hold a single track. The proposed service will be adapted for passenger and light freight service. The tunnel at the New York end will be connected with the rapid transit tunnel and Broadway by subways. The two tunnels will form a continuous loop. The south tunnel will come from the river under Pier 13 and Cortlandt Street, to the loop station at Church Street, running around into the north tunnel under Fulton Street and Pier 14. From the terminus there will be a footway under Dey Street to Broadway and John Street, the passageway being under the subway level. The company has bought the western part of the two blocks bounded by Church, Fulton, Cortlandt Streets and Broadway for a New York terminus. In Jersey City connection will be made with the Public Service Corporation cars and probably with the Pennsylvania Railroad. Jacobs & Davies will have charge of the work.

The Hudson & Manhattan Company was incorporated in New Jersey last year and is capitalized at $3,000,000. The directors, besides Mr. McAdoo, are John Skelton Williams, Anthony N. Brady, E. C. Converse, John G. McCullogh, E. H. Gary and William G. Oakman. The directors, besides Mr. McAdoo, are Walter G. Oakman, John S. Williams, E. H. Gary, Frederick B. Jennings, A. N. Brady, H. B. Hollins, ohn S. McCullough and E. C. Converse.

MOTORMAN BLAMED FOR NEW YORK ELEVATED ACCIDENT

The New York Railroad Commission has placed the blame for last week's accident on the Third Avenue Elevated line in New York, at Fifty-Sixth Street, on the motorman of the second train, who was killed at his post. In this accident a southbound train, consisting of four motor cars and two trailers, running from One Hundred and Sixth Street to City Hall, ran into the rear of another southbound train, consisting of four motor and two trailer cars. The first car of the second train telescoped the last car of the first train, the front platform of the rear car tearing through the last car of the first train about half the length of the car. Fortunately there was no derailment.

In its investigation the board caused a detailed and thorough examination to be made of the electrical and brake equipment in use on the system and, as far as possible, of the equipment of the two trains in collision and of the methods of operation, including the rules governing employees. As a result of this investigation the board is of the opinion that the accident was caused by the motorman of the second train misjudging the distance in which he could stop his train, the fact that he was running on a down grade at the time probably having some effect upon the error in judgment made by him. The evidence of the rear guard of the first train was to the effect that the motorman was making every effort to stop his train 30 ft. from the point of collision, but he no doubt did not commence the application of the brakes in time to prevent the accident.

The board has recommended that all of the motor cars operated by the Interborough Rapid Transit Company on its Manhattan Railway division be equipped in such a manner that, when the current to the motors is cut off by the action of the automatic cutout device now employed on the controllers, it also will operate the air-brake system so as to cause an emergency application of the brakes on the train. The company has announced that it has already perfected a device which will be put in soon on all cars of the Manhattan division to accomplish the same result. The devices are now being manufactured, and many of them have already been delivered, and are now being tested to overcome difficulties which arose when the motive power of the Manhattan Elevated Railroad was changed from steam to electricity.

A NEW FINANCING AND CONSTRUCTION COMPANY

An organization has recently been formed under the title of Lonas, Clendenin & McCord, with offices at 42 Broadway, New York City, for the purpose of railway organization and construction. This firm has connections, both financially and technically, which will enable it not only to take care of the financial details, but also to carry out the construction of railway properties, a combination of great advantage in railway organization. It is usually rarely possible for a firm which is in a position to finance a system to take charge of the constructional details, and this company will thus at once take an important place in the interurban railway field.

The firm consists of F. E. Lonas and I. L. McCord, both of Chicago, and C. F. Clendenin, of New York. Mr. Lonas has been a practicing attorney in Chicago for over twelve years, and has been interested in several important railway organizations, which has given him a wide experience into the details of handling problems of this nature. He was also for some time president of the Maywood Foundry & Machine Company. Mr. McCord's experience has been very extensive in business and accounting lines. He was also for a long time connected with the passenger department of the Michigan Central Railroad, with headquarters at Chicago; also as secretary of the Maywood Foundry & Machine Company, Chicago. Mr. Clendenin was for some time in touch with street railway interests of New England, in the introduction of storage batteries as auxiliaries to electric railway power equipments, and was also secretary of the Continental Electric Company, manufacturers of arc lamps. He has also had an extensive experience in corporate organization, and was lately connected with the Registrar & Transfer Company, of New York City, whose specialty is the organization of companies.

The new firm has several new railway systems in process of organization at present and proposes to carry out the constructional details in a manner which will insure permanence and profitable operation—a most desirable result for the stockholders.

CONSOLIDATION OF ILLINOIS SYSTEMS—CONSTRUCTION OF HIGH-SPEED LINE

Arrangements have just been consummated for a consolidation of the traction systems operating in Alton and Granite City, Ill., with a new company to be known as the Alton, Granite City & St. Louis Company, which is to operate these roads and construct and work a high-speed interurban line between Alton and St. Louis. The length of this road will be 22 miles. The Alton system is at present operated by the Alton Light & Traction Company of which Joseph F. Porter is president, and J. G. White & Company and Austin Fletcher, of New York, are largely interested. There are some 15 miles of track. The Granite City system is principally controlled by ex-Governor D. R. Francis, of Missouri.

Through cars will be run from Alton through East St. Louis over Eads Bridge to the central terminus of St. Louis. The cars, ten of which will be contracted for in the first instance, will be 50 ft. long, and each will be equipped with four 75 hp motors and air brakes. Power for the lower section will be taken from the new power plant of the East St. Louis & Suburban Company and carried to sub-stations on the route. The Alton power station will furnish current to operate the upper end of the line. The whole line is to be worked by despatch system with signals similar to a steam road. There will be no grade crossings. The rails will be of 70-75 lbs. weight.

J. G. White & Company, of New York, have the contract for the building of the Alton-St. Louis road, and construction work will be begun immediately.

MR. HUNTINGTON PROJECTS ANOTHER IMPORTANT LINE

H. E. Huntington has in contemplation another extensive project in connection with the extension of his electric railway interests in California. The latest plan is to build from Reno to Lake Tahoe, the line to follow the course of the Truckee River along a picturesque territory lying between the wooded slopes of the Washoe range and the majestic snow-capped peaks of the Sierras. The territory through which the line will be built is now monopolized, so to speak, by the Southern Pacific Railroad and the Truckee-Tahoe Railroad. The Huntington line will, of course, become a competitor of both of these systems, and in some quarters the statement is made that the building of this line simply means another link in the chain of electric railways which Mr. Huntington is constructing north and south through the State, and which will eventually parallel the Southern Pacific from one end of the State to the other. Mr. Huntington already controls the electric railways in the southern counties, is developing an electric power plant on Kern River, and owns the Fresno Electric Railway and that of Stockton. Last year a preliminary survey was made for an electric railway from Placerville across

the summit of the Sierra to Truckee and Tahoe, which was found to be quite feasible. The latter may be constructed to join the Reno line and perform the same function on the western side of the Sierra as the Reno road will perform on the eastern slope. The Placerville-Tahoe road, when built, considered from the service standpoint, will be a formidable rival to the Southern Pacific Company, as the view from its cars through the most attractive part of the Sierra will not be obstructed by snowsheds, which now shut out the most romantic part of the trip on the Central Pacific.

CINCINNATI COMPANY GAINS IMPORTANT POINT IN A SUIT

The Superior Court at Cincinnati has issued an injunction against the operation of the division of the Cincinnati Street Railway known as the "John Street Route," declaring it to be non-existant. The wide scope of the decision, however, is that all divisions of Cincinnati street railway service which are operated under authority prior to the execution of the Rogers law are held to be valid and good. The John Street line, however, does not come under this head, because the Court finds that it was created purely by the Rogers law. While the Court records that an injunction will issue, there will be no stoppage of traffic as the order is only a step to the taking of the case to the Supreme Court for a final decision. The company wins a victory to the extent of having its title declared good to its many lines which are now operating under resolutions and extensions made before the Rogers law was enacted.

SHANGHAI MUNICIPAL TRAMWAYS

The firm of Fearon, Daniel & Company, of China, and of 87 Front Street, New York City, is advertising again for bids on the tramway concession for the Shanghai Municipal Council. It may be remembered that this was originally brought to the attention of the public as far back as 1898, when a contract was entered into between the municipality and the Brush Electrical Engineering Company, of England. Due probably to the serious Boxer troubles which broke out in the Chinese Empire, the Brush Company did not proceed with the contract, so that the matter is again open for competition and should receive the attention of American engineers. The firm in question has the full details of the concession, the main point of which is the deposit of $25,000 upon signing the contract. The road proposed is a fairly extensive one, comprising in the five specific sections about 5¾ miles of double track and 10¾ miles of single track to be equipped with span wire construction for double-track, bracket for the single, and with iron or steel poles. The conditions laid down in the original tramway agreement must be complied with, but the agents state that a fair and reasonable proposal will have favorable attention on the part of the Municipal Council. The company putting in the road is permitted to collect from each first-class passenger 6 cents for a maximum distance of 1½ miles, and from second-class passengers 2½ cents. The company is to pay the Council a yearly rental of $500 per mile of single track and $750 per mile of double track. These and many other details are given in the papers in the hands of the firm named.

THE FUTURE OF THE MIAMI & ERIE CANAL

Tentative plans for the future of the Miami & Erie Canal Transportation Company have been agreed upon by committees representing the stockholders and the bondholders of the company. The debts of the company are to be scaled down to about $50,000, and this money will be raised by both the stockholders and the bondholders. The refinancing plan will call for the formation of a new company with a new issue of securities. The bond issue of the new company will not exceed the wrecking value of the property as it now stands. The stockholders and bondholders who advance the money will take the bonds at 90 with two years' coupons taken off. The present holders of canal bonds will receive an equal amount in preferred stock, while the holders of canal stock will receive an equal amount of new common stock. The new corporation will have but a single stock liability, which will relieve the old stockholders of the old double liability, it is claimed.

The Canal Company has secured from the State Board of Public Works an extension of time in which to complete the portion of the road between Cincinnati and Dayton, also an extension on the section from Dayton to Toledo, on which no work has been done. Under the agreement, the canal company will restore the tow-path from Dayton to Cincinnati to such condition that mules may be put in service. Inasmuch as the canal is dry and the transportation company owns all the boats at that end of the canal, this portion of the agreement is not, however, of much advantage to the old line boat owners, who are fighting the transportation company. It is understood that the transportation company still has hopes of making a broader agreement with the State for the use of the canal banks.

OHIO ASSOCIATION TO MEET MAY 26

The next regular meeting of the Ohio Interurban Railway Association will be held at the Chittenden Hotel, Columbus, May 26, at 9 A. M. This session will be an open meeting, and will be devoted to a discussion by the members of the following subjects:

1. "What arrangements can be made for the operation of cars of one company over tracks of another company?" This subject is at present in the hands of the transportation committee.

2. "What compensation should interurban companies give newspapers for advertising privileges?"

3. "How to take care of employees from the transportation standpoint, particularly the transportation of track men who are hired by the day only, and to whom the company does not care to give badge or pass-book."

4. "The benefit of associations among members, together with social relations between employers and employees."

5. "The most economical method of keeping cars neat and clean."

The subject committee felt that a greater interest would be manifested in the handling of these subjects by the members themselves, and that an occasional deviation from a prepared paper would be beneficial to the association. On account of the central location of Columbus and the fact that if it be desirable only one day need be given by members to the meeting, it is expected that the attendance will be very large. Urgent invitations are being sent to non-members.

NEW PUBLICATIONS

Quarterly Bulletin of the Committee on Special Hazards and Fire Record of the National Fire Protection Association. 42 pages, paper. Price, 20 cents. Published by the secretary of the association, 67 East Twenty-First Street, Chicago.

This bulletin is devoted entirely to car house and associated risks, and an excerpt from it is published elsewhere in this issue. There are six extended articles on the subject of the proper construction and maintenance of car houses by electrical inspectors and others associated with the different insurance exchanges and underwriters' bureaus which are members of the association, as well as records of a few of the more interesting fires in car houses and power stations which have been brought to the attention of the association. The pamphlet is of the greatest interest, and while as a rule these bulletins are printed exclusively for the information of the members, a number of additional copies have been printed in this instance to supply those who may be interested in this subject.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

759,222. Power Transmission Mechanism; Bion J. Arnold, Chicago, Ill. App. filed Dec. 13, 1902. Relates to mechanism whereby the energy wasted in braking the wheels of the vehicle may be stored and used to aid in propelling the vehicle.

759,385. Railway Switch and Operating Means Wherefor; Lucius A. Lindsey, Strubbe, McConnell & Clifford C. Hudson, Atlanta, Ga. App. filed Nov. 23, 1903. The switch tongue is moved by magnets in the roadbed, which are actuated from the platform of the car by a suitable circuit closing device.

759,433. Trolley; Elmer E. Gillingham & Delancey E. Huntley, Wellston, Ohio. App. filed April 27, 1903. A two-wheel trolley in which the rear wheel is mounted in a frame which has a hinged connection to the frame of the front wheel, whereby the rear wheel can move both in a horizontal and a vertical plane.

759,446. Car Fender; Frederick R. Keith, Randolph, Mass. App. filed June 22, 1903. Relates to that class of fender which is

normally elevated some distance above the rails, but which upon meeting an obstruction is automatically thrown into its lowered position.

759,453. Electric Railway; Timothy Mahoney, San Francisco, Cal. App. filed July 1, 1903. To obviate the necessity of using the car tracks as return conductors, the two ends of the third rail are connected directly to the dynamo, and means provided for shunting the current from the third rail through the car and back to the third rail again.

759,567. Brake-Shoe; Alfred L. Streeter, Chicago, Ill. App. filed March 2, 1903. A brake-shoe provided with a backing of steel spikes partially embedded in the metal of the shoe.

759,661. Panel for Convertible Cars; John A. Brill, Philadelphia, Pa. App. filed April 17, 1903. Details of construction of a sliding panel which will at all times make a tight joint, and which may be made flexible to conform to the curves, be easily movable in the grooves and yet be weather-tight.

759,707. Fender; John O. Harrison, Evansville, Ind. App. filed Feb. 8, 1904. Details.

759,767. Rail Support; Louis Steinberger, New York, N. Y. App. filed Jan. 7, 1904. The chair in which the rail is mounted is adapted to rock on its support to permit the rail to accommodate itself to pressures applied thereon.

PERSONAL MENTION

MR. JAMES H. McGRAW, president of the McGraw Publishing Company, has been elected a delegate from New Jersey to the Republican National Convention to be held in Chicago next month.

MR. J. C. McQUISTON, until recently secretary, has been appointed superintendent of the Westinghouse Companies' Publishing Department, having charge of matters relating to the publicity of the products of the various Westinghouse interests in the United States and Canada.

MR. C. E. FLYNN, formerly general manager of the Wheeling Traction Company, of Wheeling, W. Va., has been elected second vice-president of the Conneaut Traction Company, which is building a system between Conneaut, Ohio, and Erie, Pa.

MR. ARTHUR BUSSE, chief engineer of the Grosse Berliner Strassenbahn, the principal street railway in Berlin and the largest electric railway system in Europe, reached New York on May 11. Mr. Busse is planning to visit a number of the cities in this country on a tour of inspection, and will also go to the World's Fair in St. Louis before his return to Berlin, the middle of June.

CAPTAIN JAMES W. HINKLEY and MR. SILAS HINKLEY, sons of the late Mr. James W. Hinkley, will succeed their father in the management of the Poughkeepsie City & Wappinger's Falls Electric Railway Company, of Poughkeepsie, N. Y. Captain Hinkley has been elected president, and Mr. Silas Hinkley secretary and treasurer and general manager of the company.

MR. GEORGE W. EDWARDS, former superintendent of the elevated division of the Brooklyn Rapid Transit system, has been appointed general secretary of the Brooklyn Rapid Transit Employees' Mutual Benefit Association, to succeed Mr. J. M. Dudley, who has gone to Portland, Me., to take charge of the railroad branch of the Y. M. C. A. at that place. Mr. Edwards is a railroad man of many years' experience, and has been one of the most popular men in the employ of the Brooklyn Rapid Transit Company. Mr. Dudley came on from Chicago purposely to organize the Brooklyn association.

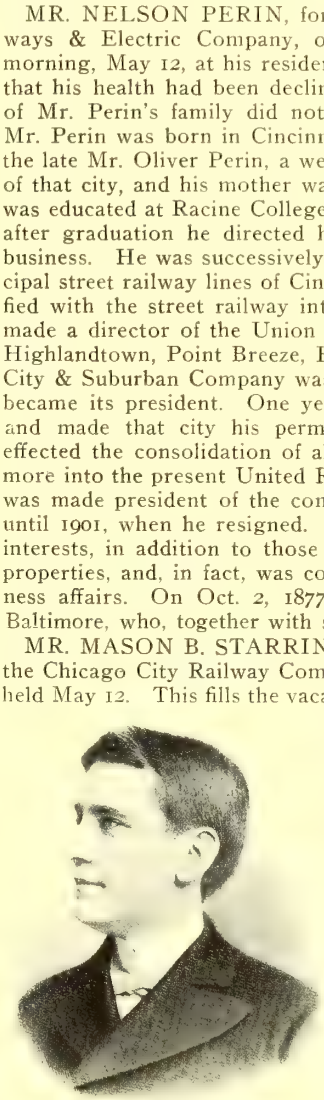
MR. W. OWEN THOMAS, who, until recently, was electrical engineer of the great water-power plant of the Michigan & Lake Superior Power Company at Sault Ste Marie, Mich., has accepted the position of assistant to the mechanical engineer of the Chicago & Northwestern Railway Company at Chicago. Previous to his connection with the Soo development, Mr. Thomas was on the engineering staff of Bion J. Arnold. He is an electrical engineer of a high order of ability, and the appointment on the staff of this railroad of such an engineer would make it appear that something more than the ordinary applications of electricity on a steam railroad system are contemplated by the Chicago & Northwestern, especially as that company is conducting a suburban service out of Chicago, second in volume only to the Illinois Central.

MR. GEORGE W. JACKSON has been selected by the local transportation committee of the Chicago City Council to act as engineer and expert adviser to that body in connection with problems which have come up regarding the lowering of the tunnels under the Chicago River and their relation to any downtown street railway subway that may be built. The government has recently ordered these tunnels either removed or lowered as obstructions to navigation. Mr. Jackson is general manager and chief engineer of the company which has built the extensive system of deep tunnels under the streets of Chicago for the wires of the new telephone exchange and for the transportation of freight. His intimate connection with underground work in Chicago makes him well fitted for an adviser to the local transportation committee in this matter.

MR. HARRY J. CLARK, formerly connected with the engineering department of the Syracuse Rapid Transit Railway Company and later superintendent of the Oneida Railway Company, of Oneida, N. Y., has been appointed assistant to Mr. C. D. Beebe, president and general manager of the Auburn & Syracuse Electric Railroad, and general manager of the Rochester, Syracuse & Eastern Railroad. Mr. Black is a graduate of Cornell University, and, while only 32 years old, is particularly well fitted for his new position. His first experience in railway work was with the Syracuse Rapid Transit Company, from which he resigned several years ago to enter the employ of the Andrews-Stanley syndicate, which built the Utica & Mohawk Valley Railway from Utica to Little Falls, and which is now building the Oneida Railway westward from Utica toward Syracuse. In his work with the Andrews-Stanley interests, Mr. Clark was associated with Mr. C. Loomis Allen, with whom he had previously been connected while with the Syracuse Company.

MR. NELSON PERIN, former president of the United Railways & Electric Company, of Baltimore, Md., died Thursday morning, May 12, at his residence in Baltimore. Despite the fact that his health had been declining steadily for months, members of Mr. Perin's family did not think that the end was so near. Mr. Perin was born in Cincinnati, Oct. 31, 1853. His father was the late Mr. Oliver Perin, a well-known banker and manufacturer of that city, and his mother was Mrs. Mary J. Perin. Mr. Perin was educated at Racine College, graduating in 1874. Immediately after graduation he directed his attention to the street railway business. He was successively director and president of the principal street railway lines of Cincinnati. In 1880 he became identified with the street railway interests of Baltimore, when he was made a director of the Union line. Later, with the York Road, Highlandtown, Point Breeze, Hampden and Catonsville lines, the City & Suburban Company was organized, and in 1885 Mr. Perin became its president. One year later he removed to Baltimore and made that city his permanent home. In 1899 Mr. Perin effected the consolidation of all the street railway lines of Baltimore into the present United Railways & Electric Company. He was made president of the company and continued in that office until 1901, when he resigned. Mr. Perin had a number of other interests, in addition to those of the street railway and lighting properties, and, in fact, was constantly taken up with large business affairs. On Oct. 2, 1877, he married Miss Ella Keck, of Baltimore, who, together with six children, survives him.

MR. MASON B. STARRING was elected general manager of the Chicago City Railway Company at a meeting of the directors, held May 12. This fills the vacancy left by Captain Robert McColloch, who went to St. Louis last month. Mr. Starring is by no means unknown in the street railway field, as he has been connected with the Chicago City Railway Company since Jan. 15, 1888. At that time he entered the employ of the company in the office of president and superintendent C. B. Holmes. Here he got experience in all branches of the street railway business. At the time of Mr. Holmes' retirement, when Judge J. S. Grinnell was made general counsel, Mr. Starring was transferred to the office of the legal department. In February, 1894, he was made assistant general counsel. Judge Grinnell, who was the head of the legal department, died in 1898. Mr. Starring remained with the title of assistant general counsel until the last annual meeting of the company in February, when he was made general solicitor. As a matter of fact his duty had been that of general solicitor ever since Judge Grinnell's death. His able paper on "Damages and Claims," for the American Street Railway Association, in 1902, will be remembered by all who have followed that subject. Mr. Starring is 45 years of age, and, as he puts it, entirely "a Chicago product," having been born and educated in Chicago, and having lived there all his life. His education was received in the Chicago public and high schools. Personally, Mr. Starring is of a very genial temperament, and he has the inborn qualities which make him a good man in dealing with both employees and the public.


M. B. STARRING

NEWS OF THE WEEK

CONSTRUCTION NOTES

JASPER, ALA.—The Jasper Water, Light & Power Company has been granted a franchise to operate an electric railway here. J. M. Crawford is manager of the company.

OPELIKA, ALA.—Rush Taylor, of this city, has left for the North, where he hopes successfully to finance the projected electric railway and lighting system for Opelika and vicinity. Mr. Taylor has already secured in Opelika and Auburn contracts for light and power sufficient to guarantee a revenue of $20,000 annually, without including the revenue from passenger service and other sources.

LOS ANGELES, CAL.—The work of widening the distance between the tracks of the Los Angeles-Pacific Railroad Company at Ocean Park is now under way. The rails of the old Kinney line have been torn up. The improvement planned by the Los Angeles-Pacific Company includes the laying of a 10-ft. walk between the two tracks from Hollister Avenue to South Ocean Park, and the erecting of neat depots at the intersections of the principal streets.

LOS ANGELES, CAL.—The Pacific Electric Railway Company is in receipt of 16,000 tons of steel rails that have just arrived from Belgium. Cargoes of steel that have arrived in the last few weeks aggregate a cost of about $600,000.

LOS ANGELES, CAL.—It is announced that the Pasadena end of the Campbell-Johnston franchise has been completed to the Arroyo Seco, and that less than a mile of road building is required to connect the two sections of the electric railway now constructed. This, it is said, will be done in the near future. The old tunnel, formerly used in the toll road, is to be enlarged so as to make a short-cut across the San Rafael rancho.

OAKLAND, CAL.—J. H. Macdonald has transferred to F. E. Chapin, president and general manager of the San Jose-Los Gatos Interurban Railway Company, all right, title and interest in the franchise for a street railway on College Avenue and on certain thoroughfares in East Oakland on the conditions as agreed between Macdonald and the Oakland Transit Company, whereby the latter is to have the East Oakland privileges mentioned in the franchise.

PORT RICHMOND, CAL.—The construction of the East Shore & Suburban Railway is progressing rapidly and it is expected that the road will be ready for operation by June 15. The power house and car house are nearing completion. The company will not generate its own power, but will convert the 10,000-volt three-phase current of the Richmond Light & Power Company. The equipment of the sub-station was furnished by the General Electric Company, as was also the car equipments.

NEW HAVEN, CONN.—In the Superior Court in this city, Judge Gager recently granted the Fair Haven & Westville Railroad Company permission to build an electric railway from Montowese to Wallingford. An all-trolley trip between New York and Boston will be possible when this stretch of 10 miles is built.

NEW LONDON, CONN.—The charter of the East Lyme Street Railway Company, which has authority to build from New London to Niantic, has been transferred to A. F. Phelps, John A. Morgan and C. C. Phelps. Surveys are to be made at once. Mr. Morgan is a resident of Poquonoc.

WATERBURY, CONN.—Fred T. Ley & Company, of Springfield, have secured a $175,000 contract to build an electric railway between Waterbury and Cheshire, a distance of about 8 miles. The contract requires that the road be completed by June, 1905.

LEWISTON, IDAHO.—Colonel Judson Spoffard, of Lewiston, Idaho, who is interested in the building of the Lewiston & Southeastern, an electric railway, 110 miles in length, from Lewiston to Grangeville, with a branch 25 miles in length to Nez Perces, says that surveys are practically completed and much of the right of way secured. "It is proposed to begin tracklaying during the coming summer," says Col. Spoffard, "and to complete the road and have it in operation by the first of next year. Power will be secured from the Clearwater River, and a plant with a capacity of some 5000 hp will soon be installed." The company is composed exclusively of Lewiston capitalists, its officers being Judson Spoffard, president; F. J. Randolph, secretary, and W. H. Hill, chief engineer. It is capitalized for $4,000,000. Colonel Spoffard formerly made his headquarters at Boise, and was the promoter of the great Boise power plant.

CHICAGO, ILL.—Further mandamus proceedings against the city have been filed in the Superior Court by the South Chicago Street Railway Company to compel the issuance of a permit for the construction of tracks under the ordinance granted March 4, 1895, by the City Council. The street involved is Ninety-Fifth Street from Ewing Avenue west to Avenue K, and the petition is directed against Frederic W. Blocki, commissioner of public works. After the granting of the franchise in 1895, which provided that the tracks should be built within five years, the Third National Bank secured an injunction against the company, restraining the construction of the tracks, and this injunction remained in force until May 15, 1902. The street railway company asserts under the provisions of the ordinance it has the privilege of an extension of time equal to the duration of the injunction for the construction of the tracks, and that it has three years in which to build the tracks. Commissioner Blocki has refused to permit, under the decision of Corporation Counsel Tolman, which the company charges he had no power to do. Judge Holdom recently issued a similar writ of mandamus for the construction of tracks on Torrence Avenue, which is included in the same ordinance and to which the city made the same objection. Double tracks with an electric trolley equipment are asked.

STERLING, ILL.—The Sterling, Dixon & Eastern Railway has opened its local lines for traffic.

AKRON, IND.—The Wabash & Rochester Traction Company will build its power house here. The survey will be made next week. It is announced that the contract will be let soon.

EVANSVILLE, IND.—The specifications for the improvement of the street railway tracks between Eighth and Franklin Streets have been prepared and the contract for the work will be let soon.

FORT WAYNE, IND.—It is said that there is a deal pending for the merger of the Fort Wayne Traction Company, the Fort Wayne & Southwestern Traction Company and the local electric light and power company, which also has the franchise for steam heating in Fort Wayne. The sale is being negotiated through John White. The new company is to construct a monster generating station, using the exhaust steam for heating the downtown districts. Eastern capital is helping to complete the deal.

INDIANAPOLIS, IND.—The Indianapolis, Logansport & Chicago Railway Company will receive bids for the repairs of the levee along the west bank of Fall Creek. Address Quincy A. Meyers, Logansport, Ind.

INDIANAPOLIS, IND.—The Chicago & Northern Indiana Railway Company has been incorporated to build and operate an interurban line in the Counties of Lake, Porter, Jasper, Pulaski, White, Cass, Howard, Tipton, Hamilton and Marion. Capital stock, $25,000. Directors: Lester Loule, H. E. Davenport, Amzi L. Wheeler, Joseph K. Kemp, Charles W. Thompson, Martin W. Eikenberg, Luther McDowell.

LAGRANGE, IND.—The Lagrange-Elkhart Electric Railway Company, of which H. E. Bucklin is president, has secured a right of way to build a line between Lagrange and Middlebury.

MUNCIE, IND.—The Commissioners of Delaware County have granted a franchise to J. P. McGrantz, of Hartford City, for an electric railway through Delaware County.

DES MOINES, IA.—Surveyors are at work in Ringgold and Union Counties locating the route of a proposed electric railway from St. Joseph, Mo., to Des Moines. The preliminary plans are for a line running through Mount Ayr, Arispe, Creston, Hacksburg and Winterset to Des Moines. The line may come only to Winterset, as the owners of interurban lines out of Des Moines have a route surveyed to Winterset. C. F. Terhune, a civil engineer of Marysville, Mo., is locating the route, and Wallace Hubbard, of Albany, Mo., is chief promoter.

WASHINGTON, IA.—The Arnold Electric Power Station Company, of Chicago, has reported favorably on the construction of the Iowa City, Kalona & Washington Electric Railway. The report recommends 30 miles of single track and 3 miles of turnouts and switches, with one power house and three sub-stations. It will be a standard gage line laid with 60-lb. rails.

WATERLOO, IA.—It is said that surveys are to be begun at once for the proposed electric railway from Des Moines to Waterloo. The principal promoters are Indiana men, but a local office has been opened here, in charge of W. W. Marsh, Thomas Cascaden, J. E. Sedgwick, Geo. E. Litchy and F. J. Fowler, of this city.

HUTCHINSON, KAN.—J. J. Burns, chief promoter of the Hutchinson-Wichita Electric Railway, announces that he has about closed a contract with the General Electric Company for single-phase equipment for the road.

OTTAWA, KAN.—By an application filed with the City Council, Hugh Holmes, of Kansas City, president of the Kansas City-Olathe Electric Railway, agrees to build an electric railway through Ottawa, connecting with Kansas City, and also to operate a municipal system here. Mr. Holmes says he will begin the survey to Garnett and Olathe at once and have the rails down in Ottawa by Jan. 1, 1905.

FRANKFORT, KY.—Articles of incorporation have been filed by the Columbia & Lebanon Interurban Railway Company, of Marion County, which has $1,000,000 capital stock, and paid thereon $1,000 organization tax into the State Treasury. The company will build 46 miles of electric railway, from the town of Lebanon, through the county of Taylor to the town of Columbia, in Adair County, and a spur track to the town of Bradfordsville, in Marion County. The principal office of the company will be located at Lebanon. The incorporators are: W. K. Azbill, of Columbia; R. W. Wathen, J. M. Knott and T. M. Estes, of Lebanon; L. C. Rawlings, of Bradfordsville, and W. W. Bradshaw and C. S. Harris, of Columbia.

LEXINGTON, KY.—The Lexington Street Railway Company has placed a contract with the Power & Mining Machinery Company, of New York, formerly the Loomis-Pettibone Gas Machinery Company, of New York, and successor to the Holthoff Machinery Company, of Milwaukee, Wis., for a 550-hp Crossley gas engine, to be direct connected to a direct-current 550-volt generator of 300 kw capacity. The equipment will be installed in the existing power house of the Lexington Company. The present capacity of the plant is 2000 hp.

LOUISVILLE, KY.—The Louisville & Interurban Railway Company has filed amendments to its articles of incorporation providing for important extensions of its lines. They are as follows: From the terminus at Valley Station to Salt River and West Point. From the terminus at Johnson and Main Streets along New Main Street to Southall Avenue to Mellwood to Reservoir, through the Louisville Water Company's grounds to Pipe Line Avenue, and thence east to Prospect, a distance of 10½ miles. Out Preston Street road to Okalona, 7 miles.

INDEXED

Street Railway Journal

VOL. XXIII. NEW YORK, SATURDAY, MAY 28, 1904. No. 22

PUBLISHED EVERY SATURDAY BY THE
McGRAW PUBLISHING COMPANY

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.
BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

PATENT OFFICE JUN 3 1904

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues) .... $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) .... $6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid .... $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

From 1893 to 1904

A visit to the Louisiana Purchase Exposition brings forcibly to mind the advance in the electric railway art since 1893 and the Columbian Exposition. Those of us that have been actively connected with electric railway development since 1893 have seldom stopped to think of the progress made since that time. In the matter of cars alone the difference between the exhibits of 1893 and 1904 is startling. By the latter we are reminded that the double-truck electric car has been almost entirely a development of the last ten years. The weight and carrying capacity of cars considered standard has been practically doubled in that time. The enclosed motor had but recently been introduced in 1893. Interurban lines were non-existent with one or two notable exceptions. The modern high-speed interurban was practically unknown. The first heavy electric elevated trains were being operated on the intramural railway. The multiple-unit system was so far from being considered seriously as a possible factor in the electric transportation problem that one or two prominent technical journals took occasion to editorialize about that time to the effect that the motive power would stay at the head of the train. Alternating-current high-tension transmission for railway work was thought of mainly as a means of utilizing distant water powers, rather than as a means of distributing power from a steam plant over a large area. What of the next eleven years? Will the single-phase alternating-current railway motor make possible the introduction of electricity for long-distance, high-speed service, now performed by limited steam passenger trains, or will the development be the building of small, cheap feeders to present trunk lines, or will development be in both directions?

The Interurban Right of Way

The importance of a private right of way in interurban electric railroading has been realized more and more in the past few years, until it is rare to hear of an entirely new line proposing to give high speed service between cities which omits to provide as far as possible an uninterrupted route for its cars. Many roads have gone to heavy expense in this direction, buying land at figures considerably above its intrinsic value through the belief that the superior service resulting would ultimately justify this investment. There is not sufficient realization of the influence of the new interurban railway upon the welfare of the community, in many cases; if this aspect of the situation were appreciated, there would be less extortion on the part of land owners and less need of resorting to the legal question of right of eminent domain.

Owners of interurban systems formed by the extension of suburban lines across country sometimes fail to appreciate the part played by a private right of way in competition with steam or other electric lines. Often the growth of such roads is a gradual, step-by-step process, the plan being to connect more and more outlying communities with each terminal city until finally a continuous line joins the great centers of population. An instance of this is found in the first through electric line placed in service between Boston and Worcester, Mass. When physical connection was first established between the two cities, it was not the result of a far seeing plan to provide continuous through service under a single management, and the system was in no sense an interurban line. Through tickets were unheard of; half a dozen changes of cars were necessary in the run of 50 miles and considerable time was lost in making connections, so that the running time rarely fell within five hours, against one hour on the competing steam road, 44 miles in length. All this has been changed by the establishment of the new trunk electric line between the two cities, which covers the 40-mile route in two hours, at half the steam railway fare. The old route possessed little, if any, private right of way, while the later line runs over its own ground to the exclusion of highways as far as physical conditions will permit—perhaps two-thirds of the way, to speak in the rough. The influence of the right of way is profoundly felt in the running time, and the double tracking of the entire route has followed as a matter of course. The traffic on the through line has been heavy enough to require half hourly cars all through the past winter, and there is no doubt that the loss of business is sorely felt by the competing Boston & Albany steam line.

One of the most striking points which has been illustrated

by the success of the electric "air line" route, is the necessity of meeting steam railway competition with steam railway methods of conducting transportation. Through cars, punctuality, comfortable rolling stock, through tickets, strict discipline, modern methods of despatching—these are essentials, coupled with high speed running. The private right of way is the condition of fast time; quite as important as its bearing on the schedule as a 200-hp motor equipment per car. Again, slow running in cities offers an obstacle not encountered to a serious degree on the steam road, whose private right of way runs entirely through the cities traversed. The electric line must make up for this drawback on the rural and suburban sections of its route. While it is possible to run at speeds of 35 miles and sometimes 40 miles per hour on clear straight highways, 60 m. p. h. is out of the question on anything except a protected right of way.

Protect Your Telephone Circuits

When the stringing of telephone lines on the same poles as high-tension transmission lines was first begun, there were some doubts expressed as to the safety of this procedure, on account of the possible danger to persons using the telephone. Practice has demonstrated, however, that on the majority of transmission lines, telephone circuits can be run on the same poles without bad results, either in the way of poor talking over the telephone line or danger to users of the telephone. The use of telephone circuits on high-tension transmission pole lines has now become so common that it is not out of place at this time to utter a word of warning lest familiarity with this practice should breed contempt and lead to the relaxing of some very important safeguards. All well constructed telephone exchanges and long-distance telephone lines operated by the regular telephone companies are equipped with protective devices, which will, to a large extent, eliminate possible danger to telephone users from crosses of high-voltage power lines with telephone lines. Where the telephone is used by an electric railway along its transmission lines, however, there is likely to be too little attention paid to protective devices, since the telephone is only one item in the operation of large property, and it is seldom that an electric railway company has a telephone expert in its employ. Only recently the daily press reported a fatality upon an interurban road, evidently due to some leak from a high-tension wire to a despatcher's telephone circuit. It must never be forgotten when a telephone line runs for many miles under a high-tension transmission line that there is a chance for a leak from or a cross with the high-tension transmission circuit, and that the best precautions known to the telephonic art should be taken to prevent danger to employees who are constantly using the telephone in conducting the company's business, and who are sure to be victims if the telephone circuits are not supplied with devices which will render the telephone line harmless whenever they are crossed with transmission circuits. To be sure, there is pretty sure to be trouble when a high-tension line gets crossed with a telephone circuit, no matter what protective devices may be installed on the telephone circuit. However, this trouble can be confined mainly to damage to property without loss of life. Telephone protective devices are usually made to put automatically a dead ground on the telephone line whenever the potential exceeds a certain predetermined amount. While the automatic grounding of a telephone instrument on a line may cause considerable fireworks at various points when there is a cross with a transmission line, it makes the instrument practically safe, and thus human life is not endangered. A telephone instrument can only be dangerous when it is sufficiently insulated from the ground so that a dangerous potential can exist between the instrument and the ground.

Kicking Against the Inevitable

The struggles of the steam railroads against electric traction would be amusing if they were less pathetic. It has been thoroughly demonstrated that in competition with a free field and no favors a well-managed trolley line can starve out suburban steam service with hardly an effort. Yet the steam lines keep along at the same old pace with the same old cars, and set their faces rigidly against yielding to the march of progress. In two very special instances electricity is being adopted for steam on short terminal sections, but outside of these two examples the changes accomplished have been made grudgingly and with loud protests. The situation reminds us of the good old times when there was war to the knife between direct and alternating currents. A direct-current man would have gone to the stake before bowing down before the sacred transformer, and an alternating-current man used to stand about his station cursing the fates that compelled him to use a direct-current exciter. Just such a fanatical spirit seems to dominate the councils of the old line railway men. Only the other day a prominent railway manager, when interviewed on the cause of recent wholesale discharges of men, raised a cry that the trolley car was ruining his suburban business, and that the devil was to pay generally. The learned counsel of another road, in arguing before the Massachusetts Railroad Commissioners against the compulsory abolition of grade crossings, complained bitterly that electric cars could use grade crossings of the highway and that automobiles were allowed to run at large. And yet the roads that could adopt electric suburban service with the greatest ease still squirm and grumble and try to dodge the issue.

We are impelled to this comment by the fearfully and wonderfully made motor cars now being tried on several of the steam roads in England and on the Continent of Europe. Some of these roads apparently mean never, never to surrender to the malign trolley and the accursed third rail. One of these motors at present being tried on a prominent British line is a sort of cross between the Heilmann locomotive and the Patton motor car. It is a mighty combination car seating fifty-two passengers, and weighing some 35 tons. The forward quarter of the thing is devoted to the miscellaneous power station. This consists of an 80-hp petrol motor with all the varied chicken fixings that go with that sort of a machine, a 55-kw direct-connected multipolar generator, with both compound winding and separate excitation, a belted 72-volt exciter, thirty-eight cells of storage battery, a fan for cooling the water circulation of the engine, a surface cooler, an air brake motor, pump set, supplementary electric braking arrangements and a collection of rheostats and other bric-a-brac too numerous to catalogue here. Two good honest Westinghouse motors on the trucks do the rest. The petrol motor runs at constant speed, and by means of a controller and the generator field rheostat a certain amount of speed regulation is obtained. The fundamental scheme belongs to bygone years, but some new and weird complications seem to have been introduced in the present application that give it an unique place in the history of contraptions. We suppose the basic idea is to gain some advantage over the Heilmann scheme by using an internal combustion engine instead of a steam engine, but otherwise the general function of the car seems to be hardly different from

that of the rest of the futile motor cars that have adorned the scrap heaps of many a railroad.

The steam dummy as a substitute for an electric car is a favorite refuge of the harassed railway man when he is trying to solve the problem of trolley car competition. But the whole tribe of dummies fail to fill any long-felt want in suburban service. The demands of such work far exceed the possibilities of steam dummies or other makeshifts. The problem of suburban rapid transit is not how to find something which can be substituted for the electric car but how to get electric trains fast enough and capacious enough to meet the growing demand. All the resources of even the multiple-unit system are taxed to get acceleration swift enough and sustained speed great enough to fill the needs of the public. Why waste time in experimenting with petrol motor dummies while the real problem is to concentrate enough energy on a rapid transit system to make it do its work? If any one wants to work with petrol motors or the like let him do the work on an economical scale in a power station, and not attempt to mount a power station on wheels. There is to-day no material difficulty in supplying energy to any number of electric cars at a cost far below that attainable in any sort of a locomotive, and the real task of the engineer is to organize the service on a scale commensurate with the demand. Some of the steam roads are working their suburban services practically to the limit of the capacity of steam locomotives to do the work. They need the power for acceleration and fast running that only a central power station can supply, and the sooner they get down to business and adopt electric traction the better for themselves and for the public. Electric roads have lessons to learn from the steam railways, as we have many times remarked, but they can give lessons as well as receive them. It is time for the prejudice against electric traction to disappear, for if railway managers were less timorous about it they would soon fully realize its advantages. The locomotive is a remarkable machine, but it has its limitations like every other machine, and it finds them in dealing with modern rapid transit.

Convenience in Truck and Motor Repairs

Considering the amount of money that is spent in the purchase of motor and truck equipments, it is strange how many companies, when ordering such equipments, fail to take into account the fact that after motors have been mounted upon the trucks and put in operation the time is sure to come when those motors must be taken off from the trucks for motor repairs and wheel renewals, and that this process must be repeated every few months as long as the trucks and motors are in service. From the way some trucks and motors are put together, one would be led to suppose that the purchasers never expected to take the motors out of the trucks oftener than once in several years. This remark applies more particularly to double-truck equipment. On a single-truck there is usually plenty of room for a motor, consequently there is no trouble about removing it from the truck. On double-truck cars, the equipment is likely to be crowded, and when buying trucks and motors, the purchasing company's officials should make sure that the combination is such that the motors can be taken out of the trucks without tearing the truck to pieces. Sometimes a half-inch difference in the dimensions of a truck will make all the difference between hoisting a motor out promptly and quickly and getting it out only by taking the truck to pieces or by a tedious process of worrying the motor out by tilting and squeezing. It has been said of some apparatus that when it is designed so as to facilitate easy repairs, it is likely to show strong inclination to give its owners the chance to make use of those characteristics. This remark was originally applied to static transformers. It certainly does not apply to the greater part of an electric car equipment. As a well-known master mechanic once put it to the writer, "we must design our equipment with the idea that at some time every piece in that equipment must be taken out for repairs." If this is true of repairs to parts which are not ordinarily considered likely to require repairs, how much more is it true of trucks and motors which must be taken apart regularly as the part of the routine in the operation of a road. Good shop facilities for hoisting are important, but it is equally important that the trucks and motors be so arranged that these hoisting facilities can be used to advantage. It is sometimes the case that neither the motor nor the truck in itself is of bad design, but the two are put together in a most unhappy combination. Manifestly, two such intimately related parts as trucks and motors must be considered together rather than as two entirely separate parts of the equipment.

Car Shop Pits

Electric railway companies now are using all varieties of pits, from pits 6 ft. deep to none at all. As we have noted a number of times recently, there is now a tendency on the part of some companies to abandon pit work as far as possible, but the repair shop pit will be with us for a number of years to come nevertheless. A certain amount of inspection must be made in pits, even if no repair work is done by lowering the motors into a pit. It is the intention expressly to call attention here to certain modifications of the usual practice in constructing pits, which should facilitate repairs. One of these modifications consists in raising the pit tracks about 2 ft. above the level of the car house floor, so as to bring trucks and journal boxes to a more convenient height for men in working on the trucks from the outside. This modification in no way detracts from the value of the pit, and in fact may sometimes lessen the amount of excavation necessary for a pit. Another modification in pit construction which accomplishes some of the same objects is that adopted at Kansas City, as illustrated in a recent issue of this paper. Here it was a case of applying pits to tracks already in a repair shop, and in order to bring the level of the repair track above the floor between the tracks it would have been necessary to either excavate between the tracks or to elevate the pit tracks above the remaining tracks in the repair shop, either of which would have been objectionable. The repair pit was, therefore, carried out beyond the track rails on each side of the track, and the track was supported on iron columns with lateral braces embedded in the masonry forming the sides of the pit. This makes it possible for a man to stand in the pit and work on the journal boxes and other parts, which can ordinarily be got at only by lying down on the car house floor alongside the trucks. This arrangement has some advantages and some disadvantages as compared to having the pit tracks above the level of the car floor between tracks. The Kansas City arrangement can manifestly be applied in old car shops without changing either floor levels or track levels. It enables a man when working in a pit to get at the outside as well as the center of a truck without crawling out of the pit. He can sit on the edge of the pit to do work from the outside of a truck, or he can stand in the pit. It is likely that under some conditions he might be able to work to better advantage if he were on a floor about 2 ft. lower than the track. Either of these two modifications of common pit construction seems to offer some decided advantages.

THE CANTON & AKRON RAILWAY

The plans of Tucker, Anthony & Company, and A. E. Appleyard & Company, of Boston, for operating through trunk lines across the State of Ohio, have been referred to a number of times in these columns, and the STREET RAILWAY JOURNAL of Aug. 1, 1903, contained an extended description of the Columbus, Newark & Zanesville Traction Company's system, a Tucker-Anthony property which forms the central link in this chain of lines. In the northern part of the State this syndicate now has in operation lines extending from Akron to Canton, Massillon, New Philadelphia, Canal Dover and Uhrichsville, which, with the completion of a proposed line from Uhrichsville to Newark or Zanesville, by way of Coshocton, will give the interests mentioned continuous trackage entirely across the State from Cincinnati to Cleveland by way of Columbus.

OVERGRADE CROSSING—CANTON-NEW PHILADELPHIA RAILWAY AND BALTIMORE & OHIO RAILWAY

The northern division of this system is at present owned by three distinct companies; the Canton-Akron Railway Company, operating an interurban line from Akron to Navarre by way of Canton and Massillon, and including city lines in these places; the Canton & New Philadelphia Railway Company, operating an interurban line from Navarre to Canal Dover, and the Tuscarawas Traction Company, operating an interurban line from New Philadelphia to Uhrichsville, and giving city service in and between New Philadelphia and Canal Dover. In all the system embraces 88.4 miles of city and interurban lines. From an operating standpoint the roads may be considered as one system, as the executive officers are practically identical and they are managed by the same general manager and general superintendent, although each road had its own superintendent and road officers.

The history of the system is an extended one. The Canton Street Railway Company built a narrow-gage city system in Canton in 1888, and in 1890 it consolidated with the Lakeside Street Railway Company, which operated a steam dummy line to Myers Lake. The Massillon Street Railway, operating a city line in Massillon, was extended to meet the steam dummy line, which had been electrified, and in 1892 the lines were consolidated by W. A. Lynch and others, as the Canton-Massillon Electric Railway Company, being one of the pioneer interurban roads of Ohio. The Canton-Akron Railway was completed between Akron and Canton in 1902. Originally it was projected by Thomas Childs, W. H. Hoover and other local people, but later it was taken up and financed by Tucker, Anthony & Company. Before it was completed the Everett-Moore syndicate, of Cleveland, obtained an option on the property together with the Canton-Massillon Railway, the plan being to consolidate them with the Northern Ohio Traction Company. Early in 1902 came the financial embarrassment of the Everett-Moore syndicate, and one of the first steps of the bankers' committee in charge of the affairs of that syndicate was to arrange with Tucker, Anthony & Company to take over the Canton-Akron and Canton-Massillon lines, and the properties were immediately consolidated under the name of the Canton-Akron Railway Company. Work was started on the extension from Navarre to New Philadelphia in 1903, and the line was recently completed. Between Canal Dover and New Philadelphia this line paralleled the Tuscarawas Traction Company. This company was formed in 1902 by the consolidation of the Tuscarawas Electric Company, which in 1890 built a line connecting Canal Dover and New Philadelphia, and the Tuscarawas Railway Company, which operated a line connecting New Philadelphia and Uhrichsville. These roads were controlled by the Pomeroy-Mandelbaum interests of Cleveland, and were sold to Tucker, Anthony & Company in 1903.

MAP OF SYSTEM CANTON & AKRON RAILWAY

The northern portion of this system traverses a rich farming district, while the southern portion passes through one of the most extensive and productive bituminous coal districts of Ohio. The cities touched are noted manufacturing centers. Akron is one of the leading centers of the world in the production of rubber goods, cereals and pottery, and it has numerous large manufacturing establishments in the iron and steel line. Canton, seat of Stark County, is one of the most beautiful and progressive cities of Ohio, and is noted as the home of the late President McKinley. It has many factories, including the Dueber-Hampden watch works, the largest in the country, employing over 3000 hands; the Canton Steel Works, Carnahan Iron & Steel Company, Canton Bridge Company, Berger Manufacturing Company, and Diebold Safe & Lock Company. The company operates about 16 miles of city track in Canton, including five city lines. Massillon is the home of the Massillon Bridge Company, the Massillon Steel & Iron Company, the Russell

Engine Company, and a large bottling works. South of the city is the Ohio State Insane Asylum, an enormous institution, having many hundreds of patients. Two city lines are operated in Massillon, one of them going direct to the asylum. Canal Dover and New Philadelphia are busy manufacturing cities and noted coal shipping points. The latter is seat of Tuscarawas County. The towns are 4 miles apart, and local service separate from the interurban line is given between them. Uhrichsville is a railroad and coal center.

The population of the cities and towns touched by the system according to the latest census is shown in the accompanying table:

CANTON-AKRON RAILWAY	
Akron	42,728
Canton	30,667
Massillon	11,944
CANTON & NEW PHILADELPHIA RAILWAY	
Navarre	936
Beach City	364
Strasburg	461
Canal Dover	5,422
New Philadelphia	6,213
TUSCARAWAS TRACTION COMPANY	
Midvale	491
Tuscarawas	412
Uhrichsville	4,582
	104,247
Tributary population	35,000

The Canton-Akron Railway enters Akron over the tracks of the Northern Ohio Traction & Light Company from East Akron. Cars operate to the passenger station of the Northern Ohio Traction & Light Company, where they make direct connection with the cars of that company for Cleveland. Tickets are sold clear through over both roads, a coupon form of ticket being used, giving each road its regular fare. The traffic arrangement with the Northern Ohio Traction & Light Company is on the Cleveland plan. The city crew takes the interurban car at the city limits and collects and keeps all the city fares, and the Northern Ohio Company pays the Canton-Akron Company at the rate of 2 cents per car mile for the use of the cars while on its tracks. The Canton-Akron Company gives hourly headway between Akron and Massillon; the Canton-New Philadelphia Company gives hourly headway between Massillon and New Philadelphia, and the Tuscarawas Traction Company hourly headway between Canal Dover and Uhrichsville. The cars connect so that a through trip is possible over all three lines without delays. Tickets are sold clear through, coupon tickets being used. In Canton the city cars operate on a 10-minute headway over five routes, all cars passing the interurban station, which, with the general offices of the companies, is located in the basement of the Court House Building, facing City Square. The company has five parallel tracks at this point, two tracks being used for the city cars, two for the interurbans, and the fifth by the cars of the Stark Electric Railway, which connects at this point, so that by this arrangement the interurban cars are permitted to lay over and do not interfere with regular traffic. Half-hourly cars are operated between Canton and Massillon, and there are half-hourly cars over the balance of the system on Saturdays, Sundays and holidays. During the summer months there is a 10-minute headway from Canton to Meyers Lake, which is located on a spur line from Canton-Massillon division. The Massillon city cars give 15-minute headway over two routes. The Tuscarawas Traction Company gives 15-minute headway between Canal Dover and New Philadelphia in addition to the interurban cars. The rates of fare on the various lines are shown in the accompanying table:

LINE VIEW—CANTON-NEW PHILADELPHIA RAILWAY

ROCK CUT—CANTON-NEW PHILADELPHIA RAILWAY

CANTON-AKRON RAILWAY

Distance		Single Fare	Round Trip
	Akron	5 cent city fare	
	Elkhorn		
3	Springfield	5	10
4	Springfield Lake	10	18
8	Uniontown	15	28
11.5	Greentown	20	38
15	New Berlin	25	48
17.5	Edgefield	30	58
20.5	Canton	35	65
24.5	Rudurban	45	85
28.5	Massillon	50	90
34	Navarre	60	105
	CANTON-NEW PHILADELPHIA RAILWAY		
	Massillon / Navarre	10 cents to Canton-Akron Co.	
4	Justus	5	10
9	Beech City	10	18
12	Strasburg	20	38
16.5	Parral	25	48
18	Canal Dover	30	58
21.5	New Philadelphia	35	65
	TUSCARAWAS TRACTION COMPANY		
	Canal Dover		
3.5	New Philadelphia	5	10
8.5	Goshen	10	18
11	Midvale	15	28
14	Uhrichsville	20	38

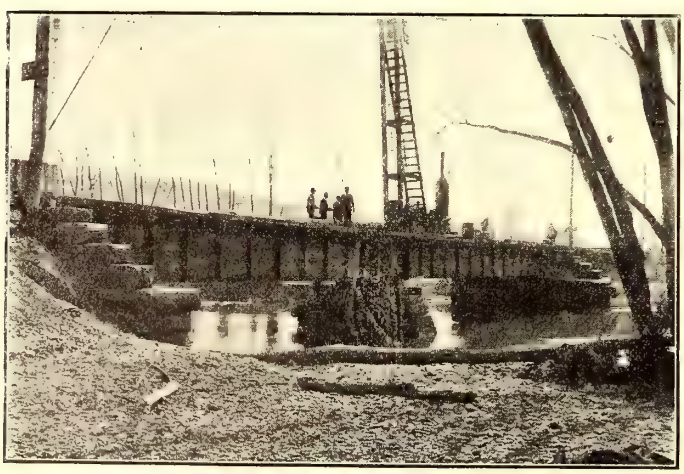
Five hundred-mile books, good on the three lines, are sold for $7.50. Commutation books, giving three-fifths of the regular fare, are sold between all points, good for bearer only within thirty days. One form of book is used for this service. It is made up of pages, each page containing five coupons, equivalent to a 25-cent ride. If the book is to be sold for a shorter distance, one, two or three strips of coupons are cut off with a paper shear. Six tickets for a quarter are sold on the city lines and transfers are given. All tickets, transfers and cash fare

receipts contain advertisements, and the company derives revenue enough from these to more than pay for the tickets.

General Manager George W. Rounds, of the system, has recently instituted a "get together" plan that has resulted in good feeling among the men. On the second Tuesday of each month all the employees of the system meet at the car house at Canton, and without any ceremony they discuss matters per-

PORTABLE TELEPHONE—CANTON-AKRON RAILWAY

taining to the betterment of the service. Two sessions are held, so that all the men of the system are enabled to take part. The result of these meetings, it is stated, has been the betterment of the service in many ways, and Mr. Rounds states that he has been greatly assisted by the suggestions of some of the men. They are able to see matters close at hand, and are frequently able to make valuable suggestions at the meetings. Such things as new rules and regulations, or old ones, are frequently discussed, and their merits carefully gone over, so that the men working under these rules may know the cause which prompted their adoption, and the results to be gained by their enforcement. One of the moves recently adopted was the uniforming of all interurban motormen in overall uniforms, so that they are enabled to make necessary repairs to cars or handle baggage



7-FT. PLATE GIRDER BRIDGE ON STONE ABUTMENTS WASHED OUT BY FLOODS—CANTON-NEW PHILADELPHIA RAILWAY

without damaging their clothes. Wages of city men start at 17½ cents and advance to 20 cents per hour. Interurban men start at 17½ cents and advance to 21 cents, although, as a general rule, the interurban men are taken from the ranks of the city men. At the car houses there are waiting rooms for the men, which are provided with individual lockers, reading tables and good sanitary toilet rooms.

Despatching of interurban cars is done by telephone. The despatcher's headquarters is at Canton, from which point he operates cars on both the Canton-Akron and Canton-New Philadelphia lines. A portable box telephone, made by the Garl Electric Company, of Akron, is carried on each car. This may be used at any point along the line by tapping the telephone wires by means of a long bamboo rod carried on the car. At regular passing points the conductor carries the telephone to a pole box, where he makes a connection by means of a short rod, provided with two metallic connections. The illustration shows a conductor using the portable telephone. The form of telephone order used is shown. The conductor calls the despatcher at regular meeting points and at other points designated by the despatcher. The conductor fills out the order blank and repeats the order back to the despatcher. If correctly received the despatcher says "complete," and the conductor signs his name. The conductor then reads the order to the motorman, who signs it, and hangs it on a hook in front of him. The motorman turns in the orders to the despatcher at the end of each trip.

C-A & C. N. P. RY. CO.

Train No. .... Car No. ....

TELEPHONE ORDER.

Date.................Hour.................M

Received at.................

Car Going.................

Meet Car at.................

Meet Car at.................

Meet Car at.................

Meet Car at.................

Meet Car at.................

Call at.................

.................Conductor

.................Motorman

This order to be filled out by Conductor and then delivered to Motorman. Conductor must repeat orders back to Dispatcher and will wait until dispatcher uses the word "Complete," and repeat it after him. Motorman will turn in telephone orders every trip to Dispatcher

The express and freight business on these lines has not been developed to any great extent, but it appears to be quite promising. Goods are handled as express, and rates are a trifle lower than regular express rates. The company maintains an express office in Canton, and operates two teams, and in Massillon the company maintains an office. In other towns along the line the agency for the business is given to some store, usually an arrangement combining this business with the ticket office, and the agent receives 10 per cent on the business he originates. The Canton-Akron Company has an arrangement with the

LONG CUT—CANTON-AKRON RAILWAY

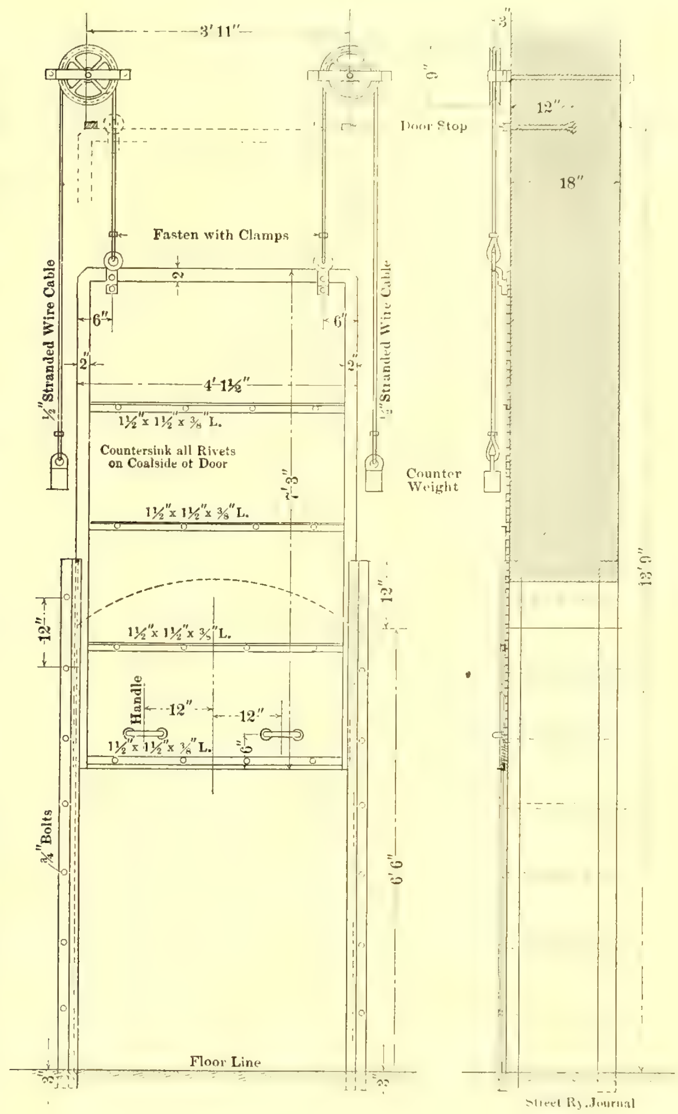
Electric Package Company, of Cleveland, whereby goods are shipped from Cleveland to all parts of the system. Goods are handled in the express cars of the Canton-Akron Company, transfer being made at Akron, and the Electric Package Company takes 60 per cent of the receipts and the Canton-Akron Company 40 per cent. This arrangement applies only as far as Massillon, and on goods coming from or goods beyond that point, the Canton-New Philadelphia Company receives its full

share. On goods originating in Akron, or going only as far as that city, the Northern Ohio Traction & Light Company receives 25 per cent for running over its road and for terminal facilities in Akron. There are two round trips over the system each day, and an extra run between Canton and Massillon, where the traffic is heaviest.

The territory traversed by this system is rolling country, and in some places rather rough, and the grades are unusally long. On the 20 miles between the city limits of Akron and Canton about half is on private right of way, 40 ft. wide, while the balance is at the side of the highway. On this portion of the road considerable heavy grading was done, as it was necessary to cut down the entire highway. At one point there is a 4 per

STANDARD INTERURBAN CAR, SHOWING MOTORMAN'S CAB AND CAB SIGNS—CANTON-AKRON RAILWAY

cent grade of 1600 ft. with a 30-ft. cut at the top of the grade, and there are several other cuts almost as deep, and from 100 ft. to 300 ft. in length. The track is laid with standard white oak ties spaced 2 ft. apart, and the roadbed is graded to 14 ft. Sidings are 400 ft. long and laid out for half-hourly service. Rails are 70-lb. 30-ft. length, Pennsylvania section. The rails are bonded with 8-in. 0000 American Steel & Wire concealed bonds, having 7/8-in. terminals and cross bonded every 1000 ft. Climax stock guards are placed at all crossings on private right of way. The Canton-Massillon division, which was formerly a 4-ft. gage, was relaid with 60-lb. rails, while on the new Canton-New Philadelphia line the rail is practically all 80-lb., with the same track standards throughout, and practically all private right of way. The Canton city lines are laid with a 70-lb. girder rail, and these were also changed from 4-ft. gage. The Massillon city lines are laid with shanghai T, and in paving the inside course of brick is laid edgewise. The company has an extensive gravel bank south of Massillon and another near Canton, and tracks are ballasted 1 ft. under the ties and filled up even with the rail with course gravel. A steam shovel is used, with a number of side-dump cars. On the Canton-New Philadelphia line are several rather expensive bridges. At Sugar Creek, near Beach City, is a double-deck timber trestle, supported on piling and nearly 1000 ft. long; crossing the stream there is a 200-ft. steel span resting on stone abutments and crossing the Baltimore & Ohio Railroad overhead there is a 100-ft. steel span. Crossing the Baltimore & Ohio Railroad, near Canal Dover, there is a 100-ft. truss steel span resting on



DETAILS OF SLIDING DOOR TO COAL STORAGE

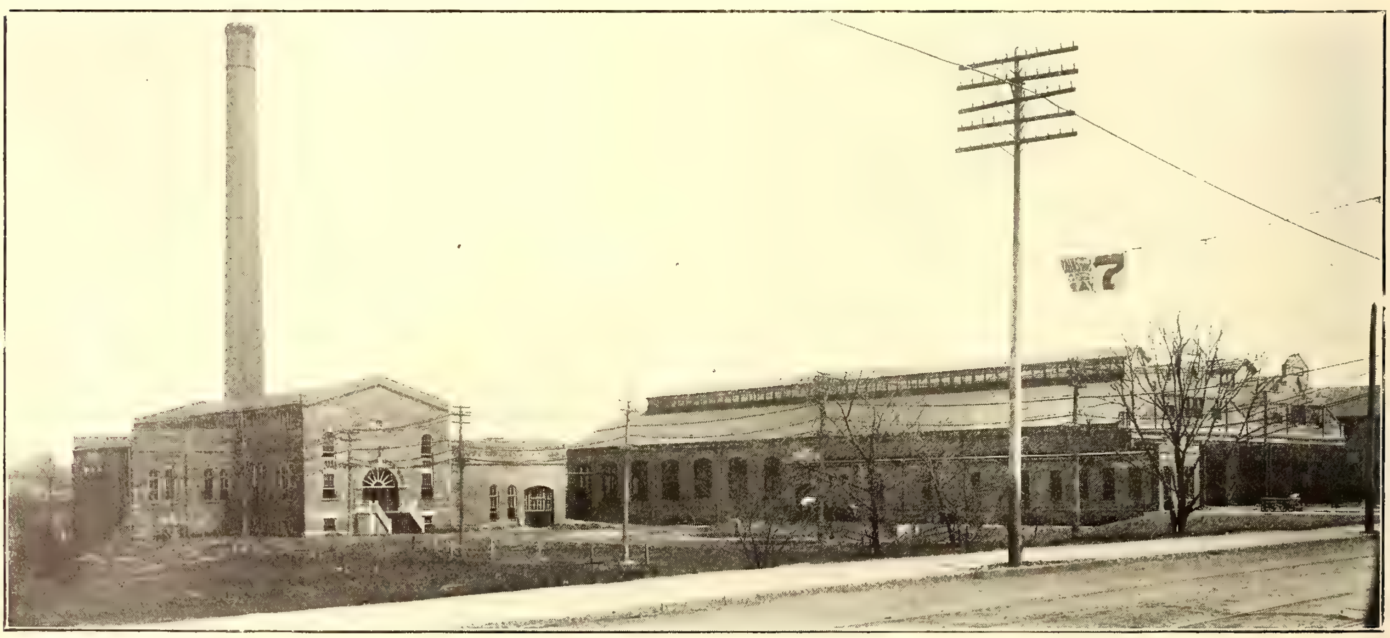
stone abutments, the approaches being filled, making long, easy grades; this is illustrated. There is also an 80-ft. girder bridge with 7-ft. girders near Canal Dover. During the severe floods a month ago the stone abutments and approaches of this bridge were washed out, and traffic over the bridge was interrupted for a time, transfers being made. It was necessary to drive piling to support the bridge and then rebuild the abutments. It is due the company, however, to state that the floods in this district were the worst ever experienced. Several times water was up almost to the floors of bridges, but this was the only one that was washed out, whereas the parallel steam road lost three bridges in this vicinity.

On the interurban lines, poles are 35 ft. tall, with 7-in. and

8-in. tops, and spaced 100 ft. apart. Fifteen inches from the top of the pole there is a cross-arm, 2 ins. x 3 ins. x 30 ins., carrying two three-phase high tension lines, the third being at the top of the pole. The pins are 2-in. locust, 15,000-volt, and the insulators are 7-in. triple petticoat Knowles glass, designed for

CONVERTIBLE CAR—CANTON-AKRON RAILWAY

15,000 volts. The high-tension wires are on an 18-in. equilateral triangle. On the Canton-Akron division they are No. 1 and No. 4 bare copper, and on the Canton-New Philadelphia they are 133,000-cm aluminum. Passing through Canton and Massillon the high-tension lines are No. 1 lead-covered, paper-insulated cables, which are strung with messenger cable hangers the same as telephone cables. Between Canton and Massillon there are two sets of high-tension lines supported on two cross arms, the same 18-in. triangle being maintained by



POWER HOUSE, CAR HOUSE AND SHOPS—CANTON-AKRON RAILWAY

placing one pin at each end of the upper cross arm and two pins on either side of the post on the larger cross arm, which is 15 ins. below. Side arms are 8 ft. long, of 1½-in. wrought-iron pipe, guyed to the post. On the Canton-Akron line the trolley wire is of peculiar section, known as the Meyers Special, and it was furnished by the Waclark Company. It is a modification of the figure 8 wire, having a flat surface on top. Hangers and ears were furnished by the Railway Equipment Company. A 500,000-cm aluminum feed wire extends the full length of the line, and is tapped to the trolley every 1100 ft. Trolley on the Canton-New Philadelphia is one 0000 grooved wire, held by 9-in. Garton mechanical ears. G. E., or Garton lightning arresters, are placed on every tenth pole and grounded

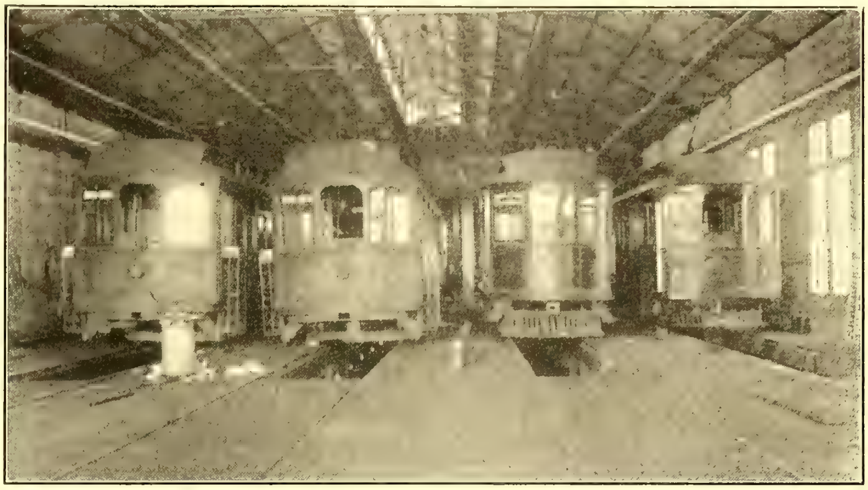
TYPE OF CITY CAR, CANTON-AKRON RAILWAY, IN FRONT OF WAITING ROOM, PUBLIC SQUARE

to the rail and to a copper plate. A 625,000-cm aluminum feeder extends the full length of this line on a separate cross arm. The telephone despatching system wires are No. 10 iron wire, and they are transposed every 600 ft. to do away with noise on the line. All stopping points have a cluster of lights on the pole and the poles are suitably marked. Approaching all crossings are whistle signals.

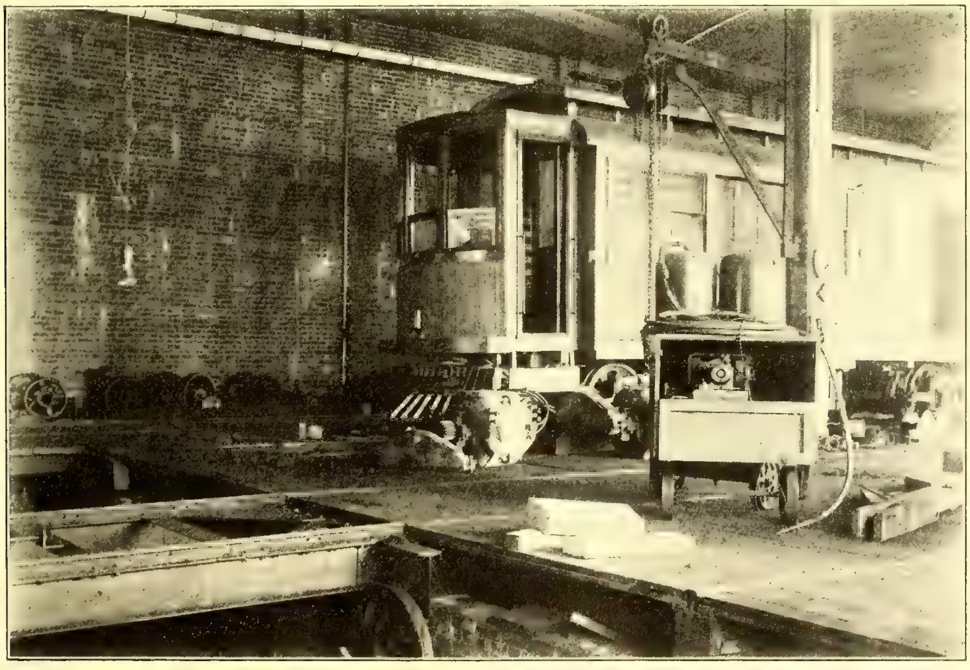
The rolling stock used on this system is of a very high order. For through interurban service there are ten cars built by the St. Louis Car Company. They are 58 ft. over all and 8 ft. 6 ins. wide. Three of the cars are straight passenger cars with no smoking compartments, and were designed especially for trolley parties or inspection trips, although they are used in regular service. They have round front end with no front platform. The motorman's cab is built into the car and occupies half the front end. This gives one side seat at the front end, making an exceptionally fine place for observation of the road. These cars seat seventy-two passengers. Seats are of the walk-over type with high roll back and are plush covered. The interior finish is mahogany decorated with marquetry.

Originally the cars were lighted by six clusters of lights, covered by tinted globes, but these are being changed. There will be seven rows of incandescents across the car; three lamps in each row from the roof and two at the sides. The trolley lead will be carried the full length of the car on one side and ground on the other side, and one switch will control all the lights. The other cars of this lot have three compartments, a baggage room in front integral with the motorman's cab, a smoking compartment, seating twelve passengers, having leather covered seats, and the balance of the car being the same as the straight passenger coaches. These cars are very valuable in the through service, as they have ample seating capacity and at the same time are able to carry trunks and express matter. The floor framing of these cars is unusually heavy. There are six sills, all of them strengthened with channel iron. The two intermediates have not only a channel iron on one side but are plated on the outside as well. The side sills have a channel and bar on the inside and there is a filler of wood. All the sills are of yellow pine, extending in a single length from end sill to end sill. The corner posts are of oak and the intermediates of ash. These are spaced in such a way as to bring the windows in pairs, with a double post between them. The sides of the car are built with the inside sheathing laid horizontally, and this in turn is covered by narrow matched stuff put on vertically.

The cars are well trussed, the truss-rods being carried by deep saddles on the needle beams. The bodies are mounted on St. Louis No. 23-B high-speed trucks. They have 6-ft. wheel base, 6-in. axles and 33-in. and 34-in. steel-tired wheels, having $3\frac{1}{2}$-in. tread, and $1\frac{1}{4}$-in. x $\frac{7}{8}$-in. flange. The cars are equipped with four G. E. No. 73 (75 hp) motors and the G. E. multiple-unit train control system. Among other items of equipment are Christensen air brakes and whistles, Nichols-Lintern air sanders, four to the car; Knutson retrievers, Consolidated electric heaters and the Holland sliding trolley base. One of the most noticeable features is a pair of ornamental gates enclosing the rear platforms. These swing out from the lower step from a common center, and are operated by levers in the motorman's cab. A person cannot leave the car or board it until the motorman has fully stopped and pulled the lever opening the gates. On the side of every car is painted a warning against attempting to board when the gates are closed. The cars have controllers at both ends, but they are operated as single enders, and have pilots at one end only. Several additional cars of this type have been ordered.



INTERIOR CANTON-AKRON SHOPS



TRANSFER TABLE, OVERHEAD MOTOR LIFT AND COMPRESSOR OUTFIT, NEW LINE CAR — CANTON-AKRON SHOPS

The Canton-New Philadelphia line at present operates six 60-ft. cars, built by the Jewett Car Company, of a type which is largely used on roads owned by the Tucker-Anthony and Appleyard interests. They are of the semi-convertible type, the windows being very deep and removable, making them practically a summer car if desired. They have slat seats, and have a seating capacity of 108 passengers, being very valuable cars for excursions. They are mounted on Peckham M. C. B. trucks, equipped with G. E. No. 73 motors and type-M control.

For city service in Canton the syndicate has recently installed eighteen 34-ft. double-truck cars, built by the Jewett Car Company, of Newark. They are fitted with Brill maximum traction trucks and G. E. No. 57 and No. 67 motors. For summer and park service in Canton there are six fifteen-bench 43-ft. open cars, operated with G. E. No. 57 motors and 14-B Peckham trucks. There are also several Brill convertible cars, used in extra service in Canton. For use in Massillon, Canal Dover and New Philadelphia there are a number of single-truck cars of various types.

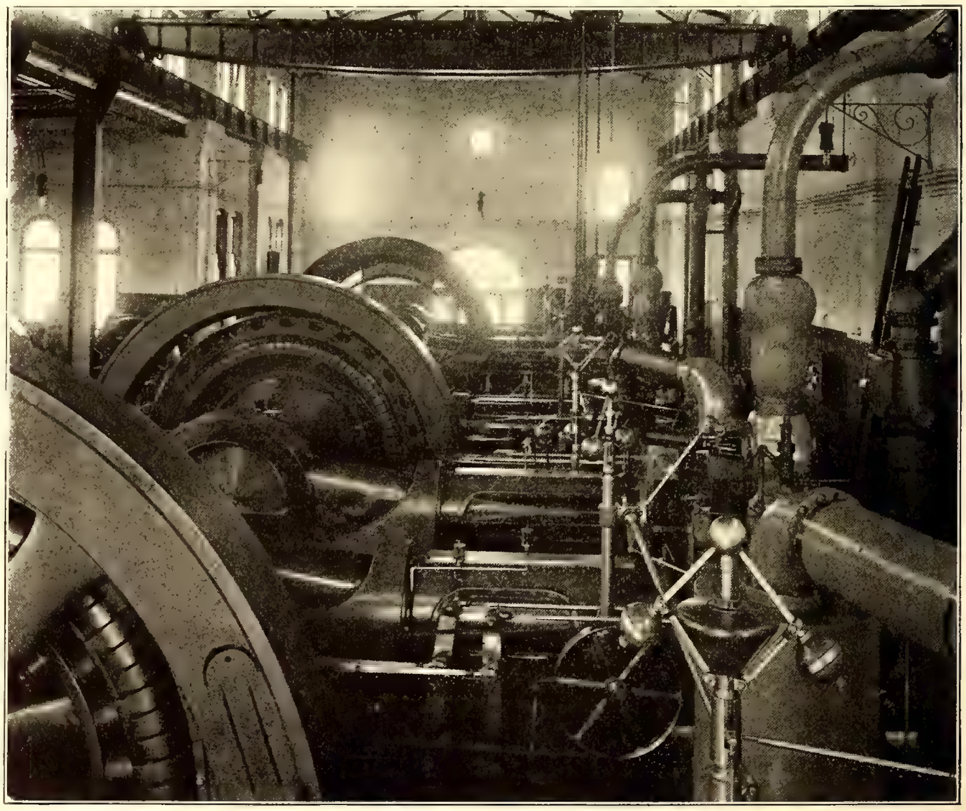
All cars, city as well as interurban, are fitted with a cabinet sign, hung in the front of the car. The cabinets are neat oak affairs, made in the company's shop. They contain two rollers having spring curtain fixtures, and by means of a small wheel and ratchet they spring to any desired position. The signs are painted in black and white, and there are twelve routes on a roll, so that a car may be used for any route on the system. They are illuminated at night by two incandescents. Motormen on the interurban cars change the signs at each terminal and at Canton. Where the cars lay over at these points a large card is also hung at the side of the car, indicating the towns to which the car is going. Conductors announce the route of their car before it leaves a station and before the gates

are closed. The main car house and shops are located at Canton, adjoining the main power station. The main buildings measure 122 ft. 6 ins. x 224 ft. 2 ins., being in reality two buildings with a fireproof wall between. The roofs consist of steel trusses covered with corrugated iron and purlines. An annex contains the superintendent's office, receiver's room, men's lounging room with built-in lockers, lavatory and stock room. The buildings are brick with ornamental stone trimmings. So far as dimensions and general make up, the buildings are a duplicate of the shops built by the Columbus, Newark & Zanesville Traction Company at Newark, having been designed by the same architect, E. H. Kitfield, of Boston. Each building has five tracks, the car storage section having concrete floor with tracks elevated on 8-in. x 12-in. oak track sticks, the other having tongued and grooved plank flooring. There are five track pits, each 30 ft. long, having concrete floors. The rear section of one house is divided off for the woodworking shop and the rear of the other for the machine shop. The carpenter shop has a transfer table covering three tracks with a pit under the center track. The shop contains several woodworking tools, and they have practically rebuilt a number of cars. At present they are building a line car by lengthening an old suburban car. It will be 40 ft. long, provided with two double doors on each side and a door at the end, so that poles may be carried. A trolley chain hoist for handling motors covers a portion of this shop. A valuable homemade device is a motor-driven compressor outfit mounted on a small truck with a long hose attached. This is used in blowing out motors, controllers, car seats, etc. Current is obtained by attaching a pole connection to the trolley wire. For pit work they use a heavy Barrett jack provided with a table and mounted on a steel-framed truck. Two women are employed in cleaning cars. They sweep and dust cars every day and thoroughly scrub out each car about every ten days.

CANTON-AKRON CAR HOUSE AND SHOPS, CANTON

SUBURBAN WAITING STATION

The repair shop equipment consists of a Putnam Machine Company's 42-in. No. 2 boring mill, a McCabe double spindle engine lathe, Hendy Machine Company's shaper, Strong, Carlisle & Hammond drill press, a Franklin portable hoist, a 200-ton wheel press, built by J. R. Schaffer & Company, Rochester, N. Y., and a wheel grinder built by the Springfield Manufacturing Company, Bridgeport, N. Y. This is in a separate dust-proof room. The emery wheels are belted to an independent motor hung outside the room, while the lathe is belted to the line shafting in the shop. Axles are turned on the McCabe lathe, and the wheels are bored to fit the axle on which they are to be used. In grinding the wheels, the wheels revolve, and both are ground at the same time. A blacksmith shop is located in a small building adjoining the shop. Babbitting is also done in this shop; a Weld babbitting device, furnished by Frank Ridlon Company, of Boston, is used. The company makes all its own coils and does its own armature winding and controller work, generator work, etc., two men doing the work for the entire system as well as work for other roads owned by the same interests. A taping machine is used in winding armature coils, and it is claimed one man can tape and finish 400 coils

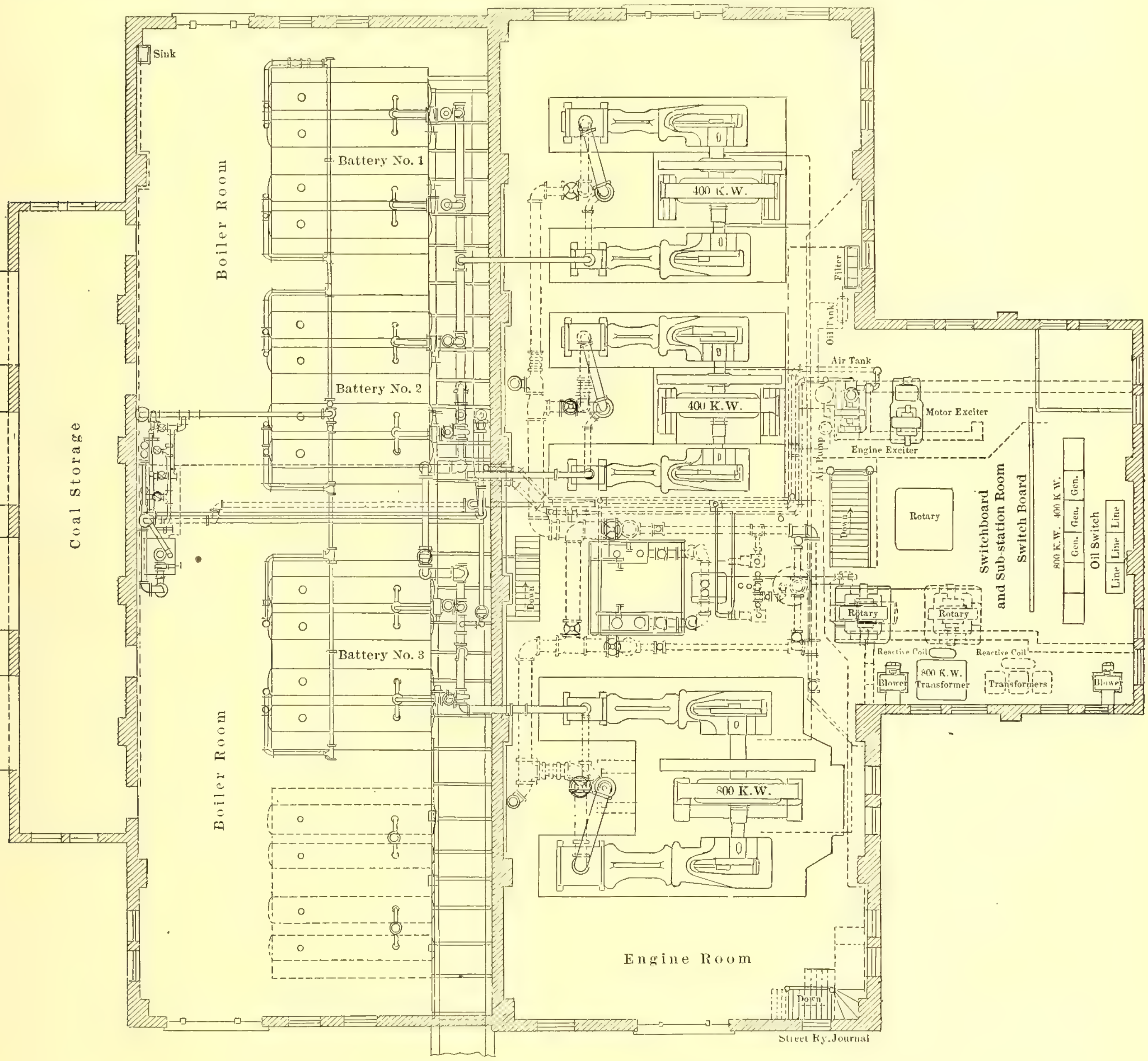


GENERAL VIEW OF ENGINE ROOM—CANTON-AKRON RAILWAY

per day. Coils are first dipped in varnish, then taped and then dipped in varnish and hung up to dry; a large supply of finished coils is always kept on hand. In wheel fitting the company does work for a number of neighboring interurban roads, so that its tools are kept busy practically all the time. Solid gears and steel-tired wheels have recently been adopted for interurban service.

A car house capable of holding ten cars is located at New Berlin, on the Canton-Akron line, and the paint shop is located there. Practically all the company's cars were new last year, and little work has been done in this shop, but many of the cars will be refinished this summer.

holding twelve carloads of fuel. A switch, having an elevation of 6 ft. above the coal storage floor level, runs alongside, and the fuel is dumped into the storage from side-dump cars through chutes. There are sliding doors on the coal storage bins and these are provided with counter weights so that they are readily opened. The details of these doors are shown in the engraving on page 801. At present there are installed in the boiler room six 300-hp Aultman & Taylor boilers, set in pairs. Each has sixteen 4-in. tubes wide and nine tubes high, and two 42-in. drums. They are designed to run at 160 lbs. steam pressure and have a hydrostatic pressure of 225 lbs. The boilers are fired by Jones underfeed stokers, and they burn half

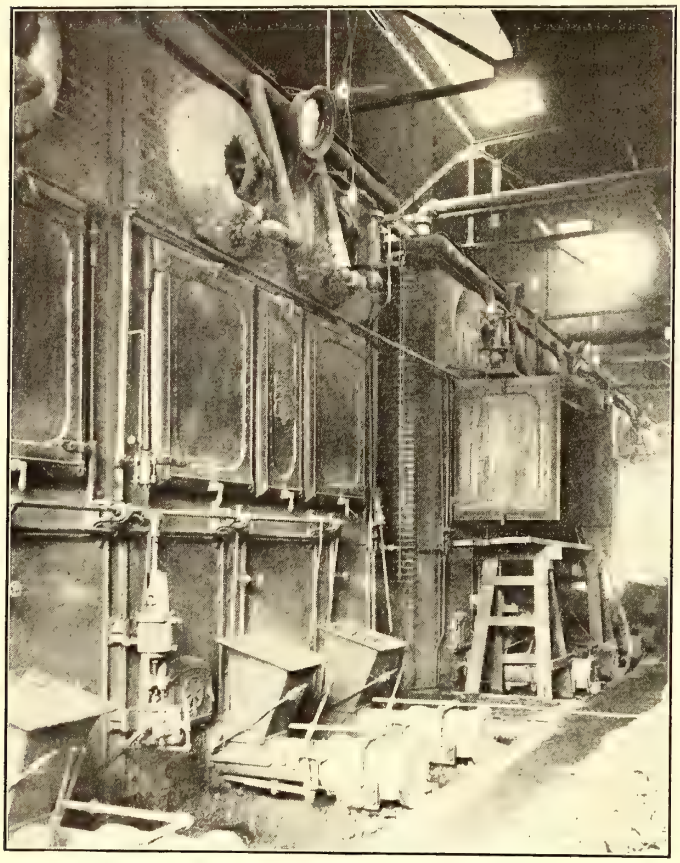


PLAN OF POWER STATION—CANTON & AKRON RAILWAY

The main power station which supplies the Canton-Akron and Canton-New Philadelphia lines is located at Canton on a branch of the Tuscarawas River. The building is brick, the boiler room section measuring 46 ft. x 128 ft., the engine room being the same size and having a bay 36 ft. x 48 ft. for a sub-station equipment and switchboards. The engine room section has a peaked roof resting on a steel-trussed frame, and the roof is matched lumber with tarred paper and slate above. The engine room section is covered by a 30,000-lb. crane furnished by the Whiting Foundry & Machine Co. Adjoining the boiler room is a covered coal storage bin, 14 ft. x 78 ft., capable of

slack and half run-of-mine. Owing to the close proximity of coal mines run-of-mine coal costs $1.70 per ton, and slack $1.20 per ton delivered. Smoke from all boilers passes through one 12-ft. smoke drum to a 200-ft. Custodis radial brick stack, which is supported on its own foundation outside the building. Draft is induced by a 6-ft. Buffalo forge fan, driven by a 8-in. x 10-in. Sturtevant engine, there being also an induction motor for reserve power. There is space in the boiler room for two additional boilers of the same size, and these are to be installed in the near future. They are to be equipped with Roney mechanical stokers. Adjoining the outside wall of the boiler

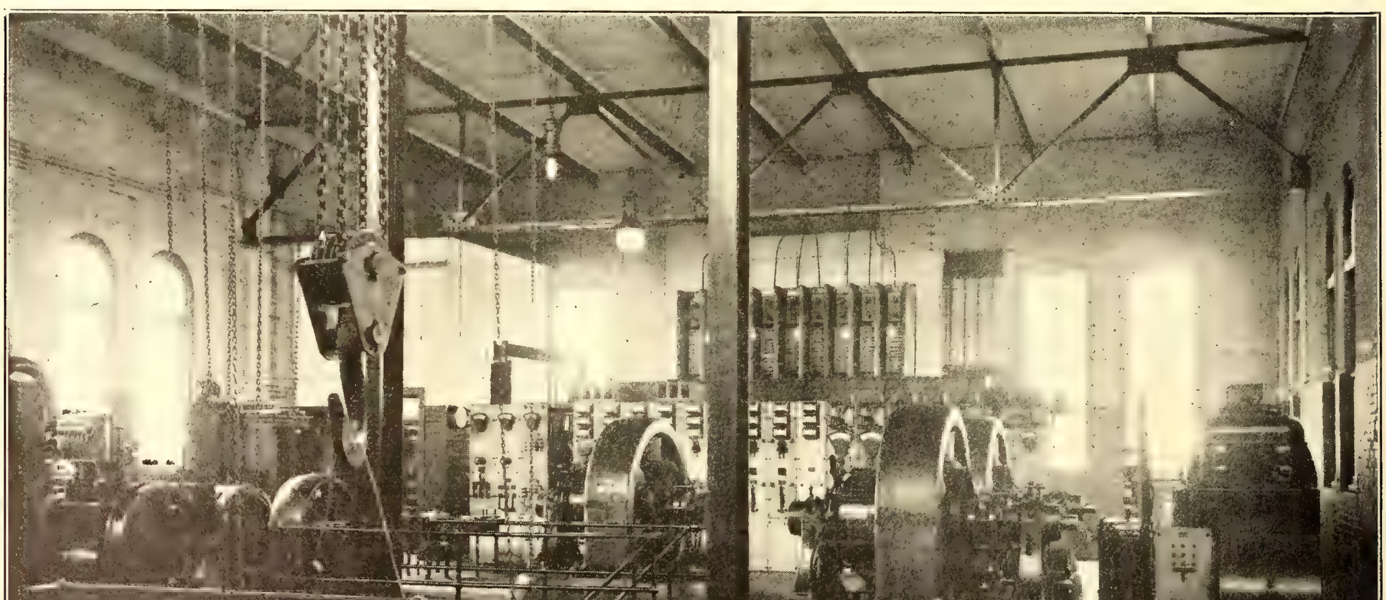
room is a No. 9 Cochrane feed-water heater and purifier. Adjoining the heater is a Smith-Vaile duplex admiralty pattern boiler feed pump, size 10 ins. x 6 ins. x 12 ins. Connected with



BOILER ROOM AND JONES UNDERFEED STOKERS—CANTON-AKRON RAILWAY

the feed-water pump is a Ross feed-water filter which removes oil from the water before it enters the pump. In an open pit below the center of the engine room are two Blake simplex twin vertical jet condensers and air pumps, 12 ins. x 28 ins. x 18 ins., with standard Blake jet condenser heads. Adjoining the condensers is a 6-ft. hot well. A ten-mesh wire screen strainer is arranged to slide between a pair of angle-bars in such a manner as to strain the water before it leaves the well. The cage formed by the strainer is packed with excelsior, and the strainer may be readily removed for cleaning and repairs. As originally designed the Blake condenser took water from the river and discharged into the hot well. It was designed to use the hot well water as boiler feed, and in the piping arrangement the pumps were arranged for delivering the hot well water to the feed-water heater with suction by-passed to the intake well so that either hot or cold water could be used, as the occasion required. Lately, however, changes have been made in both the circulating and feed-water systems. A deep well has been driven in the boiler room, and feed-water is delivered from this to the Cochrane heater, which is supplied by the auxiliaries. The water is heated to about 200 degs., and is then pumped to the boilers. For a time city water was used for feed-water, and this is still accessible, or, if necessary, feed-water may be taken from the hot well as originally intended. To provide condensing facilities for a large engine that had been installed after the house was completed, the company recently installed a 2100-hp parometric tube condenser, built by H. W. Bulkley, of New York. This takes water from a well, 10 ft. x 20 ft., just outside the house, water flowing from the creek by gravity. The condensing water is discharged into the hot well and passes from there to the overflow and back to the creek. At present the Blake condensers are not used except in case of emergency, as the new condenser has been found large enough to take care of the entire house.

All high-pressure piping is standard wrought-iron and all fittings and flanges are Crane's extra heavy. Separating each boiler from the main steam header are 8-in. Chapman valves, and separating each battery are Crane automatic globe valves. All the larger valves are by-passed. The exhausts from the engines are provided with 14-in. Chapman gate valves, and there are 22-in. Chapman gate valves at the condensers. The engine exhaust lines are provided with corrugated copper expansion joints. If desired the engines may exhaust into the atmosphere through 18-in. Lyman exhaust heads provided with drips to the hot well. These exhaust lines have 18-in. Blake automatic relief valves.



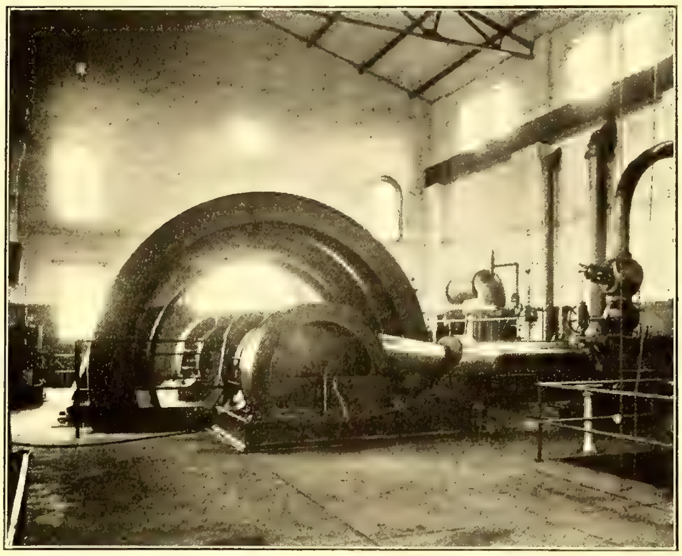
BAY IN HOUSE, SHOWING SUB-STATION EQUIPMENT AND SWITCHBOARD—CANTON-AKRON RAILWAY

The building and engine foundations were carried down to

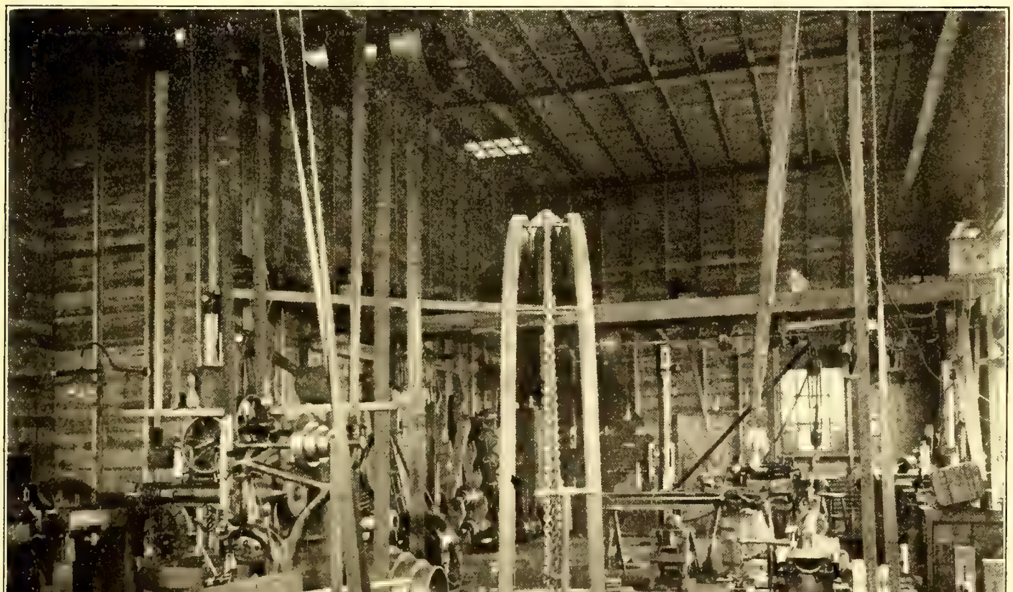
solid rock and are of solid concrete. Three engines are now installed. Two of them are Allis-Reynolds Corliss cross-compound condensing engines, cylinders 20 ins. x 38 ins. x 42 ins., while the third engine is of the same type with cylinders, 26 ins. x 52 ins. x 48 ins. The smaller engines are rated at 700 lbs., although they have developed 1200 hp, while the larger engine is rated at 1500 hp, and has developed 2000 hp. The smaller engines revolve at 107 r. p. m., and the large machine at 94 r. p. m. The guaranteed steam consumption of both types is 15 lbs. They have Allis safety governors and stop valves. In the larger engine both steam and exhaust valves are double ported. On the smaller engines the speed regulating governors have G. E. series motors operating on the exciting current for synchronizing. The fly-wheel on the larger engine is 20 ft. in diameter and weighs 100,000 lbs.

A very complete automatic oiling system has been worked out. In the basement are two 18-in. x 36-in. tanks, one above the other. The oil is fed from the upper tank and then forced by high pressure, supplied by a 10-in. x 10-in. Westinghouse air compressor to the engine oil cups, which are designed for either pressure or gravity feed. After passing through the bearings the oil is fed by gravity to receiving tanks in the basement, and is then forced by pressure to the two Turner oil filters on the engine room floor.

The large engine has direct connected to its shaft an 800-kw, three-phase, 25-cycle revolving field type General Electric generator, delivering current at 13,200 volts. The two smaller engines are direct connected to 450-kw generators of the same type. For exciting the fields of the generators there are installed in the bay a 35-kw, 125-volt, G. E. generator, driven by a 50-hp marine type engine, and a second generator of the same size driven by an induction motor. The first mentioned set is used for starting. The induction motor is supplied by current directly from the bus-bar through a separate 50-kw, three-phase transformer and through a separate switch, so that in case other transformers go out the exciting current would not be interrupted. The machines and the outgoing high-tension lines are protected by G. E. form-K hand-operated oil switches, which are arranged in soapstone barriers back of the switchboard. The sub-station equipment in the house takes care of the Canton city lines, feeds north on the Canton-Akron line half way to the first sub-station and west on the Canton-Massillon division to the Massillon city limits, besides furnishing the Meyers Lake spur line. This load recently necessitated the installation of another rotary, so that there are now in the house three 300-kw G. E. rotaries operating at 500 r. p. m., and supplying 600-volt direct current. Supplying current to the rotaries are six 110-kw and one 300-kw transformers, supplying 370 volts through reactance coils. Transformers and reactance coils are cooled by two motor-driven blowers, and in common with modern practice there is an air blast chamber below the transformers, through which carried the wiring to the rotaries and switchboards. Where the cables pass through the flooring they are lead-covered triple conductors, laid in iron conduits.

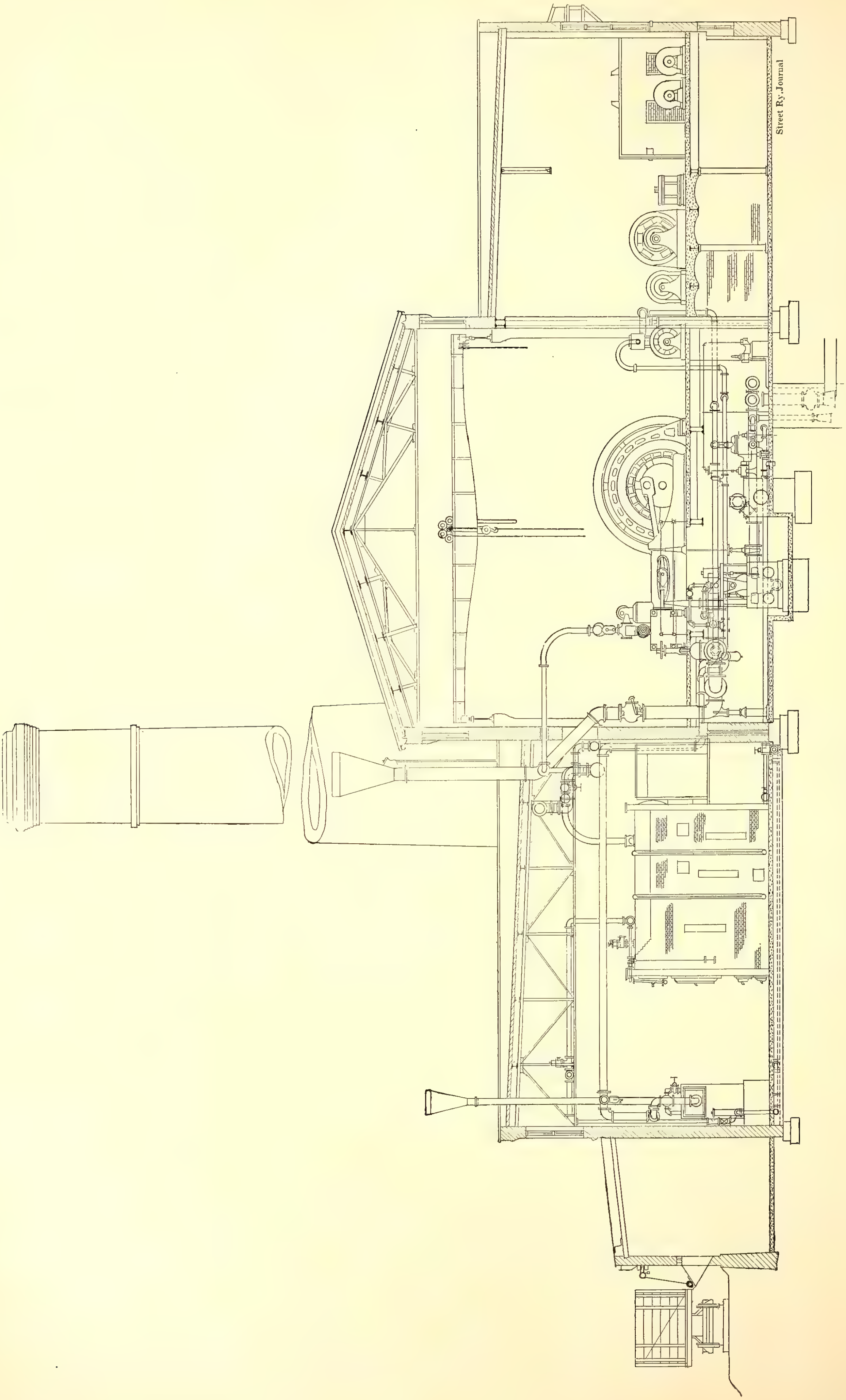


LARGE ALLIS-CORLISS ENGINE IN CANTON-AKRON POWER STATION

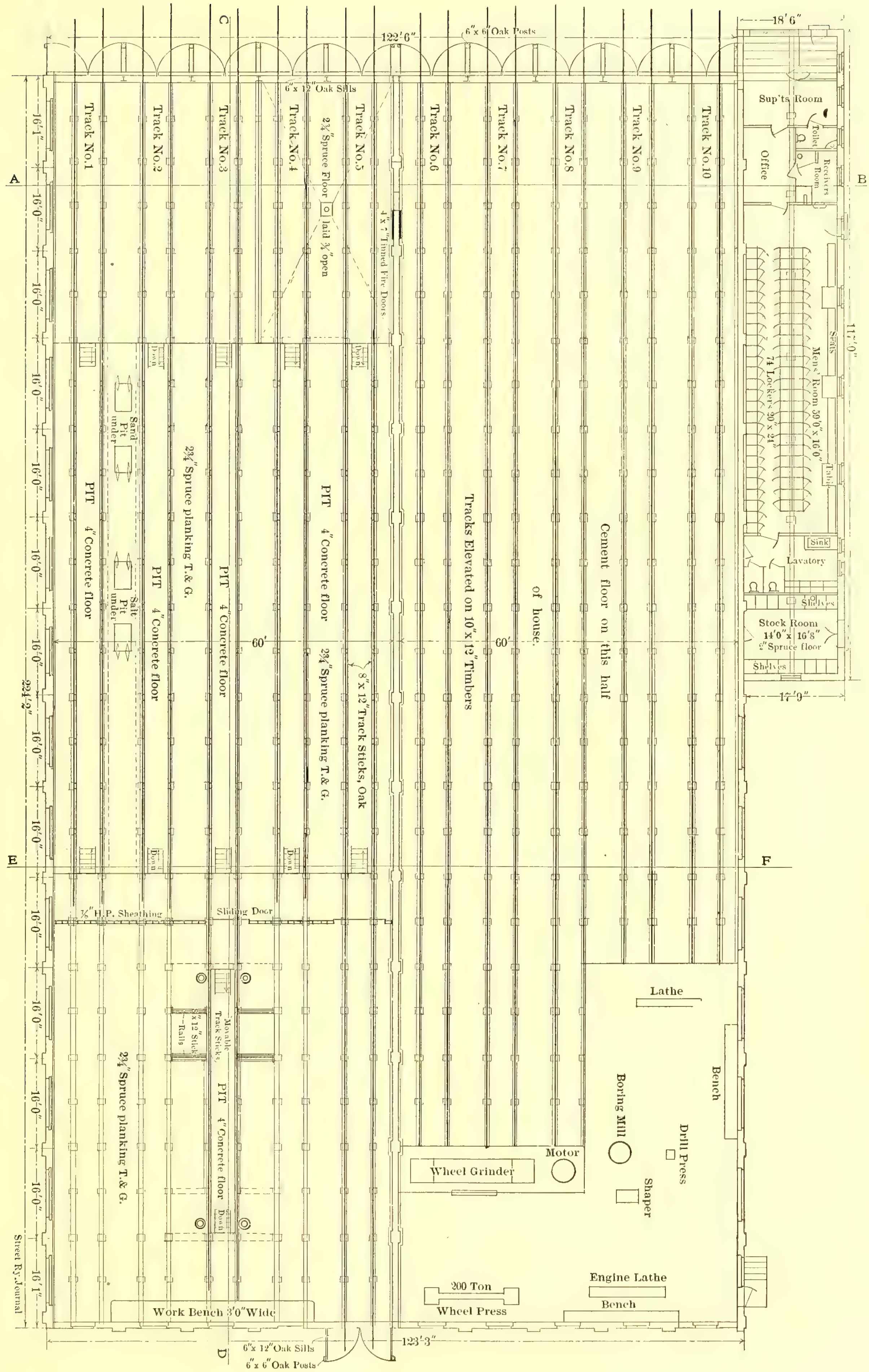


VIEW IN MACHINE SHOP—CANTON-AKRON RAILWAY

The station switchboard is placed across the center of the bay. It is made up of blue Vermont marble panels suspended from an iron frame. Beginning from left to right, the first two panels control the motor exciter and the engine exciter; they have voltmeters and ammeters. The third and fourth panels control the field circuits and have voltmeters and ammeters. Next, there are three main generator panels which have power factor indicators, ammeters, voltmeters, Thomson recording wattmeters and engine governor control switches. Three outgoing high-tension line panels have ammeters, automatic overload relays controlling the oil switches, and indicating lamps. Three panels controlling the a. c. sides of the rotaries have power factor indicators, voltmeters, ammeters and overload relays for the oil switches. Three d. c. rotary panels have M. K. circuit breakers, Thomson ammeters, field rheostats, Thomson recording wattmeters, five-point starting switches,



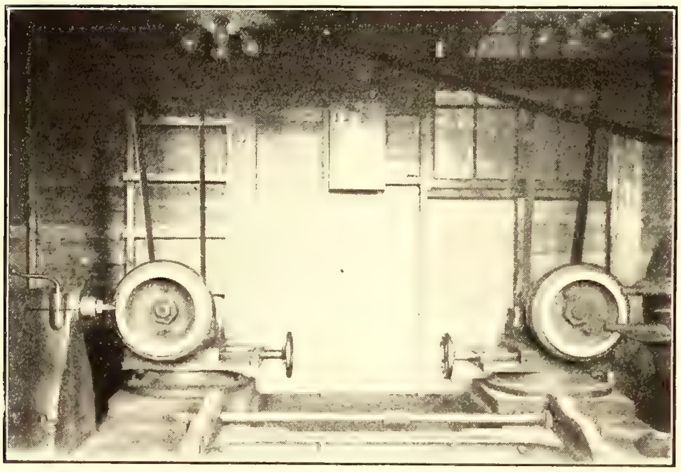
CROSS-SECTION OF POWER STATION—CANTON & AKRON RAILWAY



PLAN OF CAR HOUSE AND REPAIR SHOP—CANTON & AKRON RAILWAY

voltmeter plugs and 750-volt Western voltmeters. Four d. c. feeder panels have M. K. circuit breakers, Thomson ammeters and voltmeters. On a swinging arm at the side of the board are Weston static voltmeters for the d. c. sides of the rotaries. On panels in front of the transformers are switches for starting the rotaries at half tap. At this station they have discontinued the practice of starting rotaries from the d. c. side, although two of the boards are arranged for this method. In front of the motor-driven exciter is a panel for starting the exciter with direct current. A city lighting circuit has been brought into the house, and it may be used for lighting in case the house should shut down. Under ordinary conditions the lights in the house are supplied by the exciter sets. Owing to the use of the stokers and cheap coal, together with efficient condensing apparatus, the cost of current has been brought down as low as $.0054 per kilowatt-hour, and the average for

DESTINATION SIGN, CANTON-AKRON SYSTEM



WHEEL-GRINDER IN SEPARATE ROOM

several months has been $.006, not including interest, taxes and depreciation. Pierce, Richardson & Neiler, of Boston, were the consulting and designing engineers for this plant, and the entire steam portion was designed by Samuel G. Neiler of that firm.

In addition to the sub-station in the main house there are five sub-stations on the two lines; at Springfield Lake, New Berlin and Massillon on the Canton-Akron division, and at Beach City and Canal Dover on the Canton-New Philadelphia. The stations at Massillon and Canal Dover are in connection with the old car houses. The building at Springfield Lake has a waiting room and large covered platform for the use of the patrons of the park at that place. The other stations are low, single story buildings, measuring 20 ft. x 35 ft., built of tile and having high-tension towers in the rear. They have air blast chambers below, and the equipment of each station includes one 300-kw rotary, one 300-kw single transformer, form-K oil switches in barriers and other necessary switching apparatus. Wiring in the stations is all carried below the floor in lead-covered paper insulated cables and iron conduits. The rotaries in the sub-stations are fitted with an automatic governor, which prevents them from racing and becoming d. c. motors when the high tension goes out. It consists of a fly-pole governor, belted to the rotary shaft and adjusted to run at the same speed as the rotary. If the rotary speeds up the governor makes a connection with a trip magnet and opens the d. c. circuit breaker. The trip magnet is also arranged for low-voltage release, the magnet being charged at all times from the 500-volt circuit. The magnet has 1000 ohms. resistance and is placed directly across the 500-volt circuit. It releases by short circuiting its current through a series resistance. The high-tension feeders are arranged so that all sub-stations may be cut together. There are breakers in the trolley at Navarre, and a record is kept of the current supplied to the Canton-New Philadelphia line. For this purpose the incoming feeders at Beach City have two recording wattmeters arranged in parallel, one checking the other.

The Tuscarawas Traction Company's line is supplied with current from a small direct-current station at New Philadelphia. It has two 160-hp Ball engines belted to four 80-kw G. E. generators and the most interesting feature of the station is that the company owns a good coal mine within a stone's

TAPING MACHINE, CANTON-AKRON SHOPS

throw of the house, and fuel is mined and dumped into the boiler room by its own men.

As is the practice with the other systems controlled by Tucker, Anthony & Company, the management makes a strong feature of promoting travel by park attractions. The Canton-Akron Company leases Meyers Lake, which for many years has been the most popular resort in that district. It is reached by the Canton city cars by a double-track spur line. Over 300 acres are enclosed, the lake itself covering 140 acres. It is 70 ft. deep, supplied by springs. The company has had it stocked with bass and pickerel, and it has become famous as a fishing resort. Fishing privileges are free and boats are rented at 25 cents an hour. The company has fifty steel row-boats and thirty-five flat-bottom fish boats. Two naphtha launches, one holding fifty and the other 100 passengers, are operated by the company. The north end of the lake is leased to the Country Club, which is the best family club in that portion of the State. The club has erected a handsome three-story building, situated on a high bluff overlooking the lake, and the company's boats make regular trips to the club house landing. A large theater, seating 2000 persons and having 800 opera chairs, has recently been erected, and regular vaudeville and light opera performances are given afternoons and evenings from May 15 to Oct. 1. There is a large hotel and restaurant, bathing beach, with bath houses, figure 8 roller coaster, and a

laughing gallery, both of which were supplied by the Ingersoll Company; "chute the chutes," bowling alley and numerous other attractions. There is a closed baseball park and Inter-State League, and on a number of occasions National League, games have been played there. There is a large dance pavilion, and regular concerts are given by the Canton Grand Army Republic Band, one of the most famous organizations of its kind in the country. Admission to the grounds is free, and picnic grounds are reserved for regular picnics free of charge. A cook house has been fitted up for picnickers. A portion of the grounds is set apart for campers, and a large number of people from the neighboring towns camp there the entire season. Campers are charged 50 cents per person for the first week and 25 cents a week thereafter. The majority of the privileges are let out on a fixed basis.

The Canton-Akron Company has leased Springfield Lake, a large body of water 5 miles south of Akron, and proposes to make it as attractive as Meyers Lake. A large pavilion and vaudeville theater have been erected and other attractions are being installed in preparation for the opening of the season.

The company employs a special excursion representative, who covers all the cities and towns within a wide district. He solicits excursion business from churches and societies, and arranges for dances, theater parties and private cars. The plan has proven a profitable investment.

Officers of the system are as follows: Canton-Akron Railway, W. H. Hoover, New Berlin, president; P. L. Saltonstall, Boston, vice-president; Chauncey Eldredge, Boston, secretary-treasurer. Canton-New Philadelphia Railway, P. L. Saltonstall, president; Chauncey Eldredge, secretary-treasurer. Tuscarawas Traction Company, P. L. Saltonstall, president; J. A. Rutherford, Cleveland, vice-president; Chauncey Eldredge, secretary-treasurer. George W. Rounds, Canton, is general manager of the three roads, and E. J. Rauch, general superintendent and purchasing agent. J. B. Anderson is chief engineer of the Canton-Akron and the Canton-New Philadelphia lines. L. E. Myers Company, Chicago, were contracting engineers for the two roads.

MAKING WRITTEN REPORTS

A street railway conductor writes that a way of killing two birds with one stone in disciplining street railway employees for minor offenses would be to require them, when found violating a rule, to make out a written report in explanation of the offense. Thus, suppose Motorman Johnson is caught by Inspector Brown, or Detective Smith, starting his car on one bell. Instead of the starter notifying him to see the manager he should be told to make out a written report as to why on Oriental Avenue, at 2:15 p. m., Aug. 14, he started his car before receiving two bells from the conductor. As a general thing a motorman or conductor hates to make a written report, and the fear of doing so would serve as an incentive to the non-violation of rules. The written report could also be copied by the office typewriter, and the statement therein could be considered by the depot master better than by personal interview.

The Boston & Worcester Street Railway Company, operating between Boston and Worcester, Mass., has just issued a striking circular advertising its line. The feature of the circular is a bird's-eye view in colors of the country between the terminals of the line, showing the line itself and its connections. The circular, when opened, is 24 ins. in length and bears on its reverse side small street railway maps of Boston and Worcester, time-tables, schedule of fares, data giving the history of the establishment of routes of travel between the cities, and a list of the interesting places along the route of the line.

STARTING ELEVATED TRAINS

Recently a number of letters, expressed in vigorous language, were published in the daily papers of a neighboring city criticising the delay in starting elevated trains. It was claimed that "trains are often held standing at stations with closed platform gates and doors after the gong has been rung for starting, making it necessary for many would-be passengers to wait for later trains when they might just as well be admitted to the train which is standing at the station waiting for a clear block signal to be given."

Doubtless it is unpleasant to thus be held at a station when a person is in a hurry, and the exact train which one desires is standing with closed gates beside the platform. One would be more than human if he did not appreciate the situation when the waiting for another train means the loss of a second train at one of the steam railroad stations farther up the line. But if the gates are opened for one they must be opened for all, and the result would be that the entire elevated service throughout the city would be delayed and far more people inconvenienced than could be affected at any one station.

In the system for starting and keeping trains on schedule time which is followed on the road in question, the stationmaster rings a gong that can be heard by all train men, announcing that it is time to close the gates. If all the gates are not promptly closed, not only that train but those following are delayed. The gates are, therefore, closed as quickly as possible, and as soon as all gates are closed the motorman is given the signal to start, which signal not only directs him to proceed, but notifies him that it is safe to do so. If the block signal indicates safety the train is instantly put in motion, but if the signal is at danger, owing to the preceding train being a little behind its schedule, then the train waits until the signal clears.

If the gates were held open waiting for the block signal to clear it would be necessary either to allow motormen to get under way without knowing that the gates were closed or to hold the train still further to permit the closing of the gates and the giving of signals that would occasion the loss of five or ten seconds more. An average loss of five or ten seconds at each station would cut down the number of trains per hour from 10 per cent to 20 per cent. This is the reason that trains stand still for several seconds after the gates are closed, and in the present knowledge of elevated railway practice there seems to be no way in which belated passengers can be admitted to trains which have received the starting gong from the platform without causing great inconvenience to all the other trains and traveling public throughout the rest of the system.

The operation of this system is constantly being studied by transportation experts from both America and Europe. Probably every foreign engineer who visits this country in the interests of urban rapid transit goes over the road if it is possible for him to include it in his itinerary. Not only does the company obtain in this way the benefit of suggestions, comments and criticisms from these outsiders, but its own operating forces are constantly analyzing the conditions of traffic, train movements, handling passengers, schedules, speeds, delays, etc., and their ingenuity is continually at work in the attempt to better the service. Nevertheless, irresponsible criticisms of this kind frequently come to the surface, as they do in other cities, from the general public, who seldom realize that their interests and the operating company's welfare are identical.

The minerals collected during the work of excavation for the New York subway are to be exhibited by the Rapid Transit Commission at the St. Louis Exposition. In addition to the minerals the exhibit contains the hub and spigot ends of the first wooden water pipe laid in New York City during the administration of Aaron Burr, 1799-1804. There is also among the curios a house connection for the first water pipe laid in New York, coins of all sorts, and Indian relics.

NEW SUB-STATION ON THE DENVER & NORTHWESTERN RAILWAY

A new sub-station has recently been placed in operation by the Denver & Northwestern Railway, at Clear Creek Junction, Col., for the purpose of supplying power to the Leyden and Golden branches of the road and to the line between Clear Creek Junction and Berkeley. Shortly before the sub-station was placed in service the new Golden branch commenced operation, the length of the extension from Clear Creek Junction being 9.65 miles. Through cars are now being run hourly between the central loop of the Denver City Tramway Company, on Fifteenth Street, Denver and Golden. The cars traverse the tramway tracks as far as Berkeley, where the private right of way of the Northwestern Company begins. The line to Arvoda and Leyden was described in the 1903 files of the Street Railway Journal, and the cars, roadbed and track of the new Golden line are similar to those previously operated on the other branch of the system. The running time between Denver and Golden, west-bound, is 1 hour, the total distance being about 16 miles. Fig. 1 shows the general layout of the Northwestern road.

The sub-station building is located on filled land just at the junction of the Leyden and Golden branches. It is a one-story brick structure, with concrete trimmings and foundations. A basement is located below the level of the tracks. The building is designed for waiting room and despatching purposes in addition to its power functions. The front elevation faces the south, and is 45 ft. 1 in. wide; the side elevations are each 50 ft. 1½ ins. in width, and the rear elevation is 38 ft. 2 ins. wide. The extreme height of the walls from the basement floor to the top of the roof is 34 ft. 6 ins. The southeast and southwest corners form octagonal projections, which will be utilized by the despatchers. At the present time the waiting room and despatching offices are uncompleted.

Entering the building at the track level the interior is divided into three parts, rotary and switchboard room, despatchers' towers and waiting room. There is a loft above the waiting room, and a basement beneath both rotary and waiting rooms.

Current is supplied to the sub-station at 2200 volts over a three-phase circuit of 500,000-circ. mil cables, running to the Platte Street power house of the Denver Tramway Power Company. The distance of transmission is approximately 5.3 miles. At Platte Street current is furnished for transmission also to the South Broadway sub-station of the Denver City Tramway Company. The generating machinery consists of a General Electric 1500-kw, three-phase revolving field alternator, having thirty-two poles and giving 25-cycle current at about 2300 volts, direct connected to an Allis-Chalmers 2000-hp horizontal cross-compound condensing engine, making 94 r. p. m. The South Broadway sub-station is similar in its complement of rotaries and transformers to the Clear Creek sub-station of the Northwestern Company.

The incoming 2200-volt line is carried from the pole outside the Clear Creek sub-station to a triangular wooden bracket mounted near the roof on the north wall. Both the bracket and the adjoining bricks of the wall, inside and outside of the building, are painted with black asphaltum to avoid the effects of moisture. The cables enter the building through porcelain bushings, inclined outwardly. They then pass across the loft above the waiting room to a brick chimney or wire duct, and thence to the switchboard and transformers. Inside the north wall the 2200-volt and 600-volt circuits are supported on porcelain blocks mounted upon a horizontal pair of slate bars, which are in turn attached to the wall by iron brackets. Each phase is tapped just inside the wall for a connection to ground through a G. E. 2000-volt carbon-pencil lightning arrester, with two 1-16-in. air gaps in series. The wire chimney separates the rotary and waiting rooms, although a wooden partition is partly built. The switchboard is mounted on angle-irons near the rotary starting switches. In the basement are the main transformers, blowers, current transformers, field rheostats and wire ducts.

From the switchboard the cables pass downward to the transformer primaries, thence the low-tension circuits lead to the reactance coils, starting switches and a. c. collecting rings of the rotaries. The d. c. rotary leads run beneath the floor to the switchboard and negative side of the line.

Two rotary converters are now installed in the sub-station. Each is a six-phase, 25-cycle, six-pole, 500-kw General Electric machine, with a normal speed of 500 r. p. m. and a full-load voltage of 600. The rotaries are compound wound, and are each started by opening the shunt-field circuit and then throwing three successive increasing a. c. voltages into the armature by means of two triple pole, double-throw knife switches, mounted on a panel between the rotary and the main switchboard. The field break switch is of the four-pole, 50-amp., 125-volt double-throw knife pattern, attached to the side of the rotary frame, while on the end of this frame are mounted the negative and equalizer switches. Each rotary is fitted with a spiral spring-end play device, having a ball bearing, and the shaft oscillation is about ⅛ in. Copper brushes are used on the

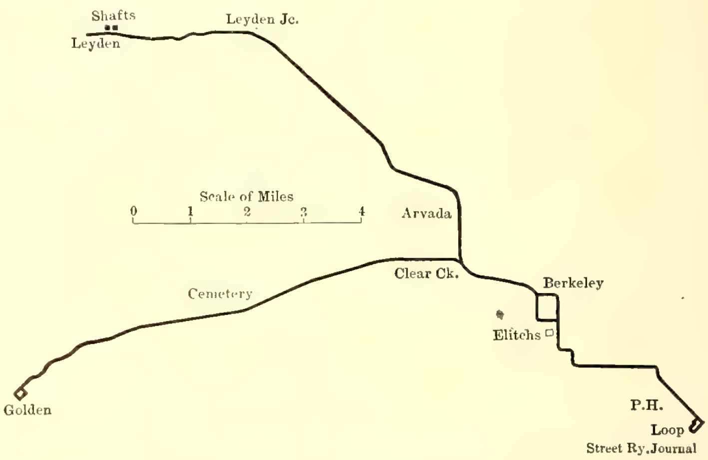


FIG. 1.—MAP OF DENVER & NORTHWESTERN RAILWAY SYSTEM

a. c. side, while the d. c. collection is made by twenty-four carbon brushes for each side of the line. Brush movement is effected by a hand-wheel shaft, operating a rack and pinion movement, and each bearing pedestal is provided with two glass oil gages and one brass drain cock. Each rotary is also fitted with a centrifugal governor at the end of the shaft, which closes an auxiliary circuit and trips the breaker in case of a runaway, due to direct-current reversal and failure of the a. c. power supply.

The switchboard is made up of eight black enameled slate panels, mounted about 6 ft. from the wall. At the end of the board are bracketed a Weston 600-voltmeter for d. c. readings, and a Thomson edgewise voltmeter, connected to a potential transformer for a. c. measurements. There are two a. c. lined panels, each being equipped with a Thomson alternating edgewise ammeter, a power factor indicator, oil switch handle and overload relay. The oil switches are of G. E. make, and are mounted on the back of these panels. At the rear are also three double-throw knife switches, designed to cut out the a. c. side of the sub-station in case it is necessary to send direct current through the three-phase line, as when the rotaries are shut down. A change in these switches connects the three-phase line directly to the positive feeder bus. The d. c. sides of the rotaries are cared for by two generator panels, each containing the usual circuit breaker, a 2000-amp. Thomson astatic ammeter, field rheostat handle, voltmeter plug, positive switch and recording wattmeter. The rheostats are hung in the basement,

and are operated by the usual rod and sprocket wheel connection. A stop with a rubber tip limits the travel of the positive switch so that it cannot strike the glass case of the wattmeter. There remain five feeder panels, manufactured by the Karas Electric Company, of Chicago, each containing a G. E. circuit breaker, Weston 2000-amp., three ground detector lamps and a quick-break, single-pole, single-throw feeder switch. A vibrating gong, mounted on the back of the switchboard, rings in case a circuit breaker opens.

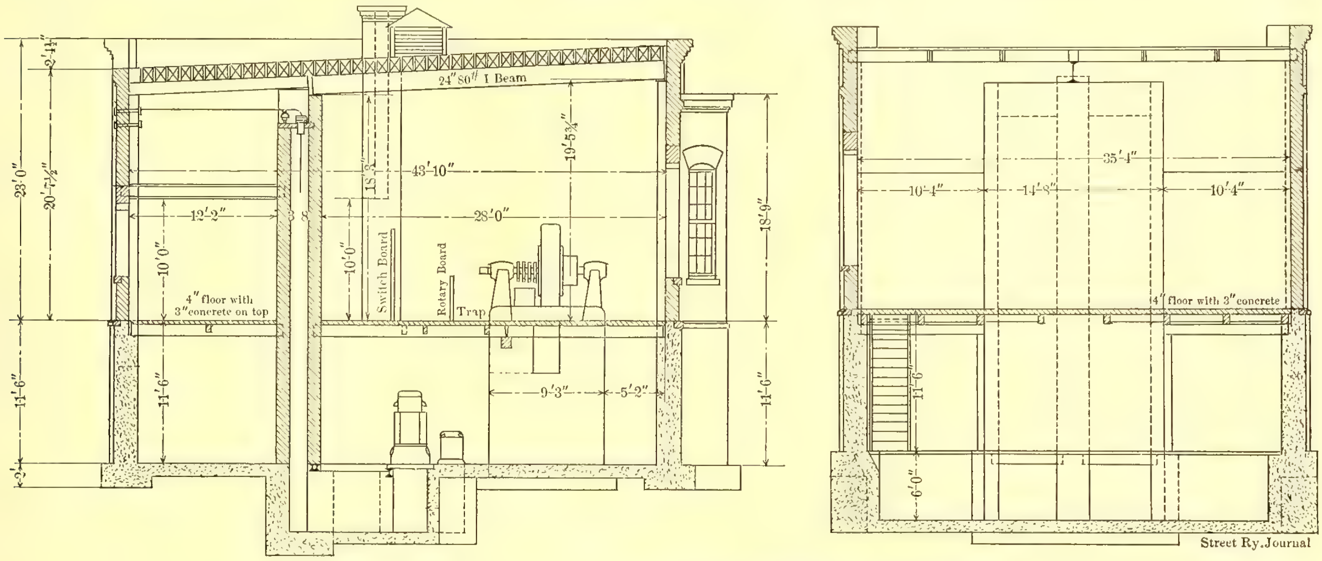


FIG. 2.—SECTIONS OF CLEAR CREEK JUNCTION SUB-STATION

The wire chimney inside is 5 ft. long by 18 ins. wide, divided into two equal parts, and it is open at each end so that an attendant can enter it when occasion arises. A striking feature of the rotary room is the daylight illumination, no less than sixteen windows being provided. The dimensions of this room are: Length, 35 ft. 4 ins.; width, 31 ft. 2 ins. The height varies from 18 ft. 3 ins. to 19 ft. 5¾ ins. Machinery is handled by a chain hoist hung from a longitudinal steel girder, which helps support the roof. No crane was provided.

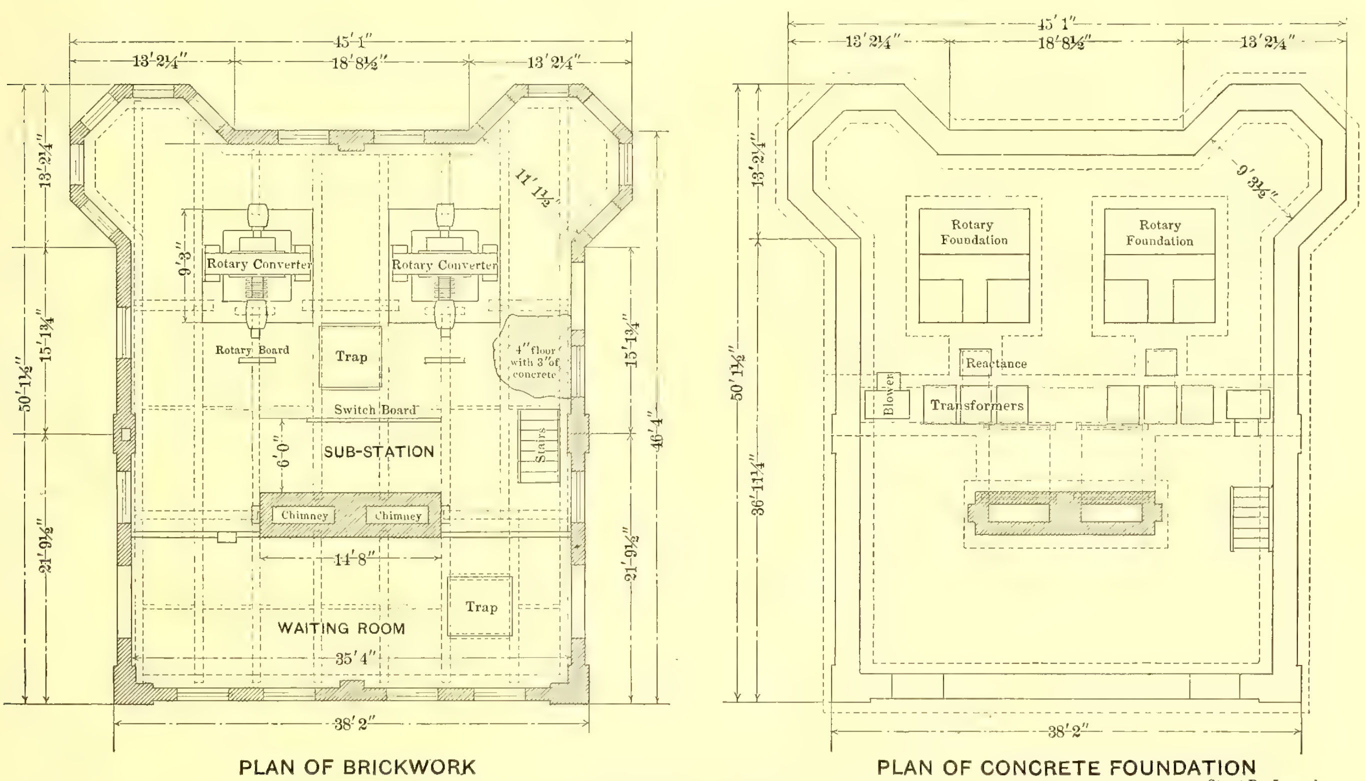


FIG. 3.—BRICKWORK AND FOUNDATION PLANS OF CLEAR CREEK JUNCTION SUB-STATION

The basement is 35 ft. 4 ins. wide by 43 ft. 10 ins. long, and has a depth of 11 ft. 6 ins. There is also a wire conduit, about 6 ft. deep, below the floor. The transformers are in two banks of three each, delta connected, General Electric make, each transformer being rated at 185 kw. They are of the air blast type, operating under a pressure of ½ ounce. The primary voltage being 2300, the secondary is wound for 430 volts. One General Electric reactance coil is placed between each bank and the rotary collecting rings. The current transformers and field rheostats are attached to the ceiling of the basement. Each bank of transformers is supplied with air by a Buffalo Forge Company's blower, direct connected to General Electric 25-cycle, 2-hp, three-phase induction motor, making 750 r. p. m. The induction motor is started by a small triple pole double-throw switch, which applies half voltage to its windings. The basement is also to be equipped with a pump, which will be driven by a G. E. 500-volt direct-current shunt motor, rated at 7½ hp with open frame, and 5½ hp closed frame, running at 1000 r. p. m.

The lighting arrangements are not yet installed, the incan-

descent work being temporary at present. The land around the sub-station is to be further filled in and platforms built to accommodate passengers who may wish to transfer at this point. A telephone system will also be added to the equipment.

A 41-ft. 6-in. trail car, closely resembling the motor cars of the Northwestern road is shortly to be placed in service for use during times of heavy traffic. The body weighs about 9000 lbs., the side entrance is 8 ft. wide, and the overall width 8 ft. 3 ins. This car is being built by the Woeber Carriage Company, of Denver, which manufactures practically all the cars of the Denver City Tramway Company and the Denver Northwestern road.

The Golden branch competes with the "Loop" line of the Colorado & Southern (steam) Railway between Denver and Golden. The regular fare on the steam road is 60 cents, and there are but two trains a day in each direction. The Denver Northwestern charges 30 cents, with the privilege of transfer to any point reached by the Denver City Tramway Company. The distance by the steam road is 16 miles, and although the Colorado & Southern has in force a commutation ticket of fifty rides for $8, the ticket expires in three months' time limit; the running time of trains between Golden and Denver is 45 minutes, against an hour by trolley, and the hours at which trains leave Golden for Denver and vice versa are not especially convenient. There is no doubt that the electric line is capturing some of the steam road's business, owing to the hourly interval and lower regular fare.

The design of the sub-station at Clear Creek Junction was made by L. L. Summers, of Chicago, consulting engineer of the Denver Tramway Power Company. The requirements of the near future were strongly in mind in the installation of 1000-kw rated capacity of machinery. At present the load is far below the capacity of the sub-station, but the anticipated summer traffic between Denver and the Rocky Mountain foot hills, and the probability of increased transportation facilities between Denver and the northern part of Colorado, warranted the installation of ample power. Acknowledgements are due to Colonel Wilson, superintendent of the Denver Tramway Power Company, for the drawings used in this description.

CIRCUIT-BREAKERS ON DOUBLE-END CARS

BY CALE GOUGH

In wiring circuit breakers or overhead switches for double-ended cars two methods are available, that is, the two breakers may be wired either in series or in parallel.

From the standpoint of first cost the series method is without doubt preferable. While a greater length of wire is used, but

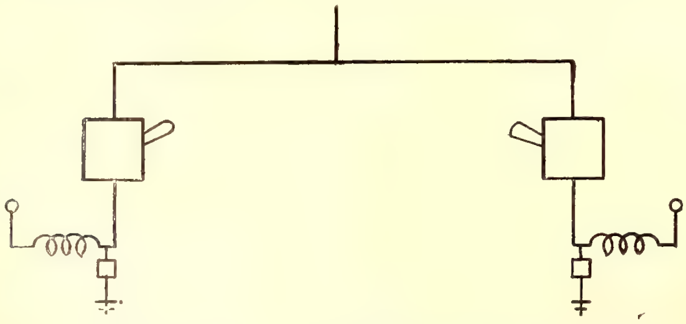


FIG. 1.—PARALLEL CONNECTION FOR CIRCUIT BREAKERS USING TWO LIGHTNING ARRESTERS AND CHOKE COILS

one lightning arrester and choke coil are necessary. Lightning arresters in themselves are a rather troublesome item, and this fact alone may cause many managers to adopt the series connection.

In the parallel connection the trolley wire of the cables is omitted. As is readily seen in Fig. 1, the trolley leads, after passing through the choke coil, go directly to the blow-out coil of the controller. Aside from the fact that two lightning arresters and choke coils are required this method is undoubtedly the more simple. It requires fewer wires on the roof of a car, and eliminates the use of a trolley wire in the cable, which is

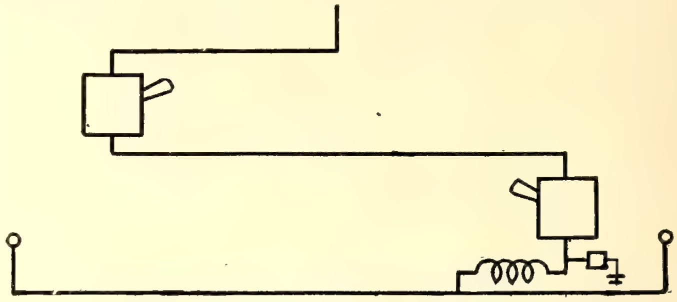


FIG. 2.—SERIES CONNECTION OF NON-AUTOMATIC CIRCUIT BREAKERS

often, from a standpoint of safety, run separate from the other wires under the car.

Fig. 3 shows a method of parallel connection requiring but one lightning arrester. This method, however, would not be countenanced in practice. Its great objection is that the motorman on the front end would have no assurance that, by throwing the breaker over him, the power would be cut off. The rear breaker might have been carelessly left in.

The fact that the current can be controlled absolutely from either end makes the series connection, Fig. 2, so popular on smaller equipment having the non-automatic breakers. When making an inspection of the controller, replacing fuse, etc., the motorman is absolutely sure of freedom from shock if he throws either breaker.

For automatic breakers the series connection has one great drawback. An overload would throw the breaker set at the

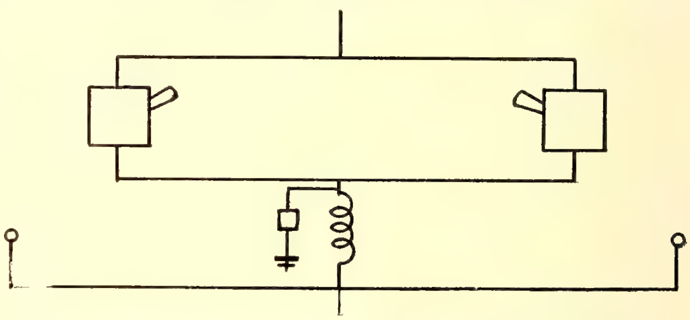


FIG. 3.—PARALLEL CONNECTION OF CIRCUIT BREAKERS USING ONE LIGHTNING ARRESTER

lowest load. This might be the breaker on the opposite end to that occupied by the motorman, and in such an event would necessitate a trip to the other end to set the breaker.

After considering the advantages and drawbacks of the two systems of wiring, it is readily seen that, generally considered, the series method is preferable, and should always be used with non-automatic breakers. With automatic breakers, however, it is better to go to the expense of an additional lightning arrester and choke coil rather than be bothered with repeated trips to the other end of the car to set the breaker.

The second annual meeting of the shareholders of the Trinidad Electric Company was held recently at Halifax, N. S. The year's receipts from the tramway and light services amounted to $176,631. After paying bond interest and operating expenses, and providing for the last quarterly dividend, at the rate of 5 per cent per annum, the balance of $52,285 was carried forward to the credit of surplus account. The net earnings were $101,185 and the interest charge $36,000. W. D. Ross, Toronto, general manager of the Metropolitan Bank, was added to the board of directors, of which John F. Stairs is the president. The company's rails extend over 13 miles in the city of Port of Spain.

THE PRINCIPLES OF THE REPULSION MOTOR

BY GEORGE T. HANCHETT

The alternating-current repulsion motor has for many years been considered nothing more than an interesting theoretical tour de force. As it now bids fair to be developed into a practical machine, and to presently find itself in the hands of practical electricians, a short discussion of its principles of operation, stripped of mathematical signs and symbols, may be of interest.

The repulsion motor in its electrical construction differs but little from the ordinary direct-current motor. It is composed of a magnetic circuit corresponding to the field magnet of an ordinary direct-current motor except in the fact that it is laminated. Its revolving part is an armature wound on practically the same principle as that of the direct-current motor, and the only difference between the two machines in the connection

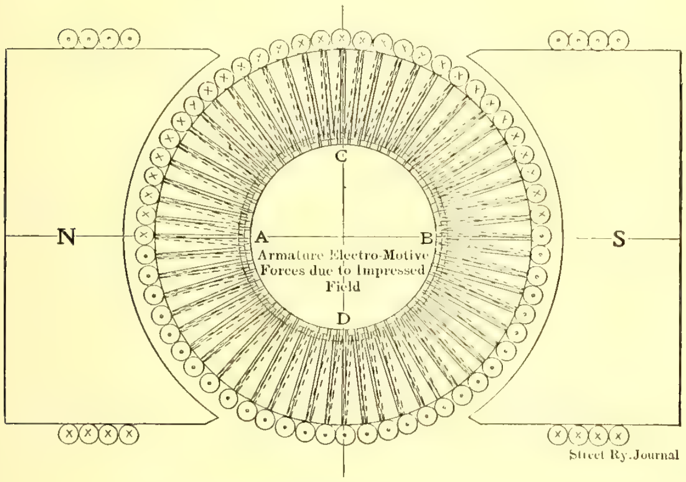


FIG. 1.—VOLTAGE DISTRIBUTION IN REPULSION MOTOR

of the wiring systems, is that the brushes of the repulsion motor are located in a different position on the commutator, and are short circuited together.

The field magnet of the repulsion motor is supplied with alternating current, and this induces in the armature currents in such a direction as will give the motor a torque, and the commutator assists by means of its short-circuited brushes to continually replace the torque-producing wires, as they move out of the influence of the magnets, with new wires carrying similar currents. The machine may be regarded as a transformer, of which the field magnet is the primary, and the armature is the short-circuited secondary.

Considering Fig. 1, which represents a repulsion motor without the short-circuiting brushes, flux will travel through the armature, alternating rapidly in direction, but following the distribution common to direct-current motors. Therefore, in each half of the armature will be induced electromotive forces. When the pole at the left is north, the current direction in the armature wires will, naturally, be in the direction to produce reverse magnetism upon the magnetic field and in quadrature therewith, according to the ordinary transformer law.

If the brushes are placed in the position A B, Fig. 2, the currents will flow in phase with the resultant electromotive forces, and it will be readily seen that in front of each of the poles there is for every wire carrying current in one direction another carrying an equal current in an opposite direction. Consequently, so arranged, the motor would have no torque, although the armature current would be very large. If the brushes were arranged as shown at C D, Fig. 3, it will be seen that on the two halves of the armature circuit there is for every wire carrying an electromotive force in one direction another carrying an equal and opposite electromotive force. Consequently, in such a case no current will flow in the armature in response to the magnetic action of the field, and, again, there would be no torque. If, however, the brushes were placed in an intermediate position between these two, as shown at E F, Fig. 4, the electromotive forces in one-half of the armature circuit would preponderate over the electromotive forces in the other half, and the result would be a current distribution such as is shown in Fig. 4, and, if certain conditions, presently to be discussed, obtain, a torque would result, causing the armature to turn in the direction of the arrow.

By a similar system of reasoning it will be at once apparent that if the brushes are arranged at points E F, Fig. 5, the current direction will be reversed, and the torque will be in an opposite direction.

The repulsion motor, considered as a transformer, therefore, is rather an inefficient one, for the reason that it contains electromotive forces which oppose the torque-producing currents, and is precisely analagous to a transformer which had, say, 100 turns, producing 1 volt each, of which ten were wound in one direction and ninety in the other, giving a net electromotive force of eighty volts, which could be just as easily obtained by using eighty turns all wound in the same direction, and would produce a secondary coil of much lower resistance, lower, in fact, by 20 per cent. This, moreover, is made even worse by the reaction of the armature, which acts precisely like a direct-current armature and distorts the field so as to tend to cover the non-torque-producing bands of wires and drags the field away from those that would produce a torque.

The phase of the armature currents with reference to the field is a very important factor in torque discussion. The armature currents will, of course, flow in phase with the resultant electromotive force in armature circuit, and if the components were due solely to the electromotive force generated by the impressed field, the current would be in quadrature therewith, and no torque would be produced, because the flux and current curves would multiply together in precisely the same way as the current and voltage curves of wattless power, giving lobes above and below the zero line of equal area, and consequently equal torque first in one direction and then in the other, which would produce no rotation.

Fortunately for the operation of the motor, the armature currents generate a field of their own, and a second electromotive force comes into play, which combining with the originally generated electromotive force produced by the impressed field, causes a resultant electromotive force lagging behind the original electromotive force, and to which the current responds in magnitude and phase. This effectively upsets the quadrature relation of field and current and the motor starts. However, these lagging currents reflect magnetic reaction into the fields, the coils of which must supply demagnetizing lagging currents according to the transformer law, and the motor starts with a very bad power factor.

The angular displacement of the brushes for maximum starting torque is, of course, a matter of great interest. The armature voltage, due to the impressed field which is effective in circulating current through the wire, is proportional to twice the angle of displacement, and, of course, should be increased until a position is reached where further motion would diminish the torque by cutting out torque-producing conductors. This cutting-out action begins at the edge of the field, or, in other words, the pole tip. Up to the point the torque steadily increases with the angular rotation, but beyond further movement does not produce proportional increase, because a factor enters to reduce the torque by cutting out wires, but further by replacing them by wires giving a reverse torque. The preliminary calculation, which is subject to modification when self induction is considered, is as follows:

For simplicity assume one wire per degree or per unit of angular measure.

Let V = the angle of displacement.
R = resistance of one-half armature.
T = torque.
n = number of wires in front of pole pieces.
f = flux.
K = a constant, which allows for units and makes equation out of the proportional relations.

Consider the torque for one side of the armature:

$$\text{Current} = \frac{2V}{R}K; \quad \text{Torque} = \frac{2VK}{R}nf$$

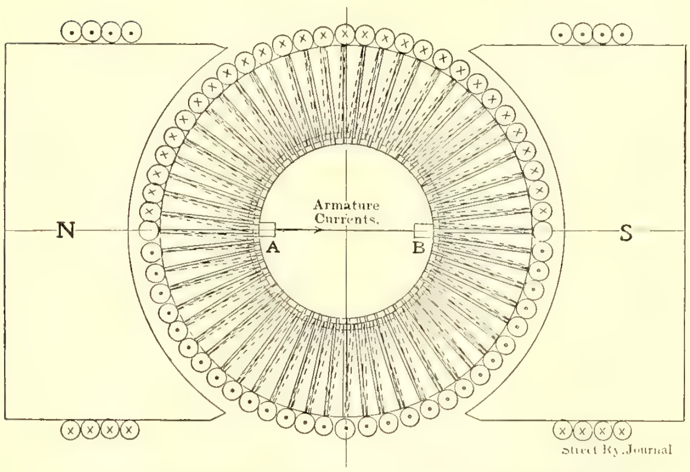


FIG. 2.—CURRENT DISTRIBUTION WITH BRUSHES OPPOSITE POLES

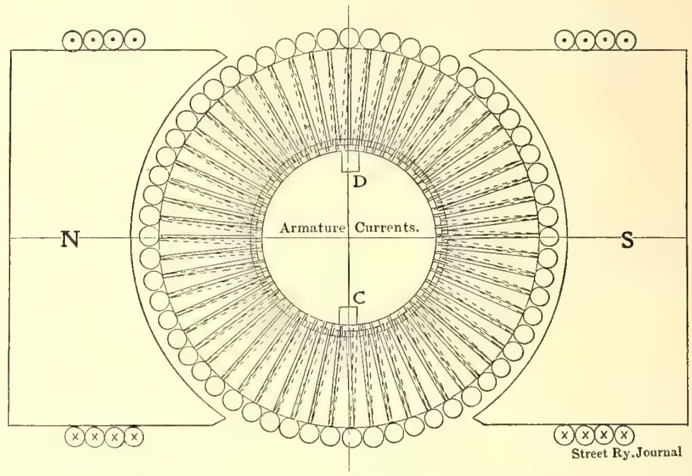


FIG. 3.—CURRENT DISTRIBUTION WITH BRUSHES MIDWAY BETWEEN POLES

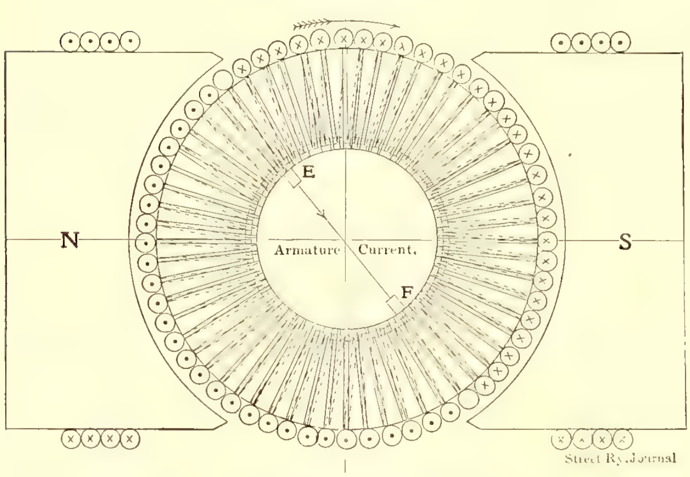


FIG. 4.—CURRENT DISTRIBUTION WITH BRUSHES AT ANGLE WITH NEUTRAL POINT

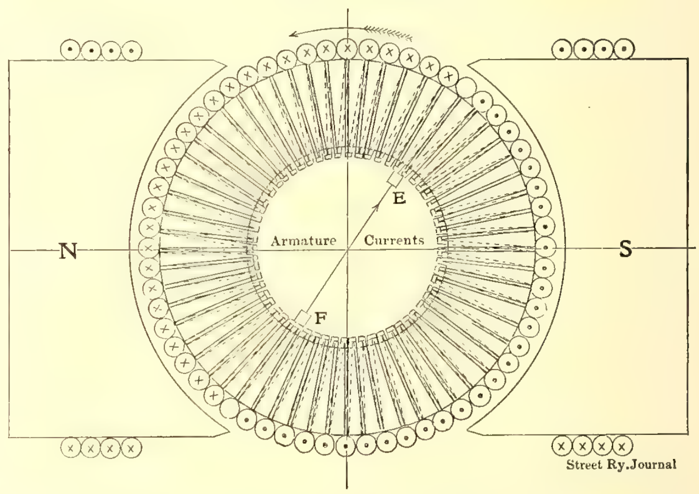


FIG. 5.—CURRENT DISTRIBUTION WITH BRUSHES AT ANGLE WITH NEUTRAL POINT

This is true till the brush begins to cut out torque-producing wires. As soon as this happens

$$T = \frac{2VK}{R} f \left\{ n - 2\left(V - \frac{180 - n}{2} \right) \right\}$$

$$= \frac{2VKf}{R} \left\{ 180 - 2V \right\}$$

$$= \frac{360\,VKf}{R} - \frac{4V^2Kf}{R}$$

differentiating

$$\frac{dT}{dV} = \frac{360\,Kf}{R} - \frac{8\,VKf}{R} = 0 \text{ for a maximum}$$

whence

$$V = \frac{360}{8} = 45^\circ$$

In practice the position will be found to differ, for the current will not increase proportionally with the voltage, due to variable impedance of the armature and the position of angular displacement, for maximum torque will, therefore, be a different amount.

As soon as the motor has started a third electromotive force comes into play. This is the electromotive force induced in the wires, due to their motion in the field, and is, of course, directly in phase with the latter, being large when the field is large and vice versa just as in the case of the direct-current dynamo. Like the direct-current analogue it tends to reduce the armature current, and further, but not analagously, it tends to draw the phase of the current back to the quadrature position. Hence, as the motor speeds up, the torque reduces and the power factor improves. Unlike the series motor, however, it has a limiting speed, which is that which obtains when the electromotive force, due to motion, has reduced the torque to fit the friction load.

From the foregoing it is seen how the torque-producing currents are generated in the armature, and it is now interesting to consider some of the reactions in the armature and the commutation problems. The field generated by the armature has its dividing line at the brushes in precisely the same way as in the case of direct-current armatures. In good modern direct-current dynamos the brushes can be set almost at the theoretical neutral point, in which case the magnetizing reaction is purely that of cross magnetizing, and does not tend to shift the initial field one way or the other. In the case of the repulsion motor, however, the brushes must be inclined with reference to the neutral axis in order to produce rotation, and the field is reacted upon. As the load on the motor increases this reaction is still greater, and, consequently, the position of the flux lines with reference to the structure of the field magnet

and armature, shifts with the load, and brings into the machine all the commutation troubles which appear with the old-fashioned, badly designed direct-current dynamos, but to a far greater degree because of the extreme displacement of the brushes. In addition to this there are the commutation troubles due to the alternating currents generated by the alternating field in the short-circuited bobbins, and these will depend in magnitude upon the phase of the current at the instant of commutation, and may have almost any value. These variables make it a practical impossibility to predict what the current in the short-circuited bobbin will be. It may vary from zero to several times the current in the adjacent coils.

For good commutation, therefore, all devices which will keep this short-circuit current down must be exhausted. Chief among these is the introduction of leads having a sensible resistance between the commutator bars and the coils to which they connect. This will materially reduce the sparking by reducing the current to be commutated. The pole pieces can also be shaped so that the commutated coil will find itself in a field which is favorable for that purpose.

Advantage can further be taken of the fact that the transformer ratio between the field and armature can be anything that is found desirable. The fields can be excited at high voltage, while the armature of secondary coils can be wound so as to have a total potential of only a few volts, thereby much reducing the commutation troubles.

By carefully exhausting all of these plans by the employment of ingenious design, the commutation is brought within the limits of practical working.

The motor has an attractive feature in that the speed may be varied by the adjustment of the brushes. When the brushes are in the positions C D, no current flows in the armature, and there is no torque. By moving them to the right or left the motor starts in one or the other direction, and the possibilities of economical control are very great, for in such a case the controller resolves itself into simply a rod connected with the brush holder and arranged with a suitable leverage system to give the brushes proper angular displacement. This, supplemented by a main switch which cuts off the current, and which may be connected to the lever system so as to operate when the brushes are midway between the pole pieces, complete the control. The motor is furthermore under control by the insertion of a variable resistance or reactance in the circuit between the brushes, which having low-voltage currents to handle can be constructed without difficulty in many desirable forms.

To briefly sum up the situation, it may be said that the motor certainly presents some advantages with reference to control. Its torque characteristics are suitable for railway work, and the difficulties which the commutation problem has heretofore presented may be overcome by the employment of low frequency, large ratio of transformation and ingenious dynamo design. Not the least feature to recommend the motor is the fact that the revolving wire may be of very low voltage, thereby minimizing troubles from short circuits, and the stationary wires can be wound and insulated so as to receive currents directly from the line without the interposition of transformers on the car, as the motor is its own transformer. It would, therefore, appear that when the motor is thoroughly "worked up" in practical shape it has commercial possibilities which are very attractive.

As late as April 21 snow threatened to tie up one of the lines in the central part of New York State. On that date a car of the Auburn & Syracuse Electric Railway, leaving Auburn at 10 a. m., encountered drifts so deep that it became necessary to put one of the rotary snow-plows ahead of the car as far as Marcellus. Conditions near Skaneateles and Marcellus are said to have been as bad as at any time during the winter.

CORRESPONDENCE

REPAIR SHOP PRACTICE

Denver, Col., May 14, 1904.

Editors Street Railway Journal:

A few days ago the writer went through the repair shops of a large steam railway company, thinking that he might pick up something of interest to the street railway man. The problems of the locomotive and car shop are, of course, heavier than those we encounter in the street railway repair shop, as far as mere size goes, but the use of electric cranes, compressed air and motor-driven tools, arrangement of yard trackage and power plants, brings up about the same questions of flexibility and economy, whether we are running a locomotive or a motor hospital.

The intense activity of the place was striking. Every employee seemed to be on hand for business, and there was no sign of hesitation in the work, from planing down cross-heads to riveting boilers. One does not always see a like attention to work in the street railway repair shop, or an equal comprehension of exactly the thing to be done next, by every employee. The opportunity for employees of the train service to loaf in this shop is almost nil, and even outside visitors are not allowed without a permit from the master mechanic—a condition much different from a shop the writer once visited in a Massachusetts street railway system, where the doors were open to all the relatives and friends of the workmen without the least formality. The effect on discipline was plainly evident.

In passing through the locomotive shop, where engines were seen in all stages of dismantlement and repair, one could not but feel that the handling of electric locomotives in the repair shops of the steam lines which are rapidly coming to adopt them is going to be an easier and, therefore, a less expensive task than the repair of steam locomotives is at the present time. The elimination of the boiler, which grows to be of literally tremendous proportions in the compound consolidation engines which haul modern freight trains, and the greater simplicity of motor equipments in comparison with all the details of cylinders, valve motions, eccentrics, spark arresters, crank pins, counterbalances, piping, levers and throttles which make up the harness of the iron horse, form the basis of this prediction. The electric locomotive ought to become far more accessible than the steam machine, when it comes to detail parts.

An interesting notice posted on the shop walls described the apprentice system of the place, stated the rules in force as to working hours, conduct of employees and the wages paid to machinists. Apprentices' wages run from 10 cents per hour in the first year of their four years' term to 20 cents per hour in the last year. The minimum wage for full-fledged machinists is 34 cents per hour. A clear statement of these matters, posted in the shop where everyone can consult them at will, is certainly a good precedent to follow, and such a course has considerable effect in reducing misunderstandings on the part of the man. I quote the above figures as a matter of general interest.

In various parts of the shops an elaborate set of rules for the prevention of fires was posted. This was, perhaps, the most suggestive thing which the writer saw. The fire risk is a question which never leaves us, and the constant occurrence of severe conflagrations in different parts of the country justifies its discussion at almost any time. Among these rules was one forbidding the use of unventilated or closed lockers. Strange to say, the rules were posted upon the end of exactly this forbidden kind of a locker. Then, again, the most stringent precautions were specified in regard to the wiring of the electric motors, switchboards, etc. Within a few feet of the regulations were three or four 220-volt motors, operating woodworking machinery. Each of these motors was a machine of

from 25 hp to 35 hp, entirely exposed to dust, shavings and chips, and, to cap the climax, so covered over with sawdust that even the raised letters of the name plates were undecipherable. The field spools looked as though they had been dipped in a flour barrel. Some of the switches were mounted upon wooden bases, and in the machine shop, incandescent lamp cord, carrying 220-volt current, was run about promiscuously in all manner of oily places. There were some excellent rules about the use of metal match boxes, the storage of oil, gasoline, etc., outside main buildings; the prohibition of smoking, reporting of defects, the accumulation of rubbish, disposal of oily waste, the use of sand instead of sawdust, provision of ladders, fire-alarm box keys and fire pails, and the use of coal oil lamps. The piling of coal in heaps over 7 ft. high was forbidden, without the provision of ventilation through the center or the placing of thermometers in pockets. The setting of stoves on concrete, cemented brick, stone or metal footings was specified, as well as the protection of woodwork by sheet metal and air spaces; the annual inspection of chimneys and flues, the separation of steam pipes from woodwork, disposition of ashes in metal cans and their daily removal, and the use of rigid gas fixtures.

The drawing of such regulations is well enough, but they are useless in cases where they are not enforced. Far too often are rules of this character posted, read by all employees, accepted by everyone as wise and then—forgotten. The reason does not lie so much in lack of discipline as in the time-honored fact that "everyone's business is no one's business." It is a pretty safe plan for both electric and steam roads to place upon some individual employee the responsibility of seeing that rules pertaining to the fire risk are enforced, and that no fires occur through carelessness in regard to the regulations. The question is an important one, and with the experience of this year in Toronto, Buffalo, Rochester and Baltimore as object lessons, we should need little additional stimulus toward all "getting down to business" in the matter of fire prevention and doing our united best to stamp the great curse of conflagration out of modern industrial life. Observer.

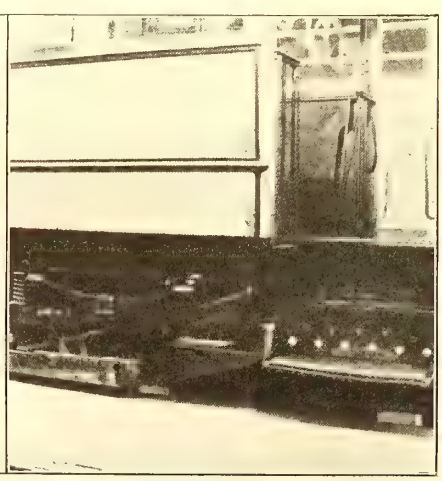
WHEEL GUARDS IN EUROPE

Boston, May 13, 1904.

Editors Street Railway Journal:

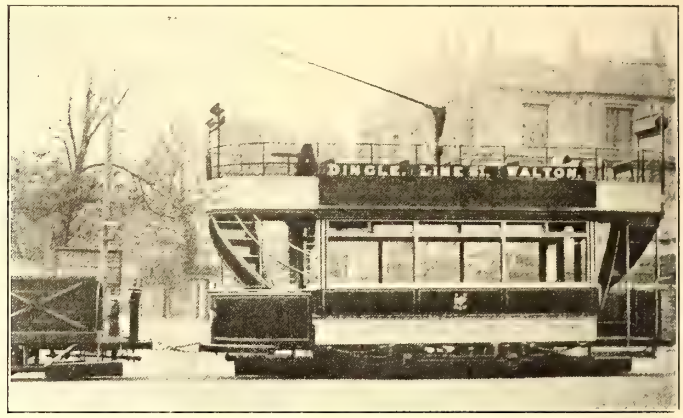
Since you published an illustrated account in the issue of Aug. 15, 1903, of the fender used in Liverpool, another year's records are available with interesting results; for, in the three

End view of Liverpool wheel guard



Wheel guard used in Paris

years now since its introduction, no person has ever been run over by cars equipped with it, though 132 persons have been actually under the cars. All of these people were pushed off the track clear of the wheels, owing to the plow-shape of the fender, only 20 per cent requiring medical assistance. Besides the tendency to reduce the extent and the cost of accidents there are no waits for a wrecking wagon to come and jack up a car. As the fender pushes snow off the track as well as people, a trial in this country would be interesting for more than one



Double-deck car in Liverpool, showing wheel guard

reason. Since in Liverpool some snow was found to collect in the rear half of the plow, the rear nose can now be kept lifted up by a chain from the platform above, leaving a free opening for any snow to pass through.

The plow-shaped wheel guard may be found in this country, but it is more common in Europe, especially Paris. In no place, however, have the details been so perfected as in Liverpool, where the great length of the plows, the bluntness of the rubber-covered ends, the attachment of the guard to the axle boxes, thus keeping the belting at the bottom always at the same height above the tracks, all contribute to the success of the device. While the prefect of police in Paris announced last year as conditions for fenders that they must not project beyond the platforms, and must be capable of being lowered on to the track either by the motorman or automatically, on the principle adopted in Marseilles and Munich, the Tramways Union of France objected to all these proposals and preferred having a fixed fender like the Liverpool one, and powerful brakes and alert motormen to any complicated system of movable gratings or nets.

The upper view shows a Liverpool salt car as well as a car fender. While the city has snow-plows and a snow sweeper the first thing done in a snowstorm is to salt the entire street railway track, 100 miles being covered in about 40 minutes, requiring about 70 tons of salt. The second cut shows an end view of the same car, while the third engraving illustrates a different type of wheel guard used by the Cie Générale Parisienne de Tramways.

John P. Fox.

A decision, handed down by the Court of Appeals at Brooklyn, N. Y., holds street railway companies liable for accidents on their cars and for courtesy by their employees as well. A women sued the Brooklyn Heights Railroad because a conductor refused to return her change and characterized her as a dead beat and swindler in the presence of the other passengers. Justice Stover ruled that the company was not responsible for the language of the conductor, and directed a verdict for the 20 cents change. Now the Court of Appeals has sent the case back for a new trial, declaring that the carrier is responsible not only for the safe carriage and delivery of the passenger but for his respectful treatment also.

TWO-BELT CONVEYOR SYSTEM

The extent to which belt conveying has become a factor in modern engineering practice, makes any radical departure, especially in the line of improvement, particularly interesting. Belt conveyors have been, without exception, designed on the fundamental principle of causing the belt to be troughed or cupped. This has been accomplished by using concentrators, either independently of the horizontal carrying pulley or in various combinations. This, to-day, with the exception of the system to be described, represents the most common type of belt conveyors.

The angles of the concentrating rollers have been varied from 45 per cent to as low as 20 per cent, these changes being made because experience showed that the wear on the belt, by causing it to bend abruptly, is very damaging and destructive to its life. As the belt is forced to make an angle more or less sharp, all the strain is concentrated on two points. Again, the three-pulley type of carrier requires that the pulleys be loose on the shafts, the friction surface is very great, and the tendency of the side rollers is to wear in such a manner as to produce in time a gyrating motion.

In the two-belt conveyor system, designed by the Ridgway Belt Conveying Company, of New York, an interior troughing and supporting belt runs over its individual head and tail pulleys, having separate take-ups, and is entirely independent of the conveying belt proper. The conveying belt is threaded over its head and tail pulleys in the usual manner, and has its separate take-up, so that the two belts, although moving together in the same direction at the same speed, are entirely separate and distinct. This enables the conveying belt to be lifted off the supporting belt and out of the troughing blocks and passed through either a stationary dumper or a moving tripper.

The conveying belt has no work put upon it other than that required to drive the lower carriers and its own head and tail pulleys, all the carriers on the upper line, which comprise two-thirds of the total number used, being revolved by the inner supporting belt. The strains, therefore, are divided, the belt revolving two-thirds of the moving parts not being subject to the wear and tear of carrying the load, and the belt carrying the load being relieved of the strains and wear and tear of revolving the greater part of the moving parts of the machine. This produces a divided labor in wear and tear which enables both belts combined only to represent in strength what would be required of one belt in any one-belt system.

FIG. 1.—CARRIERS USED IN TWO-BELT CONVEYOR.

The interior belt is driven by a roller or block-chain sprocket drive from the main driving shaft, and with the two belts in tension just sufficient to prevent slip on their driving pulleys; both belts move at exactly the same speed in the same direction, and there is no rub of the conveying belt on the troughing blocks. At the points where the conveying belt meets the interior supporting belt, to prevent the rub and wear caused by the troughing blocks moving in a larger radius (the conveying belt being at the same height as the center of the supporting belt) a pair of concentrating rolls lifts the edge of the belt and drops it into the troughing blocks. The same method is used where the conveying belt leaves the troughing blocks at the opposite end.

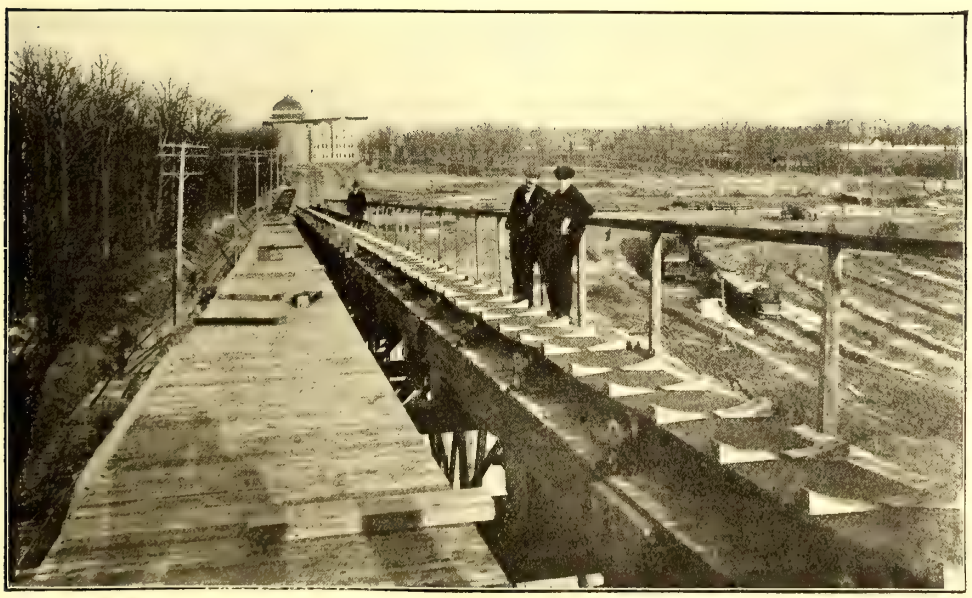


FIG. 2.—INTERIOR TROUGHING AND CARRYING BELT

Fig. 1 represents the carriers used in the two-belt system. They are straight rollers fastened to steel shafts revolving in babbitted boxes, the boxes being ball and socket, ring oiling, felt washered and dust proof. In the two-belt system the conveying belt proper lies in a natural position, a true segment of a circle, with the strains distributed over its whole width uniformly. This increases the life of the belt from 75 per cent to 100 per cent over any type of pulley-troughing belt.

Fig. 2 shows the interior troughing and carrying belt with its troughing blocks attached. This interior belt, by a compensating drive, is driven at the same speed as the upper carrying belt, and the two move together through their entire travel

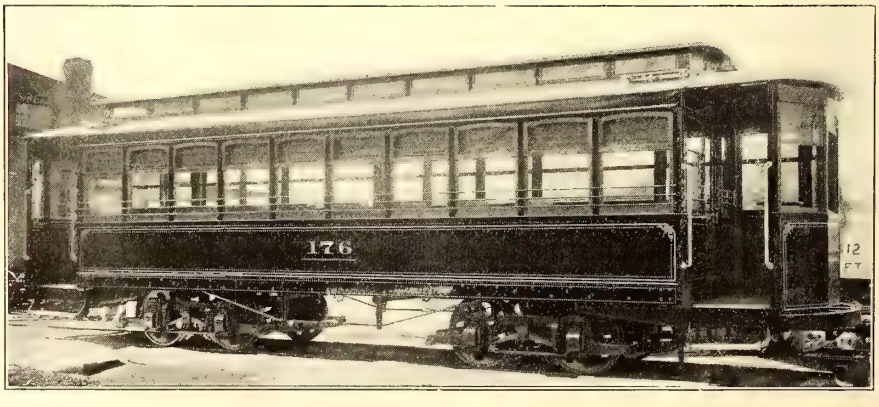
on both the upper and lower sides. The conveyor belt proper for the two-belt system is a machine-made belt with a protective cover of average good material. The special belts, which are made to conform to the hard conditions of continuous flexing, are hand-made belts, and to give satisfactory service must be made of the highest grade of material to stand the wear and tear of angular bending.

The inner or troughing belt carries the outer or conveying belt through the upper line of working travel and the outer belt carries the inner belt on its return, and through its travel in the lower line. The ability to use straight rollers, all strains being compression strains and not bending or breaking strains, enables the use of the lightest castings that can be machined and finished. This reduces the weight, cost and power required. Only a clean belt comes in contact with the upper carriers, which comprise two-thirds of the total number used. When the conveying belt proper, the only one necessary to be renewed, gives out, the cost of its renewal is stated to be approximately one-half in the two-belt system of what similar material would cost in any type of single belt conveyor.

NEW CARS FOR DES MOINES CITY RAILWAY

The Des Moines City Railway Company has received twenty new cars like the one shown in the illustration from the American Car Company, of St. Louis. Evidently the seating arrangement, which the interior illustration shows, is satisfactory, for the company had eighteen cars with this arrangement built for it last year by the American Car Company. The purpose, of course, is to obtain the largest seating and standing capacity possible to the area of the floor. The transverse seats are 32 ins. long, and made so that a person's body may extend a trifle over the end without discomfort. The wide aisle obtained by having the seats on one side placed longitudinally accelerates the movement of passengers in and out—an important consideration in city service, for which the cars are intended. The entrances of the vestibules are both at the same side, as the cars run in one direction only. The sashes in the vestibules are arranged to drop into pockets, while in the car the upper sashes are stationary and the lower arranged to be raised. The interiors are finished in cherry with ceilings of the same made of tongued and grooved boards.

SEATING ARRANGEMENT OF DES MOINES CAR



EXTERIOR OF CAR USED BY THE DES MOINES CITY RAILWAY

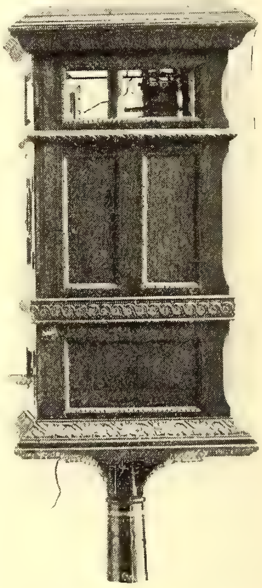
The length of the cars over end panels is 28 ft.; over crown pieces, 37 ft.; from panel over crown piece, 4 ft. 6 ins.; width over sills, including panels, 8 ft.; from center to center of posts, 2 ft. 8¾ ins.; side sills, 4¾ ins. x 7¾ ins.; end sills, 4 ins. x 7¾ ins. The side sills are plated on the outside with ⅝-in. x 8-in. steel. The thickness of the corner posts is 4½ ins., and of side posts, 2¼ ins. From the rail to top of step is 18 ins., and from step to platform, 14 ins. The cars are furnished with Brill sand-boxes and angle-iron bumpers, and cars are mounted on Brill No. 27-G trucks, with 4-ft. wheel base and 33-in. wheels, having 2½-in. tread and ¾-in. flange. The trucks are equipped with 38-hp motors.

THE PHOTOSCOPE

Among the many ingenious devices invented for the edification of visitors to picnic parks is the nickel-in-the-slot photographing machine made by the Photoscope Company, of New York. This machine is operated simply by pressing a button at the end of a flexible cord, held by the person whose photograph is being taken. It is reported to be giving excellent results and should prove a highly profitable attraction wherever introduced.

This machine takes pictures continuously as fast as a person can pose in front of it. Its capacity is from six to eight exposures per minute, and during the time of exposure others which have preceded are being developed and finished inside of the machine. It delivers a perfect photograph,neatly framed and finished, in less than 1 minute, and will operate regardless of the weather, making as perfect a likeness under the electric light as on a bright, sunny day.

The simplicity of the photoscope is one of its most advantageous features. Every movement is a rotary one, which gives the least friction, and is the least liable to get out of order. By removing the top of the cabinet, the mechanism is entirely exposed to view, and all parts made accessible.



THE PHOTOSCOPE

The great advantage which this machine has over other nickel-in-the-slot machines is that its novelty does not wear out, and it gives a permanent value for the money spent. As

a person sees himself in the mirror on the front of the photoscope so will the picture be produced. The manufacturer states that this is the only self-operating photographing machine in the world that delivers a picture completely finished and framed.

It is possible to take from six to eight pictures a minute, but as it takes some little time to seat each person three pictures per minute is believed to be a conservative estimate. The pictures made by this machine are about 1 in. in diameter. As many people desire brooches for such photographs the manufacturer has arranged to supply them to machine users at a slight additional charge.

OPEN CARS FOR THE PUBLIC SERVICE CORPORATION OF NEW JERSEY

The Public Service Corporation of New Jersey has just added to its rolling stock sixty new open cars of the type shown in the accompanying illustration for use on various sections of its lines between Jersey City and Trenton, which, though extensive, form but a part of the great system operated by the company. The cars and trucks were built by the J. G. Brill Company, and have a number of interesting features in plan and construction. The body framing is of unusually powerful construction. The long-leaf yellow pine side sills are 4½ ins. x 7⅞ ins., plated on the outside with 10-in. x ¾-in. steel plates the full length of the sills. The end sub-sills are of white oak, 3¼ ins. x 4 ins. The center and intermediate crossings and the diagonal braces are of the same material. One ¾-in. tie-rod at the side of each crossing extends through the outside sill, and is bolted against and bears upon the outside sill plates. The short framing and the trap door framing have ½-in. rods, and are plated to obtain the greatest possible strength. The wooden sills are protected by plating on the inside from the wheels in case of derailment. The side posts are 2¾ ins. thick, and the corner posts 4⅜ ins. The top rail, of yellow pine, is secured by a heavy letter panel gained into it as well as into the posts. This panel is 1⅛ ins. x 7½ ins. There are steel carlins to every post in addition to the usual wooden rafters. The ceilings are of three-ply maple veneer, neatly decorated. The sashes in the bulkheads and in the vestibules are arranged to drop into pockets. In addition to guard rails, which slide behind the grab handles on both sides of the car, net guards, 18 ins. wide, and in two sections, are provided for one side and may be readily changed from one side to the other. It is only intended that the motorman shall occupy the front platform; therefore, the platforms are short, with folding gates at the entrances. The height of the running board from the railhead is 19½ ins., and from running board to car floor, 17½ ins. The cars are furnished with ratchet brake handles, radial drawbars, round-corner seat-end panels, and other specialties of the builder's make. The trucks are Brill No. 27-G. E.-1, with 4-ft. wheel base, 33-in. wheels and 4¼-in. axles. The radius of the shortest curve on the lines is 30 ft. The motor equipment consists of four 40-hp motors.

OPEN CAR FOR PUBLIC SERVICE CORPORATION OF NEW JERSEY

EMERGENCY CAR-LIGHTING EQUIPMENTS

The advantage of having auxiliary car-lighting equipments for use in emergencies, particularly in dark and lonely places, is undisputed, but hitherto very few have been installed, owing to the complexity and expense of the methods suggested. Recognizing the need for some simple and reliable scheme, the Federal Electric Company, of New York, has placed on the market a very compact arrangement for this purpose.

The method employed by this company obviates any necessity for specially charging the storage batteries used in the auxiliary lighting system. An automatic switch is placed in series with the regular 500-volt lamp circuit ordinarily used. This switch can be placed in circuit with either one, two or three series of lamps. The storage batteries are in series with the switch. Although the flow of current to the batteries is very small, they are always well charged, as they are constantly in circuit.

Four to six additional lamps are placed in each car for operation by the batteries whenever the trolley current is interrupted from any cause. The switch automatically throws the storage batteries into circuit, and as soon as the trolley circuit is restored automatically throws off the current from the auxiliary or emergency lighting circuit.

The storage batteries required do not weigh over 150 lbs., and can be placed underneath the car seats together with the automatic switch. Separate indicating switches are also supplied to cut out of service the storage batteries either from the charging or the lighting circuit as desired. Each car is supplied with a voltmeter, so that the motorman may know at all times the condition of the batteries.

By using this auxiliary system it is possible to have lamps in service either for the front or rear headlights, such an arrangement being very serviceable in preventing collisions on single-track roads. In addition to this, one lamp is sometimes placed above the top of the car with a reflector to assist the conductor to replace the trolley pole on the wire.

ELECTRIC RAILWAY TIME-TABLE BETWEEN PHILADELPHI AND NEW YORK

The Trenton & New Brunswick Railway Company has just issued a through time-table of the train schedules via that line between Philadelphia and New York. As at present arranged the trip from Philadelphia to Trenton is made by steamers of the Delaware River Navigation Company; the trip from Trenton to New Brunswick by the Trenton & New Brunswick Fast Line, from New Brunswick to Bound Brook the traffic passes over the Middlesex & Somerset Traction Company, and from Bound Brook to New York over the lines of the Public Service Corporation. The fare charged from Philadelphia to New York is $1.10 single fare, and $2 a round trip. The running time from Trenton to New York is 5½ hours, and fromTrenton to New Brunswick 1½ hours. Tickets must be purchased at the ticket offices of the company to secure the benefit of these low rates of fare, and are good until used.

Buenos Ayres, Argentina, probably stands pre-eminent as a city of street cars. With the exception of two streets, there is a line in every one of the principal thoroughfares, with a total of 275 miles of track. Leading out to the suburban towns of Belgrano, Palermo and Florest, there are overhead trolley lines equipped with American apparatus. In 1900 a total of 116,447,982 passengers were carried.

FINANCIAL INTELLIGENCE

WALL STREET, May 25, 1904.

The Money Market

If the usually accepted signs may be trusted, the end has about been reached in the season's extraordinary gold movement; sterling exchange has gradually eased off until it is fully a half cent in the pound lower than two weeks ago. Except for a few comparatively small consignments, contract for which has already been made, no further engagements are in prospect, nor does it appear at the lower exchange level that further shipments would be profitable. It is understood that nearly the whole $40,000,000 involved in the Panama Canal purchase has already been sent abroad, and that whatever small amount may still have to go will be postponed until such time as suits the shippers. Now that money rates have risen to a parity with the foreign markets there is no immediate cause for the outflow to continue. Reviewing the whole of this remarkable episode in American finance, there is good cause for congratulation in the way our money market has behaved during the trying interval. Within the last six weeks over $57,000,000 gold has been sent to France. Our money rates have risen less than an average of 1 per cent, and the surplus reserve of the New York banks still stands at the comfortable figure of $12,000,000. For this result a great deal is due to the skillful handling of the Panama transaction on the part of the banks engaged in it, and to the intelligent co-operation of the treasury officials. The plan of drawing down government deposits from different sections of the country, instead of confining the treasury call to this city alone, has lessened the strain by diffusing it. The interior banks have made good a large part of the losses to the New York institutions, and the cash reserves of the latter have therefore suffered no very severe decline. Another very important relieving factor has been set in operation automatically as it were by the advance in money quotations. Trust companies and banks outside of New York, which for months past have not cared to place their funds on the market directly, owing to the unprofitable interest return, have now begun to lend again. In consequence, they have assumed a portion of the credits hitherto carried by the Clearing-House members, and have thereby, through the reduction in liability, supplied another important means of sustaining the surplus reserve. Last Saturday's bank statement reflected this shifting process in a $22,000,000 decrease in loans, which was slightly more than enough to offset the $7,000,000 decrease in cash holdings of the week. The surplus remaining stationary in a period where gold exports amounted to $13 000,000, it can be safely assumed that bank resources have passed the low level for the season, and from now on will improve. It may also be concluded that money will work no higher than it has during the past two weeks until the autumn crop demands begin to be felt. Within the last few days, in fact, call money has begun to relax, the ruling rate at this writing being 1½ to 1¾ per cent, as compared with 2 to 2¼ per cent a week ago. Sixty-day money is also a shade easier at 2½ per cent, and six months money at 3½ per cent. At these figures offerings of funds are much more liberal than they were, while the demand is very moderate.

The Stock Market

A better feeling has developed on the Stock Exchange this week, partly because of improvement in outside conditions, but more largely because of the belief that liquidation at the recent low level of prices was pretty well completed. Cessation of gold exports has removed whatever misgivings there were lest the money market should cause trouble. Advices from growing crops have been decidedly more cheerful, so much so indeed that hopes are expressed that the June report on winter wheat will show a condition equal to the one of a year ago. Meanwhile both spring wheat and corn are making good progress on a considerably larger acreage than last year's. In these two respects the financial situation has taken a positive turn for the better, and the week's movement of security prices has reflected the change. But the condition we now have in the market is one in which technical considerations—those relating to the quality of the buying and selling, to the thoroughness of the liquidation, the size of the short interest, etc.—play the most prominent part. Wall Street has become convinced that there can be no real improvement in prices until many things which now appear dubious in the financial outlook are settled—until more light is thrown upon the outcome of the presidential campaign, upon the fate of the harvest and upon the tendency of general trade. Railroad earnings are not as good as they were, reports from the steel industry are not encouraging, business elsewhere everybody agrees is dull. Under these circumstances, with nothing but an occasionally over-extended short interest to put prices up, the leading question is whether prices can or cannot be forced down any lower, in other words, whether there are any more stocks to be thrown on the market for no other reason than sheer disgust on the part of their owners. The answer to this question contains the main interest there is in the dealings of the immediate future.

The local traction stocks have been favorites in the week's operations for the rise. Brooklyn Rapid Transit, both stock and bonds, has been conspicuous in the movement. The best explanation undoubtedly lies in the fact that the inside speculative party is more inclined to help a bull campaign, in these issues, than is now the case with any other group of securities on the list. Brooklyn Transit's earnings are, of course, increasing, and this is the season when its business reaches the maximum. These are matters of common knowledge. It is also well to consider the possibility that one of the chief objects in making the stock strong, is to create a better market than has heretofore existed, for the bonds. The rise in Manhattan and Metropolitan has been more or less sympathetic, the buying in the latter instance coming mainly from recent short sellers.

Philadelphia

One of the interesting episodes in the week's Philadelphia dealings was the discovery that for some time past many holders of Electric People's Traction 4 per cent bonds have been swapping their investment for Philadelphia Traction stock. Both are guaranteed 4 per cent dividends by the Union Traction and are accordingly assumed to be pretty near equal in investment value. The stock, however, has for a long while been selling considerably below the bonds, and this difference has provided the incentive for the exchange. The recent heaviness of the Electric People's bonds—now selling around 98⅝—and the recent activity and strength of the stock between 95⅝ and 96 are now satisfactorily explained. The declaration of the regular dividend on Philadelphia Electric was already anticipated by last week's sharp recovery in the stock. This week the stock eased from 5⅝ to 5⅜, and later, with the dividend deducted from the price, sold at 5¼. Philadelphia Company common rose from 37⅝ to 38¼ on fairly active trading, but the preferred dropped a half point from 44½ to 44. Union Traction was dull and steady at 49⅞. American Railways sold up from 44½ to 45, and later reacted to 44⅞. One sale of Rapid Transit at 13 was all that was done in that stock. Only one sale of Consolidated Traction of New Jersey at 65 was reported. Odd lots were recorded of Pittsburg Traction preferred at 49¾, Union Passenger Railway at 230¼, Union Traction of Indiana preferred at 70⅞, and Rochester Passenger preferred at 99¾ and 100.

Chicago

There is a report, which, however, lacks confirmation, that New York capitalists identified with the new regime in the Union Traction Company have obtained options on large holdings of City Railway stock, with a view to the consolidation of the two properties. If this be true, the market at least has failed to give any intimation of it. Only 50 shares of Union Traction common sold all the week at 5½, and only one transaction of the preferred was reported at 27½, while there were no sales of City Railway at all. Metropolitan Elevated issues were stronger, the preferred rising from 46 to 48 an sales of 300 shares, and the common gaining a point from 15⅛ to 16⅛ on sales of a like amount. Good increases in earnings were the cause of this improvement. North western Elevated common changed hands at 16, and 50 shares of the preferred at 44. An odd lot of South Side went at 91. Lake Street receipts after touching 3 sold at 3⅛. A small block of North Chicago passed at 69¼ after which 100 shares sold at 70. One trade in West Chicago was reported at 40.

Other Tractions Securities

Boston traction specialties have varied very little during the week on a light volume of trading. Prices are about the same as they were a week ago, Boston Elevated holding steady around 141, West End common between 90½ and 90, and West End Preferred at 111. Massachusetts Electric common, after selling as high as 18½, weakened to 17¾. The preferred, on a few transactions, recovered from 69¼ to 70¾. In Baltimore

the United Railway issues have been depressed again, more particularly the 4 per cent mortgage bonds and the stock. The first named fell a half a point from 90 to 89½ and rallied to 89¾. After 900 more shares of the stock had passed over at 6½, the quotation was lowered to 6¼, and 180 shares went at that figure. The income bonds sold up to 48¼, 1½ points above their low record of a week ago, but subsequently they eased to 47¾. Other sales in Baltimore for the week comprised Virginia Electric Railway and Development 5's at 93¼, Atlanta Street Railway 5's at 106, Anacostia and Potomac 5's at 97½ to 98, and Lexington Street Railway 5's at 102. On the New York curb the feature has been the strength of Interborough Rapid Transit, which has made a new high record for the season. Three thousand shares changed hands last week between 108¼ and 112½. Six hundred more sold Monday, the high price being 112⅝, while yesterday the stock touched 112¾ and then dropped to 112 on sales of 400 shares. One hundred New Orleans common sold at 8½, and 200 of the preferred from 27 to 26⅝. An odd lot of Washington Traction went at 14. The bonds were strong, rising from 76¾ to 77. Nassau Electric 4's sold at 80 and 80⅛.

Cincinnati Street Railway showed considerable activity in Cincinnati last week. About 900 shares sold at 137½ to 138½, the latter the closing price. Cincinnati, Dayton & Toledo stock was in good demand and about 300 shares in small lots sold at 19½ to 20. Cincinnati, Newport & Covington common was firm at 85½ for a number of sales, and the common sold at 29⅝. Several blocks of the 5 per cent bonds of this company sold at 109, and $20,000 worth of Cincinnati, Dayton & Toledo 5's sold 81.

Cleveland Electric gained a trifle, and several lots sold at 72 in Cleveland last week. Syracuse Rapid Transit came into the market at 75½ for several lots. Northern Texas Traction 5 per cent bonds sold at 78 for $18,000 worth, a trifle lower than last week. There is considerable demand for small lots of these bonds.

Iron and Steel

The leading authority in the iron trade reports a sudden rather remarkable increase in the export movement, which it estimates will shortly reach a rate of 100,000 tons per month for steel and finished products. This is a very gratifying development, in that it provides the one sufficient offset needed for the decrease in home consumption. The home demand continues very light, and the Southern furnace men have found it necessary to make a further concession in their quotations on pig iron. A moderate increase is reported in standard steel rail order, and a more active trade in lighter rail, although at a considerably lower price level. Quotations are as follows: Bessemer pig iron $13.60, Bessemer steel $23, steel rails $28.

Metals.

Quotations for the leading metals are as follows: Copper 13 and 13¼ cents, tin 27¼ cents, lead 4½ cents, and spelter 5 1-16 cents.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid May 17	Closing Bid May 24
American Railways	44½	44½
Aurora, Elgin & Chicago	—	a14
Boston Elevated	140	140½
Brooklyn Rapid Transit	45⅝	46⅞
Chicago City	155	156
Chicago Union Traction (common)	5¼	5½
Chicago Union Traction (preferred)	29	29
Cleveland Electric	—	71
Consolidated Traction of New Jersey	65	64¾
Consolidated Traction of New Jersey 5s	107½	107
Detroit United	61⅜	61⅜
Interborough Rapid Transit	110⅜	112
Lake Shore Electric (preferred)	—	a35
Lake Street Elevated	3	3
Manhattan Railway	142¾	143¼
Massachusetts Electric Cos. (common)	17½	18
Massachusetts Electric Cos. (preferred)	69½	71
Metropolitan Elevated, Chicago (common)	15	16
Metropolitan Elevated, Chicago (preferred)	46	48
Metropolitan Street	110	110¼
Metropolitan Securities	75	77
New Orleans Railways (common)	8	8¾
New Orleans Railways (preferred)	26	26⅝
New Orleans Railways 4½s	76	74
North American	83½	81
Northern Ohio Traction & Light	—	13½
Philadelphia Company (common)	37⅝	37⅞
Philadelphia Rapid Transit	a13½	12½
Philadelphia Traction	95¾	95⅝
St. Louis (common)	13	13
South Side Elevated (Chicago)	91	91
Third Avenue	116	116
Twin City, Minneapolis (common)	93½	94½
Union Traction (Philadelphia)	49⅞	49⅝
United Railways, St. Louis (preferred)	57	57
West End (common)	90	90½
West End (preferred)	a111	111

a Asked.

THE McKINLEY SYNDICATE'S OPERATIONS

The McKinley syndicate, which owns a number of important street railway properties in the West, decided last year on the construction of an extensive system of interurban lines with Springfield, Ill., as a center. Accordingly construction was commenced last year upon 150 miles of line extending from Decatur, Ill., west to Springfield, and south from Springfield to East St. Louis. This line, however, is to be only part of the entire system, which will embrace about 250 miles of road in all. For the convenience of financing, it was found advisable to divide the scheme into small corporations. The name of the Decatur, Springfield & St. Louis Railway Company was dropped and the St. Louis & Springfield Railway Company is now building a road from Springfield south, and the Illinois Central Traction Company is constructng a line from Springfield east. All material is on the ground for 80 miles of the track, extending east and south from Springfield, and this portion of the road, it is expected, will be in operation by Aug. 1. It is planned to begin operating at once about 25 miles of the road from Riverton, on the east of Springfield, to Auburn, on the south. A $400,000 power house is now under construction at Riverton, a town on the Sangamon River about 8 miles east of Springfield. Nearly all the machinery for this power house is on the ground, and same will probably be completed inside of sixty days. W. B. McKinley, of Champaign, Ill., the president and general manager of the Danville, Urbania & Champaign Railway Company, is also president of the Illinois Central Traction Company and the St. Louis & Springfield Railway.

CHICAGO RECEIVERS APPLY FOR INJUNCTION AGAINST MINORITY STOCKHOLDERS

Notice has been served on the attorneys for the minority stockholders of the North & West Chicago Street Railway Companies that the receivers will make application in the State Supreme Court at Springfield for a review of the recent decision of the Court of Appeals by which the injunction against the minority stockholders was dissolved and the decision of Judge Grosscup reversed.

Separate petitions for writs of certiorari are to be filed by the receivers of each company against the plaintiffs in the two cases now pending in the State Court. Practically the same arguments will be made in each application for a writ. It will be alleged that Judge Grosscup in no way exceeded his rights in restraining the minority stockholders from pressing their suits in the State Courts, and that what he did was for the best interests of all concerned.

While planning for this move in the State Supreme Court, the attorneys for the traction companies filed an answer in the State Court in the Jacob-Miller suit, denying the right of the State Court to investigate the affairs of the underlying companies and asserting that the Federal courts are the only courts having jurisdiction over them.

This latest move is merely another attempt by the receivers of the North and West Chicago Companies to have the minority stockholders in the companies enjoined from interfering with the operation of the line by the present management and from seeking in the State courts to have the amended leases existing between these underlying companies and the Union Traction Company annulled.

An American syndicate, represented on the spot by Hugo Gruning, proposes to construct an extensive electric traction system in Rosario, Argentine Republic. The new lines will traverse portions of the city at present unserved by tramways. The existing lines represent an aggregate of about 40 miles, and are mostly horse roads. The principal system is operated by the City of Rosario Tramways Company, which has about 12 miles of track

TRACTION OFFICIALS MAKE LONG TRIP

Henry A. Everett, Charles Wason and several other prominent Cleveland traction men, started Monday, May 23, on a trip over the various traction lines in northern Ohio, Pennsylvania and New York, between which there now are connections. They went as far east as Westfield, N. Y., traversing the Cleveland, Plainesville & Eastern Railway, the Cleveland, Plainsville & Ashtabula Railway, Ashtabula Rapid Transit Company, Pennsylvania & Ohio Railway, Conneaut & Eastern Railway, Erie Motor Company and the Erie Rapid Transit Company. The trip was made in the "Josephine," the private car of Mr. Everett, which was described in the Street Railway Journal of Aug. 29, 1903. While no plans for connecting up the various lines and operating through cars are considered for the immediate future, it is quite probable that the inspection trip may lead to negotiations for arrangements whereby better connections may be afforded passengers who desire to travel considerable distances by the electric lines.

INTERPRETATION OF TRANSFER DECISION UPSETS ENGINEERS

The city engineer of Toledo, Ohio, is just now concerned with the question of what the meaning is of the recent transfer decision handed down by the Circuit Court, and which affects the giving of transfers by the Toledo Railways & Transit Company, which controls all the lines in the city. The whole question, it may properly be said, had its beginning in the action of the City Solicitor, Brailey, who instituted a suit for universal transfers. He passed it on to City Solicitor Denman. The Court rendered a decision, and when it could not be interpreted the judges gave it back to the solicitor and the attorney for the railway. The attorneys, so a supposed reliable authority says, gave their findings to the Court, and the Court gave them back to the attorneys. The problem to be settled rests in the interpretation of the words "the same general direction," which seems to have been the basis covering transfer provisions in all franchise grants. The words of the Court on this matter follow:

"The meaning of the phrase 'the same general direction' as contained in the statute hereinbefore mentioned and herein, is to be determined at the point of intersection or junction of two street railway lines, where such separate lines conjoined and prolonged as herein described will produce the least angle, and is ascertained by drawing straight lines, passing through the most distant point within the city of Toledo of each of such lines of street railway tracks to the point of intersection."

A SAN FRANCISCO RAILWAY PAPER

The United Railroads of San Francisco has commenced the publication of a semi-monthly paper for car distribution entitled "Transit Tidings," very similar in general appearance to those published in Detroit and a few other cities. The first issue of the new paper appeared on April 1, and the four succeeding issues indicate that the paper is readable and newsy and well able to fulfill the function for which it is intended. This, to quote from the official announcement, is to be "a vehicle by which to convey to our patrons and to the public generally, useful items of information concerning our street railway service." The paper contains general news and comments on the first of its four pages, and information in regard to the rent of special cars, observation and funeral cars on the last page.

ORDINANCE AGAINST END-SEAT OCCUPANT IN NEW YORK

San Antonio, Texas, recently passed an ordinance to compel persons who ride in open cars to occupy seats at the far side of open cars, so as to facilitate the ingress and egress of passengers, or in other words passed an ordinance against the individual who has come to be commonly known as the end-seat hog. It is just possible that the ordinance can be enforced in San Antonio, or that the residents will meekly comply with the mandate. That is matter for speculation. But it is not matter for speculation when an Alderman of New York introduces into the Council of that city an ordinance imposing penalties on street railway companies and passengers in any instance when a person occupying the end seat of an open car refuses to change to a vacant seat near the inside.

LUNA PARK SEASIDE FESTIVAL OF BROOKLYN RAPID TRANSIT EMPLOYEES' BENEFIT ASSOCIATION

By special arrangement with Thompson & Dundy, owners of Luna Park, Coney Island, the Brooklyn Rapid Transit Employees' Benefit Association is holding a grand seaside festival at that famous amusement resort. It was intended to begin the outing on May 16, but as some of the principal attractions were not ready on that date, the opening was postponed to May 23. The festival will continue for about two weeks.

The association has placed on sale at all Brooklyn Rapid Transit stations and ticket offices two forms of admission tickets. The ticket sold for 50 cents entitles the holder to visit a number of attractions which usually cost $1.00, while the 25 cent ticket is good for an entertainment which usually costs 50 cents.

PROPOSED MONTREAL-OTTAWA ROAD

The Ottawa River Railway Company, recently chartered by the Dominion Parliament for the purpose of building a railroad system between Montreal and Georgiana Bay, a distance of about 350 miles, proposes to start construction work practically immediately on the Montreal-Ottawa section, which will be electrically operated. Power will be derived from the Ottawa River. T. W. Raphael, a prominent member of the Montreal Board of Trade, is primarily interested in the scheme. The Montreal-Ottawa line is estimated to entail an expenditure of about $3,000,000.

THE ACCOUNTANTS' CONVENTION

A circular issued by W. B. Brockway, secretary and treasurer of the Street Railway Accountants' Association of America, announces Thursday, Friday and Saturday, Oct. 13-15, as the date of the eighth annual convention of that association. Originally but two days were assigned to this association, but as it is impossible to condense the program into that time and still give it good consideration, arrangements have been made to extend the time one day by using a different hall for the opening session. The full program will be published by the association about Aug. 15. The "Inside Inn," which is located within the grounds of the Exposition, has been adopted as the headquarters of the association.

A particularly interesting program is under course of preparation. Part of it will be a joint consideration, with the American Railway Mechanical & Electrical Association, of a subject equally interesting to both associations. Another part will be an expansion of the question box idea into what it is believed will be one of the best of the new branches of association work. This is somewhat of a novel feature in any national association, and blanks are being sent to each of the members of the association upon which queries can be filed. These questions will be printed and sent to each member of the association, with the omission of the name of the member making the inquiry, which will not be known to anyone outside of the secretary. The replies to these questions will then be printed before the convention and will be published for circulation among the members. They, with their answers, will also form part of the program, with opportunity for further discussion. As the compilation and printing require some time, members are requested to send all questions to the secretary by July 1, 1904.

By this action, the association places the combined experience of its members in a very positive way, at the disposal of the smallest and furthest company as well as the largest, which is an advantage of great value. The only condition imposed is that, naturally, the question should relate to an accounting subject.

The last convention directed the rebuilding of the collection of blanks. The secretary announces that this is progressing finely and will be completed and exhibited in the association's meeting room. At the present date over 20,000 blanks have been filed, which, together with others to be mounted, will make the most valuable library of contemporary practice in electrical railway records in the world.

From the above it will be seen that the convention will be an important one, and enough has been said to show that the association does not intend to make it any the less important this year because it is to be held within the grounds of a world's fair. The location means a large attendance, and the value of the program means interest.

NEW RECORDING FARE REGISTER

The patent, No. 758,444, for a fare register issued April 25 to Hyram Tyler, of Dayton, Ohio, and illustrated in the issue of this paper for May 14, has been assigned to John F. Ohmer, and by him to the Ohmer Fare Register Company, of Dayton, Ohio.

DEVELOPMENTS IN THE WESTINGHOUSE ORGANIZATION

A recent development of commanding interest in American industrial organization is the acquisition by the Westinghouse Machine Company of several well-known engineers and officials formerly prominent in the ranks of other industrial concerns. The Westinghouse Machine Company has within recent years been gradually building up its organization in order to more effectively handle the increase of business brought about to a large degree by its development of the steam turbine and the high power gas engine. Its latest action is therefore another step in this direction.

JOHN B. ALLAN

John B. Allan, formerly vice-president and general manager of the Allis-Chalmers Company, will shortly commence his duties as Western manager of the Westinghouse Machine Company, with headquarters at 171 LaSalle Street, Chicago, having direct charge of the entire western district. Mr. Allen has been prominently associated with the Allis-Chalmers Company for the past twenty-four years, and has filled positions of progressively increasing importance, including those of sales manager, general manager and vice-president.

Mr. Allan can truthfully be held up as a shining example of a self-made man. He was born in 1860, at Davenport, Iowa, and received a common and high school education in his native city, followed by a course at the Wooster Polytechnic Institute. from which he graduated in 1880 as a mechanical engineer. He immediately commenced practical work, entering the service of the Edward P. Allis Company, shortly after leaving college, wherein he was successively employed as draughtsman, machinist and erecting superintendent.

During this time Mr. Allan also had charge of making economy tests of engine and steam plants. In January, 1896, the company opened a general sales office in Chicago, of which Mr. Allan was made manager, the engineering as well as the selling departments coming under his supervision. Mr. Allan's subsequent career has been one of continuous advancement. He is a prominent member of the American Society of Mechanical Engineers and the Engineers' Club, of New York.

Arthur West, formerly engineer with the Allis-Chalmers Company, will also augment the organization of the Westinghouse Machine Company as chief engineer. He will make his headquarters at East Pittsburg. Mr. West is eminently fitted for his new position by his experience with the Allis-Chalmers Company, with whom he has been associated with for about seventeen years in various positions. For several years past he has had full charge of that company's entire pumping station work. Mr. West was born at Milwaukee, Wis., in March, 1867, and received a common school education at Milwaukee public schools, supplementing this by a technical course at the University of Wisconsin, from which he graduated in the class of 1887. This was followed by post-graduate work at the same institution, and he then entered the employment of the Edward P. Allis Company as a machinist, and his career with that concern has likewise been one of continuous advancement. Some of the positions which he has filled are those of erecting engineer, assistant to shop superintendent, assistant superintendent, private engineer for Edwin Reynolds in his special work, general trouble engineer on all steam engine work, salesman in pump department, engineer of tests, manager of pump department and finally assistant chief engineer. He is a member of the American Society of Mechanical Engineers and the Engineers' Club, of New York. Mr. West recently started for Europe to investigate the most recent practice of British and Continental engine builders.

It is further rumored that several other engineers of wide reputation will be retained by the Westinghouse Machine Company within a short time.

CHANGES IN PERSONNEL IN PITTSBURG—NEW ROUTINGS FOR CARS

Important announcements have recently been made regarding changes in the personnel of the operating force of the Pittsburg Railway Company, also regarding new routings for cars which are expected to work greatly to the public benefit and reduce the complexity of operation of the various lines involved

The changes in the personnel are almost entirely confined to division superintendents and minor officials. J. S. Shedd, who was assistant superintendent of transportation, has been made superintendent of the Birmingham division, including the Carson Street, Hilltop & Suburban lines. Charles E. Long, who was superintendent of overhead lines, has become superintendent of the Second Avenue division. John B. Loftus, chief despatcher of the Monongahela division, has been made assistant superintendent of Second Avenue. He will have charge of the McKeesport sub-division. J. M. Loftis, superintendent of the Butler Street division, has been transferred to the Homewood division, of which he will be superintendent. C. J. King, chief despatcher in East Liberty, has been made superintendent of the Highland Park division. W. J. Fleming, despatcher on the Butler Street division, has been made superintendent.

The change in the routing of the cars effects several important lines. The Verona cars, which have been running through to the city, will have their terminus at Wilkinsburg Junction, where city-bound passengers will be transferred to the Swissvale and Rankin and East Pittsburg and Wilkinsburg cars. The Lincoln and Ellsworth route has been discontinued, and a new route, known as Lincoln and Liberty, substituted. Instead of coming to town via Elleworth and Forbes Avenue, the Lincoln Avenue cars will come in by Liberty Avenue to Wood, to Water, to the Baltimore & Ohio Station and return east by the same route. Changing these two routes will help the congestion of cars in Sixth Avenue and Wood Street, and at the same time benefit Wilkinsburg. They will now have a cross-town, through service which they never had before for 5 cents. The transfer car between Crafton Junction and Thornburg, on the West End division, has been abolished on every other car on the Crafton and Ingram route will run through to Thornburg. This will give Thornburg people a ten-minute service from Pittsburg.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED MAY 17, 1904.

759,858. Air Brake Mechanism: Gus. A. Brooks, Covington, Ky. App. filed June 15, 1903. Means whereby when the car motor is driven as a generator by the momentum of the car, the current will be supplied to a motor to drive an air compressor for operating the brakes.

759,870. Unbroken Main Line Switch; George M. Ervin, Johnstown, Pa. App. filed Aug. 1, 1903. A movable deflecting tongue in the outer side of the branch track or turnout, a movable lifting tongue at the inner side of the track and a connection between said tongues whereby they may be moved in unison.

759,871. Unbroken Main Line Switch; George M. Ervin, Johnstown, Pa. App. filed Aug. 1, 1903. A deflecting tongue at the outer side of the switch, a lifting tongue at the inner side thereof and movable to and from the head of the adjacent main rail from the inner side of the same.

760,079. Trolley; Frank A. Overdier, Columbus, Ohio. App filed June 30, 1903. Two wheels arranged tandem in a harp mounted upon a vertical axis at the end of the pole.

760,145. Guard for Trolley Wheels; Charles O. Phillips, Kalamazoo, Mich. App. filed March 2, 1904. Details.

760,163. Trolley Catcher; Irwin W. Smith, Dayton, Ohio. App. filed Jan. 25, 1904. Details of a spring drum and pawl and ratchet arrangement for controlling the cord.

760,184. Trolley Pole Head; Robert I. E. Dunn, Dallas, Tex. App. filed Aug. 29, 1903. Details.

760,223. Electric Railway; Thomas D. Lovell, Beverly, Mass. App filed Jan. 22, 1904. A system for single roads wherein the movement of the cars in a block automatically cuts off current from adjacent blocks.

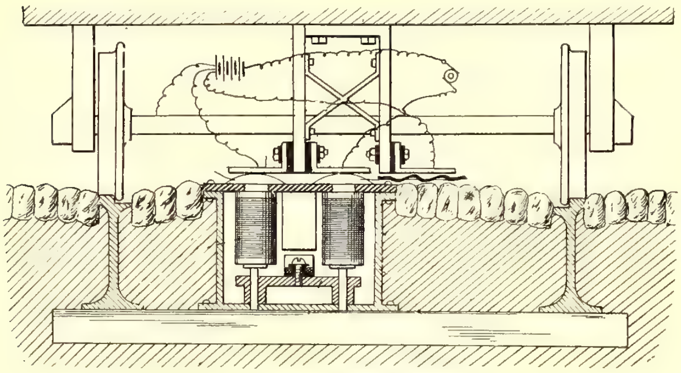
760,231. Trolley Base; Peter David Milloy, Buffalo, N. Y. App. filed Nov. 16, 1903. The object of the invention is to produce a low-down base in which the revolving section surrounds and incloses a large portion of the fixed section and revolves upon horizontal bearings which are concealed from exposure to the elements.

760,292. Maximum Traction Truck; Walter S. Adams, Philadelphia, Pa. App. filed Aug. 29, 1903. The car body is supported by a frame which is swung from spring supports on the side frames of the truck.

760,293. Maximum Traction Truck; Walter S. Adams, Philadelphia, Pa. App. filed Aug. 29, 1903. See preceding patent.

760,294. Maximum Traction Truck; Walter S. Adams, Philadelphia, Pa. App. filed Aug. 29, 1903. See patent 760,292.

760,305. Coupling for Electric Wires; Ricardo Garibay Castillo, Mexico, Mex. App. filed Sept. 9, 1903. Comprises a block of insulating material, a coupling wire secured thereto, conductor wires attached to the block and mercury cups carried by the conductor wires to receive the ends of the coupling wire.



PATENT NO. 760,325

760,325. Electric Railway; William R. Fearn, Camden, N. J. App. filed Dec. 16, 1903. Details.

760,330. Trolley Pole; James Furgason, Montour Falls, N. Y. App. filed May 28, 1903. Details.

760,379. Convertible Car; John A. Brill, Philadelphia, Pa. App. filed Aug. 29, 1903. Relates to the provision of a step for use when the car is used as an "open" car.

760,380. Maximum Traction Car Truck; John A. Brill, Philadelphia, Pa. App. filed Aug. 29, 1903. Details.

PERSONAL MENTION

MR. GEORGE O. NAGLE, general manager of the Wheeling Traction Company, of Wheeling, W. Va., is to be married on June 8 to Miss Helen S. Williams, daughter of the Rev. Hugh Spencer Williams, of Memphis, Tenn.

MR. E. H. RAUPP, chief train dispatcher of the Rochester & Eastern Railway, of Rochester, N. Y., has resigned to accept a similar position with the Detroit, Monroe & Toledo Short Line, with headquarters at Detroit, Mich.

MR. S. W. CHILDS, who superintended the building of the Kalgoorlie & Perth (Western Australia) Electric Tramways, has been appointed to take charge of the construction of the Conneaut Traction Company's system at Conneaut, Ohio.

MR. W. S. TURNER, who recently returned from New Zealand, where he superintended the construction of the extensive Auckland Electric Traction system on behalf of the contractors, J. G. White & Company, will supervise the building of the Youngstown (Ohio) & Southern Railway.

MR. CHARLES T. YERKES arrived in New York from London last week. Mr. Yerkes says rapid progress is being made in the construction of the underground lines in the British metropolis, and that he hopes to have the Metropolitan District line in operation by Jan. 1.

MR. BRIGGS KECK, formerly treasurer of the United Railways & Electric Company, of Baltimore, Md., has returned from the Philippines, where he recently went in behalf of J. G. White & Company, of New York, who have the contract for the construction of the Manila Electric Traction system.

MR. J. A. McFARLAND has resigned as superintendent of the Steubenville, Mingo & Ohio Valley division of the Wheeling Traction Company, of Wheeling, W. Va., so as to go west for the benefit of his health. Mr. McFarland is succeeded by Mr. John Marsh, assistant superintendent of the company.

Mr. GEORGE M. HENRY, formerly general passenger and ticket agent of the Detroit Southern Railway (steam), and later with the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., in the capacity of special inspector, has been appointed general passenger and freight agent of the Detroit, Monroe & Toledo Short Line, which is now operating between Toledo and Detroit.

MR. M. R. McADOO, president of the Compania Mexicana de Traccion (the Mexican Traction Company), which concern, as noted in the STREET RAILWAY JOURNAL, April 9, has merged with the Compania de Ferrocarriles del Districto de Mexico, S. A. (the Federal District Tramways Company, Mexico City, the system which is usually referred to as the Wernher-Beit road), is now in New York. He expects to be here for three weeks or so, and will make his headquarters at his brother's offices, 15 Wall Street.

MR. A. E. WORSWICK, formerly chief engineer of the extensive electric traction system in Mexico City, controlled by Wernher, Beit & Company, of London, has been appointed consulting electrical engineer for Sir Weetman D. Pearson, M. P., chairman of the British contracting concern of S. Pearson & Son, Limited. The Pearson people have considerable electrical work in hand in Mexico, and are now contemplating the conversion and extension of the Ferrocarril de Veracruz, of which Sir Weetman is the president. The existing line is about 12 miles long. It is a horse road. Mr. Worswick will make his headquarters in Mexico City.

HERBERT E. REED, formerly superintendent of the Northampton Traction Company's lines in and around Easton, Pa., is now in charge of the Trenton & New Brunswick Railroad, of Trenton, N. J., having succeeded Mr. A. C. Harrington, who resigned on account of ill health. Mr. Harrington succeeded E. T. Wagenhals as superintendent of the Trenton & New Brunswick Railroad, the latter returning to Cincinnati, Ohio, about two months ago to assume charge of railroad construction work. Mr. Reed brings to the Trenton & New Brunswick Company a wide range of experience in the electric railroad field, which has been crowned with success.

MR. EDWARD C. BOYNTON has been retained as electrical engineer of the Poughkeepsie City & Wappingers Falls Electric Railway Company, of Poughkeepsie, N. Y. Mr. Boynton has been connected for a number of years past with the New York office of the National Electric Company. He was one of the pioneers in the application of electricity to heavy electric railroading and was for a long time a member of the electrical engineering staff of the New York, New Haven & Hartford Railroad, and at the time he left that company to associate himself with the National Electric Company, was electrical engineer of the New Haven road. Two contributions from his pen have appeared in recent issues of this paper.

MR. E. H. McHENRY has been appointed fourth vice-president of the New York, New Haven & Hartford Railroad, a position just created, and in which he will have charge of all the electric railway lines controlled by the company. Mr. McHenry is 45 years old, is a graduate of the Pennsylvania Military College, and completed his education abroad. He was for nineteen years connected with the construction and operation of the Northern Pacific Railroad, and was chief engineer and receiver of that property pending its last reorganization. He spent some time in China, Japan and the Philippines, returning two years ago to become chief engineer of the Canadian Pacific Railway. He will assume the duties of the new office with the New Haven July 1.

MR. J. T. HAMBLETON, superintendent of the Susquehanna Traction Company, of Lock Haven, Pa., has resigned from the company, his resignation to take effect not later than June 1. Mr. Hambleton has accepted the position of superintendent of the Slate Belt Street Railway, of Pen Argyl, near Allentown, which comprises the Slate Belt and the Bethlehem & Nazareth Companies. Both these roads were constructed by Mr. Hambleton about four years ago, and were operated by him until he accepted the position in Lock Haven. About that time both lines were leased by the Lehigh Valley Traction Company, of Allentown, but the properties recently reverted to the original owners, owing to the reorganization of the Lehigh Valley Company.

SEVERAL CHANGES are announced in the management of the Pennsylvania & Mahoning Valley Railway Company, with headquarters at New Castle, Pa. Mr. M. E. McCaskey, who has been in charge of the New Castle division of the system, has been made second vice-president and general manager of the entire property. Mr. W. C. Smith will act as manager of the Youngstown division of the system. Mr. J. M. Walker has been appointed chief engineer, succeeding Mr. John Wolff. Mr. F. C. McGonigle succeeds Mr. Wolff as purchasing agent and will continue in charge of the lighting department. Mr. W. T. Burns has been appointed auditor and assistant treasurer. Mr. Fred Carpenter, who has been excursion agent for the company, has been promoted to the position of general freight and passenger agent. The operating headquarters of the system will be located in New Castle, and it is probable that all the offices will be centralized there.

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, JUNE 4, 1904. No. 23

Published Every Saturday by the
McGRAW PUBLISHING COMPANY

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues).............................. $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL
114 Liberty Street, New York.

Track Depreciation

The past two weeks have witnessed the removal of the paving around a piece of track in St. Louis which is of considerable historical interest. This track is located in North Broadway, and was laid just ten years ago with electrically-welded rail-joints. A large number of the joints in this track proved defective during the summer of 1894, immediately after they were laid, owing to the fact that the weld was not really complete. Many of the defective joints were cast welded the following fall, at the same time that the first piece of cast-welded track ever laid was placed at the southern end of the Broadway line. This track on North Broadway, since the imperfect joints were repaired, has remained in very good condition during the ten years that it has been in use. The paving having been removed for the purpose of shifting the track, with reference to the center of the street, an excellent chance was afforded to study its condition and form some conclusions as to track depreciation. In this track the joints have lasted as well as the balance of the track. The rail wear has been simply that of the rolling down and wearing off of the rail head. The rails, which were girder, were laid on braced tie plates, on ties without tie-rods. They have kept gage well, and the ties are apparently in good condition. The rail heads have in some places worn down until the wheel flanges touch the tram, but the number of such worn places is not considered yet sufficient to necessitate relaying the track.

The traffic over this line was comparatively light when the track was first laid, as it was started as an electric extension and feeder of the old Broadway cable line, with single-truck cars about 9 minutes apart. Just what the average has been for the ten years of its life would be difficult to determine, owing to changes in management and to traffic conditions, but it would probably not average more than a car every 5 minutes during the business portion of the day. The line has had maximum traction trucks running over it for the greater part of its life. This example of track depreciation is interesting, because it represents about as near average conditions as can be obtained, and it is simply a case of track wearing by virtue of the wheels that have passed over it without any complications introduced by defective joints, poor ballast, spreading of the gage, or any of the other diseases caused by poor construction, which frequently cause the wearing out of a track before its time.

The Gas Engine Situation

Among the papers read at the recent convention of the National Electric Light Association was one upon gas engines, which is deserving the attention of every power producer. We have repeatedly written of internal combustion engines in their relations to large power production, and with every succeeding year the subject gathers importance. Most Americans when gas engines are mentioned call to mind the picture of a little wheezy, thumping machine, mostly fly-wheel and base, staggering and halting under its load, and altogether unworthy of serious attention. But the subject has now assumed grave importance, and no amount of contemptuous neglect will suffice to push it into the background. The paper in question sets forth the present state of the art very clearly, and shows that even at the present time the internal combustion engine must be reckoned as a formidable competitor of the steam engine in central station working. Broadly, the situation is this: For a given electrical output the fuel cost for an internal combustion engine is just about one-third the same as for a steam engine. Suppose that next year a steam engine were produced which gave the brake horse-power-hour on between 4 lbs. and 5 lbs. of steam, how long could our present engines and turbines stay in the game, even at half the original cost of installation? Yet this saving is an accomplished fact with internal combustion engines, according to the performance tests which have been published.

But the idea is unfamiliar, the engine looks strange and misshapen, and the producer used in connection with it does not resemble our familiar boiler, and, therefore, the average engineer looks at it askance and moans that it is impractical or experimental, or something else that he does not quite understand. In spite of this the internal combustion engine is coming steadily into use in large units. The difficulties of regulation once considered serious have been, for the most part, overcome, so that even a railway load is being successfully handled in several instances, and there is not the slightest reason to sup-

pose that the general principles of good government cannot be applied to such engines as successfully as to steam turbines or water-wheels. Of course, the mere unfamiliarity of the apparatus will, for a time, count against it, especially since its manufacture in large units has been hitherto mainly European. It needs the active competition that comes from vigorous exploitation to give it the prestige that counts for more than intrinsic merit in certain stages of an art's development.

It is now certain that large internal combustion engines will be actively pushed on the American market within the next year or two, and the immediate result of this activity will be not only to bring the engines into use but will reduce the somewhat high cost, which is the chief valid argument against the type. If the steam turbine had not been taken up and pushed by several huge manufacturing concerns in this country it would still be considered an interesting freak, and the public would have still doubted its practicability. The same effects will follow the exploitation of the internal combustion engine on a large scale. There is no good reason why its cost should remain at anything like present figures, although it is relatively bulky and heavy in its usual form. In the long run the advantage is likely to remain with the prime mover, which demands the least fuel for a given power, save in cases where extreme lightness and compactness have a large direct value aside from sentiment. At equal efficiencies the cheaper machine will win out, as when the steam turbine competes with an engine of the ordinary sort. But to-day even in sizes as low as 100 hp responsible makers are willing to guarantee the brake horsepower on 1.25 lb. of coal in the producer, and in such a condition relatively large first cost is justified. As the cost of fuel rises and the current rate of interest on investments diminishes, by so much the more does the scale turn in favor of the prime mover of great thermodynamic efficiency. The internal combustion engine, therefore, must be reckoned with from now on an important factor in power production.

The Trifling Delay

There are many minute details which go to make up the sum total of time required to make a round trip in street and elevated railway service. It is difficult to predict or to theorize in advance as to the effect that a change in any one of these details will have on the whole running time. A most interesting illustration of this occurred recently on a certain street railway line operating on a very fast schedule in a large city. The motormen had been in the habit of starting the cars with a jerk; a habit, no doubt, partially brought on by a desire to start quickly and partly due to carelessness. The cars were equipped finally with a device for limiting the rate of turning on current. It soon came to be reported around that it was easier to maintain schedule time with the cars equipped with the restricting devices than with those not so equipped. While such a result might have been predicted by an electrical or mechanical engineer on the theory that there would be less slipping of wheels, even the most ardent advocates of the device failed to predict the real reason given by the conductors of the cars after the device had been put in use. This was that in very many cases when feeble persons, or persons carrying children, were boarding the cars, a conductor could feel safe in giving a go-ahead bell much sooner if he knew that the car would not start with a jerk than he could if he were tolerably certain that the car would be started so abruptly that a feeble person must be either seated or supported to prevent an accident. The cars on this line had several steps from the car floor to ground, and the conductors did not feel safe in starting the car with a woman climbing the steps, because of the liability of a jerk which would throw her to the ground. Here was a factor in the time-table which had been entirely unthought of, and it is likely that there are many more such.

A few years ago the Minneapolis plan of placing gates, operated by the motorman, on all cars, and opening them only when the cars are at a dead standstill, was suggested. Immediately it was argued that there must be a considerable loss of time on a car equipped with these gates, as compared to the ordinary car, for the reason that often a car will not come to a full stop for an able-bodied man if it has not gates. As a matter of fact, the cars equipped with the Minneapolis gate make the same schedule as they did before they were so equipped. It may be a little more difficult to keep them on schedule, but the fact remains that they make it year in and year out. Time is lost in some stops, because of the gates no doubt. In other cases there is a gain. For example, a motorman may think he will not need to come to a full stop to take on an active looking man. He may finally have to stop after drifting at slow speed for several feet, and in the long run may loose more time than if he had stopped promptly in the first place. The whole problem is full of factors little considered.

Another case where theory and practice did not correspond was as regards the comparative schedule time that could be made by long as against short cars in city service. Street railway men operating in large cities, many of them, held the theory for a long time that a long car in such service would necessitate a slower schedule than a short car, because of the time required for persons to get from the middle of the car to the step. This argument might hold in an easy-going small town, where passengers expect to remain seated until the car stops. But in large cities the argument is absolutely worthless, simply because the majority of people will be at the car step ready to get off the moment the car stops, without regard to whether the car is 10 ft. or 60 ft. long. More passengers must get off the long car at transfer points, it is true, but this delay is compensated for by the wider doors and longer platforms of the long cars.

On elevated roads a small factor of the delay of trains at stations is due to the bell signals commonly used. On a six-car train, if the rear guard is the last man to close his gates, a delay of from 3 seconds to 5 seconds is caused, simply by the length of time taken to signal by "two bells" from one guard to the next the length of a six-car train. This loss of time does not occur at each stop unless the rear guard is especially slow about getting his passengers loaded and unloaded. It would be exaggeration to say that the loss of time in this way is very great, but it is one of the small items that go to swell the total of time lost. We have already referred in this paper to the possible saving in time in elevated service by the use of a side aisle, side entrance car of the type recently adopted by the Illinois Central in Chicago. With our present rapid rates of acceleration and braking the only hope for any important further reduction in schedule speeds lies in reducing the length of the station stop.

The New York Aldermen

Time-honored traditions have become reversed during the last year, and particularly during the last two weeks, by a remarkable spectacle which has been exhibited by the New York Board of Aldermen. Since the time when the memory of man runneth not to the contrary, Aldermen, according to the popular idea, have been ever prone to sacrifice the interests

of the city to those of corporations, and award the latter franchises over public streets for inadequate compensation. This idea must now be changed in view of the extended hearing which has been conducted by the Board of Aldermen in New York to prove that they have not demanded money for attending to a neglected duty. The New York & Portchester Railway Company has been before the Board for more than a year to secure its approval of its franchise for a high-speed electric railway connecting the Borough of the Bronx with Mt. Vernon, Portchester and other suburban cities along the Sound. The road has the endorsement of all the residents of these places, as expressed through their authorities and in frequent indignation meetings which have been held as a result of the holdup in the Board of Aldermen. The franchise has also been approved by all of the representative bodies of citizens in the Borough of the Bronx which have taken action upon it, by the Merchants' Association of New York, and by other distinguished bodies of citizens, all of which have urged the Aldermen to grant the franchise or give some good reason for not doing so. This the body has refused to do up to the present time. As a substitute it has a held a public hearing to prove that no one has offered to pay any of the members for passing the franchise, and that no member has offered his influence for private compensation. This may be admitted, but a question which cannot be so easily answered is, why is a road which is so greatly wanted by the public at large refused consideration, and will the Aldermen permit the people whose property will be affected by the construction of this road have something to say about it?

Automobiles and Street Cars

In a recent address before the Economic Club, of Boston, John Brisben Walker, editor, automobilist, social reformer, poseur and advocate for all generally unpopular causes, denounced earnestly all modern methods of rapid transit upon tracks. With 5000 automobile 'buses, on which he would probably not be unwilling to furnish estimates, he would do the entire rapid transit business of greater New York, and relegate all street cars to the ash heap of civilization. His plan would, unquestionably, be good for the automobile business, but where would the public come in? In spite of Mr. Walker and other automobile boomers there are still many, yes very many, persons who have to use the streets for other purposes than scorching, and the effect of 5000 huge automobiles trying to get down town all at once is something in which the walking public has more than a passing interest. Of course, no proper chauffeur admits that the pedestrian has any rights, or that any vehicle less massive than a steam roller deserves the slightest consideration, but considering the trouble from blockades already existing, one must look with reprobation on unconditional surrender to the Vermilion Peril. The promiscuous use of an indefinite number of public automobiles, however useful it might be as a stimulant for the manufacturer, is utterly impracticable on city streets as at present constituted. Vehicles enough even partially to replace the street cars now in use would render the streets utterly impossible for any other kind of traffic, a phase of the matter which would-be reformers do not seem at all to realize.

If passenger traffic is to be attempted with a large number of capacious high-speed vehicles, not confined to any track, the conditions become incompatible with the use of the streets by pedestrians or by any other vehicles. At considerably increased cost and danger to life and limb it would, doubtless, be possible to carry a very large volume of traffic by automobiles if a clear way were provided. To attain anything like the speed reached on underground electric roads, however, the way must be absolutely clear of all other traffic, and all the vehicles using it must work at the same general level of speed. Granted this complete surrender of a street, or system of streets for rapid transit, the way could still be most efficiently utilized by laying out a four-track or six-track electric car system, since the power available for fast running and rapid acceleration can be taken from a trolley wire far more readily than it can be generated on the vehicle, and much less power would be required for the same service than if the tracks were abolished. The street car replaced the omnibus by reason of the ease with which large numbers of passengers could be conveyed on tracks which both gave easier traction and checked blockades. For the same reasons the electric car will hold the supremacy as a traffic carrier against any system of vehicles running on roadbed inferior to track, and running without the control given by the confinement to a track. Fancy the disastrous results of a huge automobile omnibus breaking down in the thick of the morning rush. A breakdown on a track is bad enough, although the next car generally comes quickly up and helps the cripple, but in a tangle of flying automobiles a break means a blockade, and probably three or four 'busses piled into a mass of shattered woodwork and humanity drenched in blazing gasoline. If a whole street is given up to the purposes of rapid transit, immense carrying power is gained as a matter of course, but it can best be gained by fast electric trains. The viaduct proposition has, in fact, often been made, but it has steadily been rejected on account of the enormous cost of condemning the necessary property. Costly as a subway is, it is cheap compared with a viaduct, and viaducts of immense cost are what Mr. Walker's proposition requires.

No man, with a reasonable knowledge of mechanics or of the properties of prime movers, can fail to recognize the limitations of the self-propelled vehicle in cases where large power is necessary. There are, of course, hosts of automobile cranks who believe anything they are told by the manufacturers, and when Mr. Vanderbilt, or some other notoriety, breaks a record at Palm Beach, immediately jumps to the conclusion that railway trains will soon be a thing of the past, forgetting how large an amount of New York Central dividends it takes to keep Mr. V's automobile racing stable in commission. Of course, few rational persons take Mr. Walker very seriously, and in this land of free speech any one who desires can get into his soothsayers' togs and set up in business as a prophet. But the matter has a somewhat serious side, in that loud talking, however foolish, is heard by many people, and out of the many is believed by some. A sufficiency of talking about automobile omnibuses will set some enthusiast, with more funds than discretion, at trying it on, and then there will be trouble as long as the money holds out. The electric roads need not concern themselves about the direct competition involved, but there will probably be many instances in which a franchise, really needed for public convenience, will be held up by a bluff, based on an automobile line that nobody really means to establish. The game has, in fact, been tried with some success, and it behooves the electric roads to stand together and fight the humbug to a finish. Particularly to be blocked are all attempts to raise the speed limit for automobiles beyond that permitted for electric cars. If vehicles on a definite track are held down to 15 m. p. h. it is gross injustice to permit automobiles, which are far more dangerous to vehicles in general, to run at any higher speed. A public automobile should certainly be kept to the limits which other public vehicles have to respect.

THE LEICESTER CORPORATION ELECTRIC TRAMWAYS

On May 18 the newly constructed Leicester Corporation electric tramways were formally opened for public use by Councillor Samuel Flint, the chairman of the tramways committee. Leicester, which has a population of about 220,000, is one of the last of the large English cities to adopt electric traction. The street railway system in the city, which was then being operated with horses by a private company, was purchased by the municipality late in 1901 for £134,000. E. George Mawbey, M. I. C. E., was appointed engineer; E. Manville, of Kinkaid, Waller, Manville & Dawson, consulting engineer, and E. Lucas, operating manager. Steps were immediately taken to convert the lines to electricity and the necessary contracts were placed.

LEICESTER TRAMWAYS—CLOCK TOWER JUNCTION, SHOWING SPECIAL WORK

TRACK CONSTRUCTION

The tramway system authorized by Parliament comprises 19½ miles of double track and 3½ miles of single track, being equivalent to over 42 miles of single track. The track construction was commenced in April, 1903, and notwithstanding the abnormally wet weather which has prevailed throughout most of the period of construction, the total length of track which it was decided to carry out immediately, amounting to about 33 miles, was completed in April last, and the remainder is in hand.

Generally speaking, the routes comprised in the scheme are moderately straight, with no excessive grades, the steepest being 1 in 16 for a distance of about 50 yds. It has been found necessary, however, to lower the roadway under seven of the railway bridges, in one case as much as 2 ft., in order to obtain sufficient head-room for double-deck cars.

The sharpest curve on the system is 37 ft. radius to the center of the track. A minimum radius of 40 ft. for all curves was aimed at, and with one or two exceptions this has been attained. The distance from center to center of tracks with side pole construction is 8 ft. 1 in., giving 3 ft. 4½ ins. from gage edge to gage edge between tracks, and for center pole construction 10 ft. 11½ ins., giving 6 ft. 3 ins. between tracks. The gage of the track is 4 ft. 8½ ins.

The rails, which are in 45-ft. lengths, weigh 100 lbs. per yard for the straight track, the grooves being 1⅛ ins. wide. The curve rails weigh 105 lbs. per yard, the grooves being 1¼ ins. wide. Both rails are 7 ins. deep and 7 ins. across the flange. The angle plates weigh 54 lbs. per pair, and are 2 ft. in length, each being drilled for six 1-in. diameter bolts. Cooper patent base plates are used on all joints, being secured to the rails with twelve ¾-in. diameter steel rivets except on special track work, where bolts are used. The tie-bars, 2 ins. x ⅜ ins., are placed 7 ft. 6 ins. apart. The composition of the steel for the rails is as follows:

Carbon, between 0.4 per cent and 0.55 per cent.
Manganese, under 1.00 per cent.
Phosphorus, not to exceed 0.07 per cent.
Sulphur, not to exceed 0.07 per cent.
Silicon, not to exceed 0.07 per cent.

The composition of the steel for the fish-plates is similar to the above, except that the carbon is between 0.25 per cent and 0.35 per cent.

In laying the track the ground was excavated to the required depth, and the rails laid and packed up to the required level on wedge-shaped blocks of concrete, 10 ins. square at the base and 8 ins. square at the top. Where bad ground was met, or

the surface worked up owing to inclement weather, these blocks were again supported on circular blocks of concrete, 6 ins. thick and 18 ins. in diameter, to distribute the weight over a greater area. When the rails were leveled up, a concrete foundation, composed of six parts of granite and Destructor clinker to one part of best Portland cement, was then laid, a space of about 1 in. being left under the rails for packing, great care being taken to make the concrete perfectly solid for a space of 6 ins. on each side of the flange of the rails. The space between the concrete and the rails was then very carefully packed by means of beater picks with 6 to 1 fine concrete in a semi-dry condition. The total depth of concrete under the rails is 7 ins., and under the paving 6 ins.

Ample provision has been made for the drainage of the track. In addition to a liberal supply of drain boxes on all the tracks, all the switches have a 4-in. diameter spigot cast on to the drainage box, which is trapped and connected to the sewer. The drains from these boxes pass through a disconnecting chamber in which a slit pit is formed before being connected to the sewer. Generally speaking, the track has been paved with 5-in. x 3-in. granite blocks from the local quarries, except in the center of the town, where 9-in. x 4-in. x 3-in. hardwood blocks were used. The granite blocks were laid on a bed of gravel and grouted up with pitch. The wood blocks were laid on 1 in. of cement screeding. The rails were supplied by the North Eastern Steel Company; the bolts, nuts, tie-bars and copper bonds by R. W. Blackwell & Company, Ltd., and the special work by Hadfield's Steel Foundry Company, Ltd. All of the switches and crossings furnished by this latter company are provided with manganese steel renewable centers.

The most important piece of special work on the system is that at the Clock Tower Junction, illustrated in two of the accompanying engravings. This is said to be the largest tramway junction in the United Kingdom. Its total weight is over 100 tons, but it was so carefully designed that it was laid by the Corporation staff in ten days.

The bonds used are of the solid copper Crown type of No. 0000 B. & S. gage. Two bonds are inserted at each rail-joint. The track is cross bonded every 40 yds., and the two tracks every 80 yds. Where special track work occurs the castings are connected to adjacent rail ends by 30-in. bonds, and are also bridged by long bonds joining rail to rail.

COMPLICATED OVERHEAD EQUIPMENT AND SPECIAL WORK AT CLOCK TOWER

AYLESTONE ROAD, WITH GAUNTLETED TRACKS

SPAN POLE CONSTRUCTION—GRANBY STREET

ENGINES AND GENERATORS

The engines are of Messrs. Yates & Thom's vertical cross-

compound Corliss condensing type, having cylinders placed at opposite ends of the crank shafts with the crank shafts at right angles. The cylinders are 22 ins. and 44 ins. diameter respectively, 3-ft. stroke, and the engines are intended to run at 95 r. p. m. The normal load of the engine is 500 kw, with a steam pressure on the top valve of 160 lbs. per square inch. The high-pressure cylinder is steam jacketed with boiler pressure steam. In addition to the ordinary governor, which is a very sensitive one, the engine is fitted with a special safety stop, which will operate in case the engines reach a speed of 10 per cent above the ordinary working speed. It will also stop the engine in the event of any failure of the governor gear, although it does not interfere with the engine taking excessive overloads, even beyond the full range of the cut-off gear. The flywheel is 16 ft. diameter and weighs about 25 tons.

A very complete system of lubrication has been supplied to these engines, consisting of two ram pumps worked by a drag shaft from the main cranks, and delivering oil under pressure to all the main bearings about the engines.

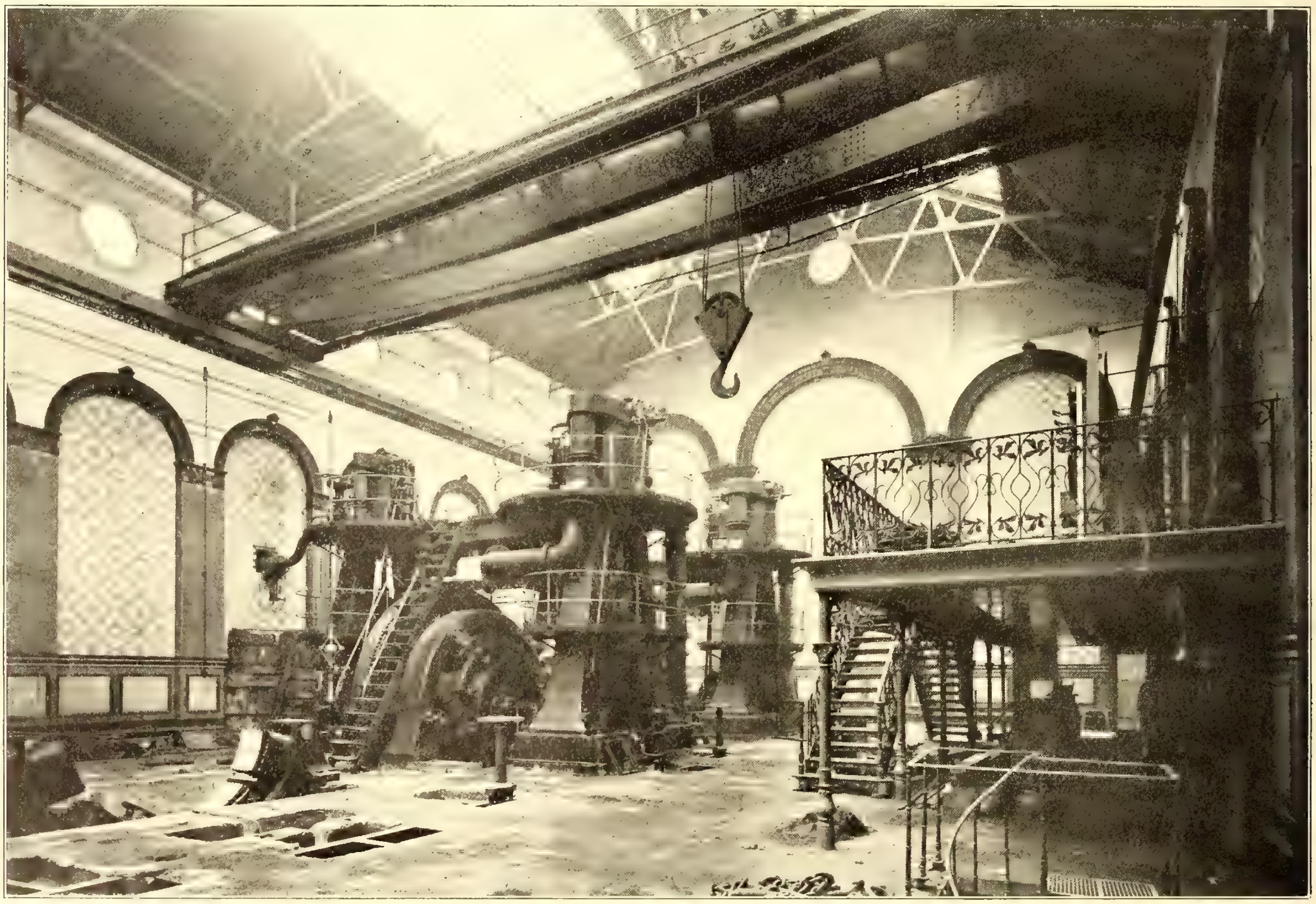
Each engine is directly coupled to a Dick, Kerr 500-kw direct-current railway generator.

SWITCHBOARD

The switchboard, which was also supplied by Dick, Kerr & Company, consists of twenty-five panels of white marble, controlling, besides the three 500-kw generators, a negative feeder booster set of 20-kw capacity, a positive feeder booster set of 60-kw capacity, an automatic reversible battery booster set of 40-kw capacity, the station lighting and motors and the distribution. The general arrangement of the switchboard and the diagram of connections are shown in the illustrations.

CONDENSING PLANT

The condensing room plant consists of a surface condenser capable of dealing with 25,000 lbs. of exhaust steam per hour, and was manufactured by the Mirrlees Watson Company, of Glasgow. The exhaust steam from the several engines is led into a common exhaust main running to the condenser house, with a branch for free exhaust, controlled by an automatic atmospheric relief valve. Before reaching the condenser the exhaust steam passes through an oil separator, manufactured by the Klein Company. The surface condensing plant consists of a set of twin electrically-driven Edwards air pumps and a centrifugal circulating pump, both driven by a double-wound series parallel motor. The condenser, which has 2500 sq. ft. of cooling surface, is designed on the counter-current system, the exhaust steam and cooling water each passing twice through the full length of the condenser and in opposite directions. Suitable baffle and diverging plates are arranged so as effectually to distribute the steam over the entire surface of the tubes. The air pumps have barrels 18 ins. diameter by 10-in. stroke, and run at a speed of 100 r. p. m. The centrifugal pump is capable of delivering 1500 gals. per minute, regulated by means of a series parallel controller. A small plunger pump is carried on the air pump bed-plate, and driven from a crank disc mounted on the end of the crankshaft. There is another small pump driven by chain gearing, which draws the oil and water from the oil separator and discharges same into the waste oil tank.



GENERAL VIEW OF ENGINE ROOM, MAIN POWER STATION

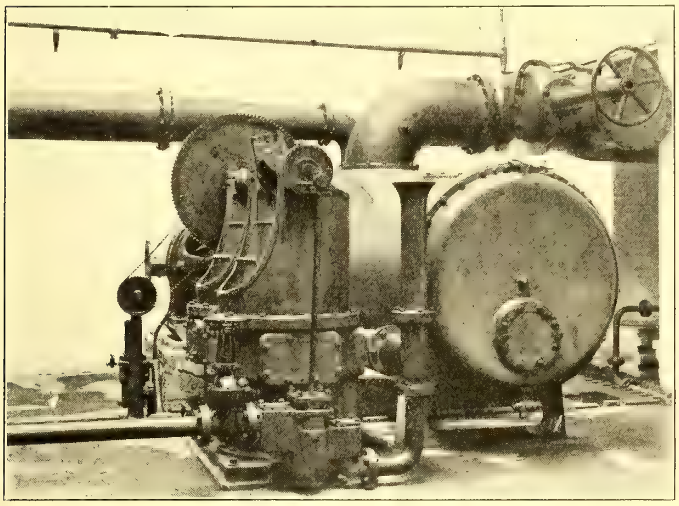
THE BATTERY AND BOOSTER

The battery is composed of 240 cells of the standard Tudor pattern, type No. 413 HF 19. It is capable of giving 600 amps. for one hour, or 900 amps. for short periods, and can be charged normally at 270 amps., or at 450 amps. for short periods. The cells are in lead lined wood boxes, resting on glass oil insulators. The stands are entirely of pitch pine without any metal fastenings, and rest on large porcelain oil insulators. The battery is used in connection with a reversible booster controlled by means of a Thury's patent regulator. This booster has a smooth armature core and tangential field coils. As the arma-

ture winding is placed as near as possible to the periphery, and as the field iron is reduced to its possible minimum amount, the machine is most sensitive, and is claimed to act almost as quickly as the load peaks occur.

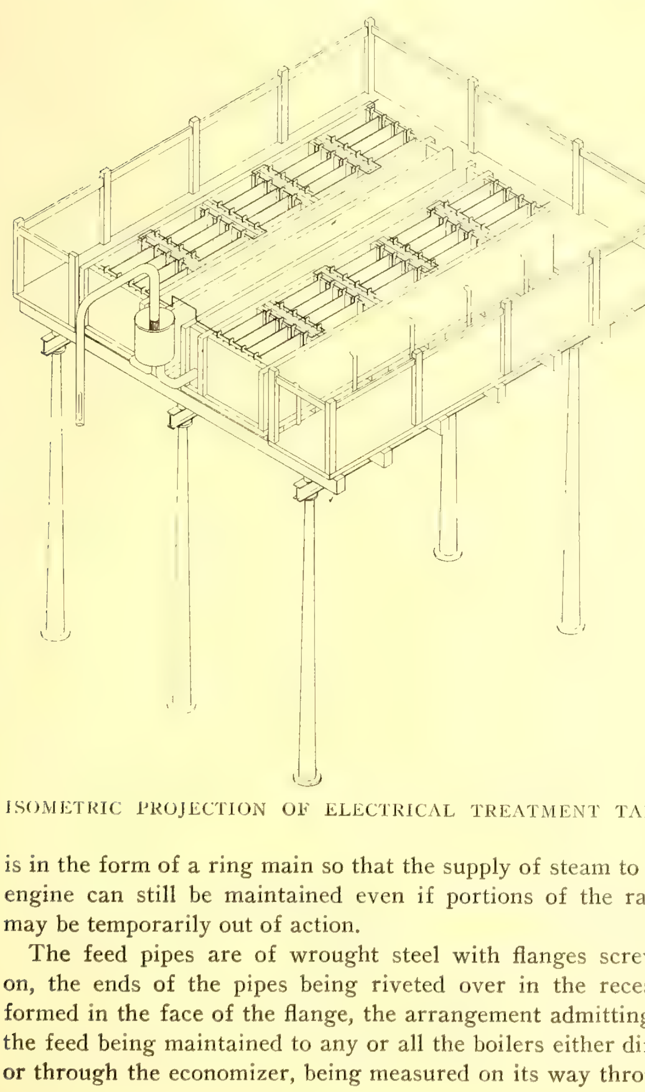
BOILERS AND PIPING

Passing now to the generation of the steam there are four boilers, made by Yates & Thom, of the Lancashire type. Each



SURFACE CONDENSERS IN POWER STATION

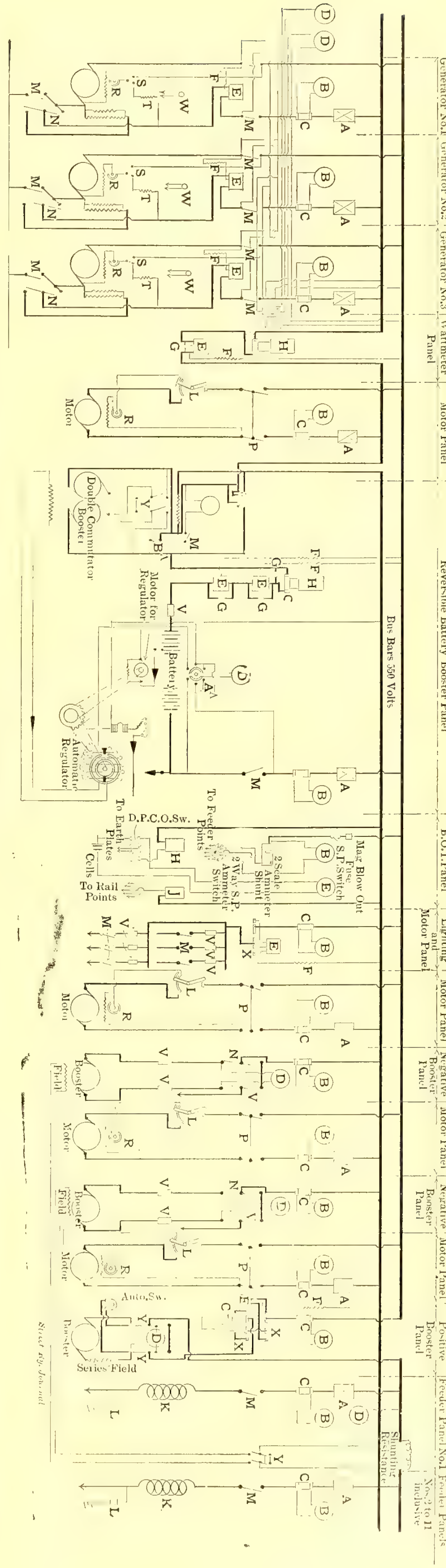
boiler is 33 ft. long by 8 ft. 6 ins. diameter, with two flues, each 3 ft. 5 ins. diameter, constructed for a working pressure of 160 lbs. per square inch, the shell plates being 13-16 in. thick, flue plates 19-32 in. thick, and the end plates 3/4 in. thick. The steam piping is of wrought steel with flanges welded on. The piping



ISOMETRIC PROJECTION OF ELECTRICAL TREATMENT TANKS

is in the form of a ring main so that the supply of steam to any engine can still be maintained even if portions of the range may be temporarily out of action.

The feed pipes are of wrought steel with flanges screwed on, the ends of the pipes being riveted over in the recesses formed in the face of the flange, the arrangement admitting of the feed being maintained to any or all the boilers either direct or through the economizer, being measured on its way through



REFERENCES

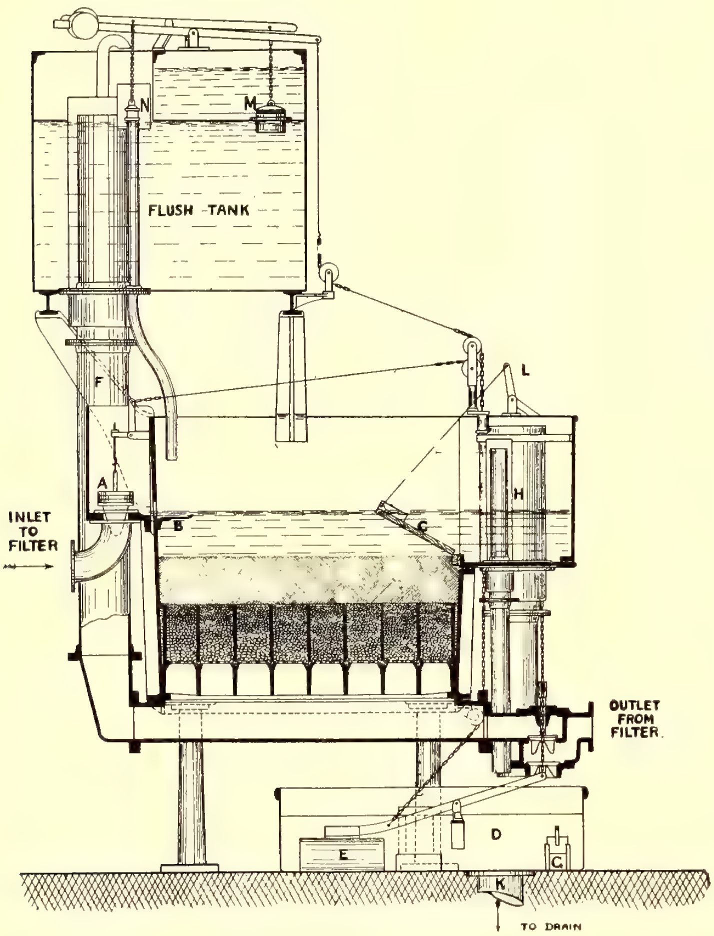
A Circuit Breakers
B Ammeters
C Ammeter Shunts
D Voltmeters
E Wattmeters
F Wattmeter Resistance
G S. C. Plug Switches
H Recording Ammeters
J Recording Voltmeters
K Kicking Coil
L Motor Starters
M S. P. S. T. Switch
N S. P. D. T. Switch
P D. P. S. T. Switch
R Reg. Field Resistance Switch
S Field Switch
T Non-Inductive Resistance
V S. P. Fuses
W Pilot Lamps
X Short Cir'g. Isolating Links
Y D. P. C. O. Switch
Z 3-Way D. P. Switch
Aa Voltmeter Switch
Bb Reverse Current Cut-Out

DIAGRAM SHOWING SWITCHBOARD CONNECTIONS

meters in the usual manner. The feed is taken from the hot-well supply from the surface condensers before mentioned, and in order to get rid of the emulsified oil a special treating plant has been installed.

SEPARATION OF OIL FROM CONDENSED STEAM

The separation of the oil from the condensed steam is effected by the Davis-Perrett patent electrical process. As is well



END SECTIONAL ELEVATION OF SELF-CLEANSING FILTER

known, oil in condensed steam is largely in a state of emulsion, so as to be incapable of being separated by mechanical filtration. In this process the water passes through a series of tanks in parallel, and is subjected to the action of an electrical current, the result of which is to immediately destroy the emulsion and form a flocculent precipitate, which can then be easily removed by subsequent filtration, leaving the water absolutely pure.

The diagram on page 833 indicates the arrangement of the electrical treatment tanks, while the sectional drawing above indicates the construction of the filter.

The bottom of the filter is cellular, each cell being divided vertically into two parts, and the division plates being perforated allow the water to pass through. The upper part of the cells contains stones which support the sand, first the larger stones and then the smaller stones upon which the sand rests. The lower part of the cells forms an air space and trap.

The water enters the filter at the point A B, through holes in the side plates of the filter by the bend pipe indicated. The water passes through the sand medium and stones, and leaves the filter by the outlet valve. The outlet valve is shown closed, but during the filtering operations it is, of course, open, to allow the water to leave the filter.

As the surface of the filter becomes coated with impurities the level of the water gradually rises, owing to the fact that it enters the filter more rapidly than it passes through the sand. When it reaches the top it overflows a syphon pipe, H, shown on the drawing, and through this syphon it descends rapidly into the float chamber, D, underneath. In this float chamber is a float fixed on to a lever. The water raises this float, and by so doing it closes the outlet valve by which the unfiltered water escapes from the filter, and at the same time allows the water from the flush cistern above to flow down very rapidly into the underside of the filter.

The water descending with considerable force presses upon the air in the underside of the cells, forcing the air up through the sand, which is thus broken up and is thoroughly washed by the water as it rises up through the medium. The sand would escape from the filter except for a board, C, extending right across the filter, and which being fitted with a float rises up as the water rises in the filter, and prevents the sand from passing out of the filter. When the flush water is exhausted the operation of washing is complete. The water escapes from the float chamber, D, and the float, E, falls again to the bottom of the chamber. The outlet valve is again open, and the ordinary operation of filtering is proceeded with. The whole operation only takes about three minutes, and while this is going on the collecting tanks are sufficiently large to receive the water passing from the electrical tanks, so that the continual passage of the water is not interfered with.

When the filter resumes filtering operations after the wash it empties the collecting tanks from the amount of water accumulated during the wash.

The feed pumps were manufactured by Hall & Sons, and are of the vertical direct-acting type.

POWER-STATION BUILDINGS

The power station has been erected centrally to the system on Belgrave Road, and is well situated for the delivery of coal either by barge (the canal basin running alongside the boiler house), or by rail. The buildings are faced externally with red sandstock bricks with stone dressings, copings, etc.

The station comprises engine room, boiler room, pump room, condenser room, battery room, test room, engineer's office, general office, inquiry office, mess room, fitting shop, stores, engine house lavatory and office lavatory. Bath rooms have been attached to the two latter.

The engine room is 118 ft. x 60 ft. and 40 ft. high to

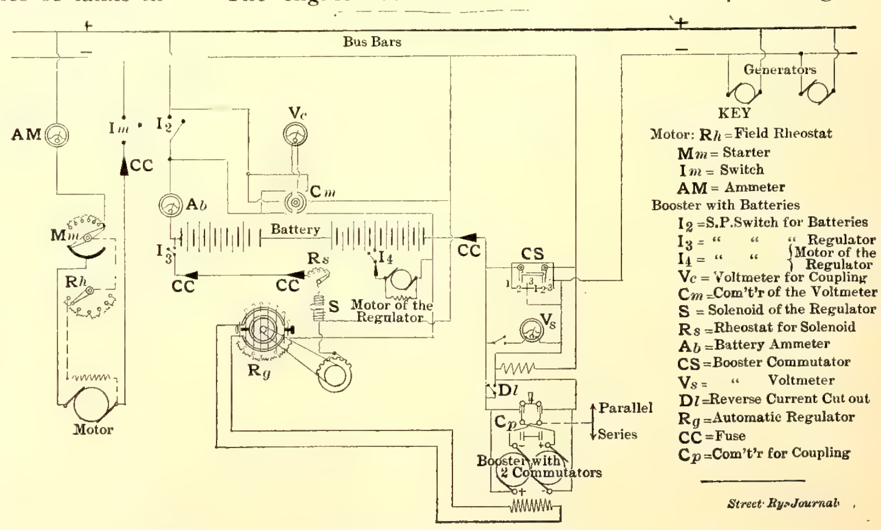


DIAGRAM OF BOOSTER CONNECTIONS FOR STORAGE BATTERY

the eaves. It is lighted mainly from the top by means of patent glazing, which has also been used in the fitting shop and battery room. The only side lights in the engine room are bull's-eye windows above the traveler rail.

The room is lined internally up to the height of the traveler

rail with glazed tiles having patent keyed backs, moulded tiles being carried up to a height of 6 ft. to form a dado. Moulded tiles are also carried round all the arches, with moulded faience blocks under the traveler rail. This tiling gives the room a very fine appearance. The entrance hall and the floor in the engine room, except the space reserved for the extra set, have been laid in mosaic.

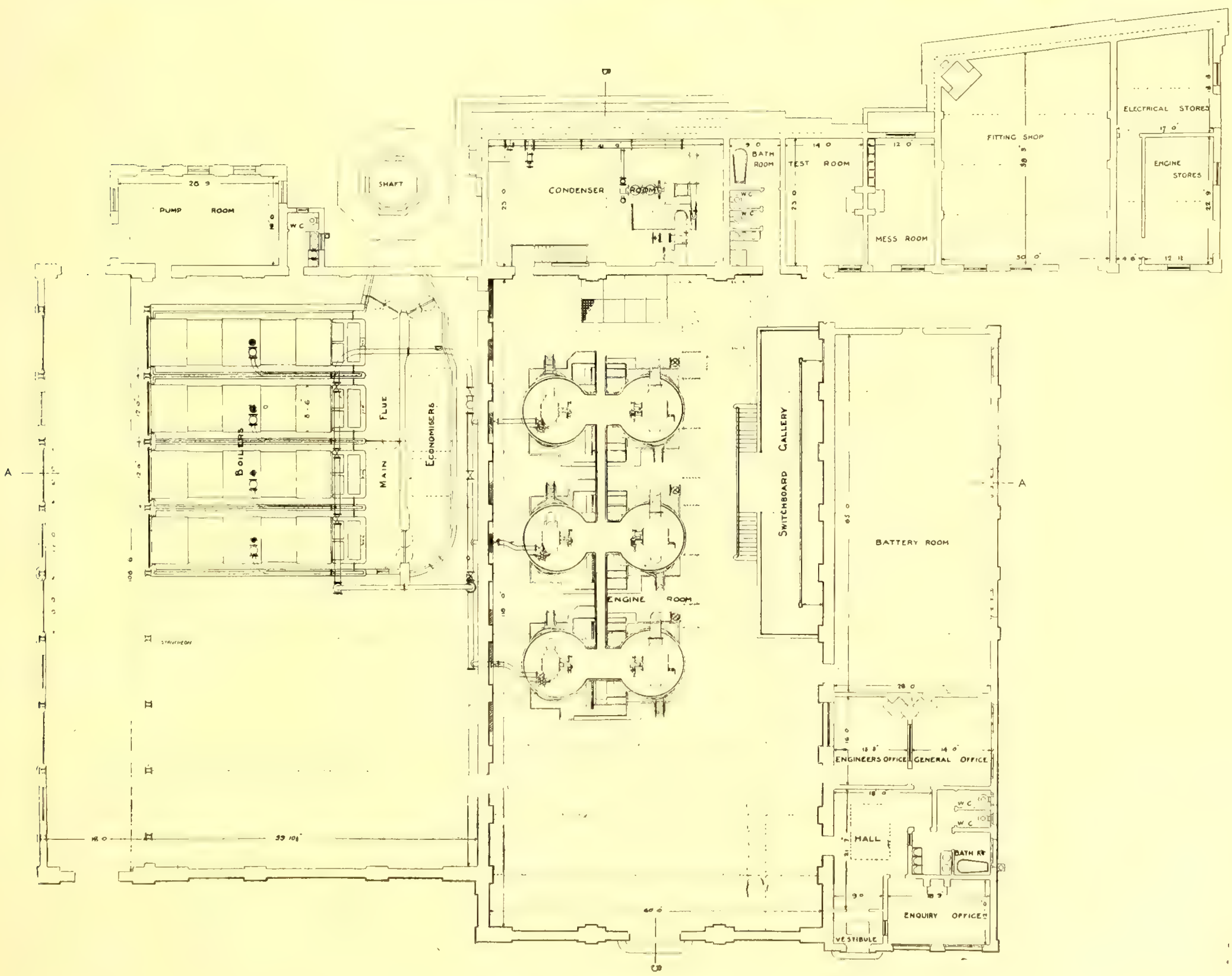
The boiler room is 108 ft. x 77 ft., and a stoking floor, 18 ft. wide, extends its full length with an ash tunnel under. At present the stoking floor is covered with a temporary corrugated iron roof. The question of the coal supply to the boilers, when a larger number have been installed, has been very carefully considered, and the boiler room has been so arranged that when the coal is delivered by barge alongside it will be lifted by a crane fixed at the northwestern end of the boiler house into a conveyor, and conveyed into the coal bunkers. The conveyor will be continued round and through the ash tunnel for the removal of the ashes.

The boiler house is lighted principally from the roof by means of patent glazing. Windows have also been inserted in the southwestern elevation. Kinnear rolling shutters have been inserted in the doorways opposite the fronts of the boilers.

The condenser room is 42 ft. x 23 ft. The floor is 11 ft. below the level of the engine room floor. It is lighted entirely from the roof, and is provided with a 5-ton overhead traveling crane. The battery room is 65 ft. x 28 ft., and 12 ft. high to the eaves. All of the roof trusses, except those for the battery room and offices, are constructed of flat steel bars and plates throughout, except the rafters, which are of T-section.

The chimney is octagonal in shape, faced with pressed bricks. The foundations are carried down to a depth of 17 ft. into the solid red marl. The stack is 186 ft. high, the external diameters being 20 ft. at ground level and 11 ft. at the top. The internal flue is 8 ft. 6 ins. in diameter throughout. It has an independent firebrick lining 9 ins. thick for a height of 70 ft., the remainder

FRONT ELEVATION OF GENERATING STATION



PLAN OF POWER STATION

being 4½ ins. thick. For a height of 110 ft. to the top the cavity is omitted. The cast-iron core is constructed in eight sections, each section weighing about 1 ton.

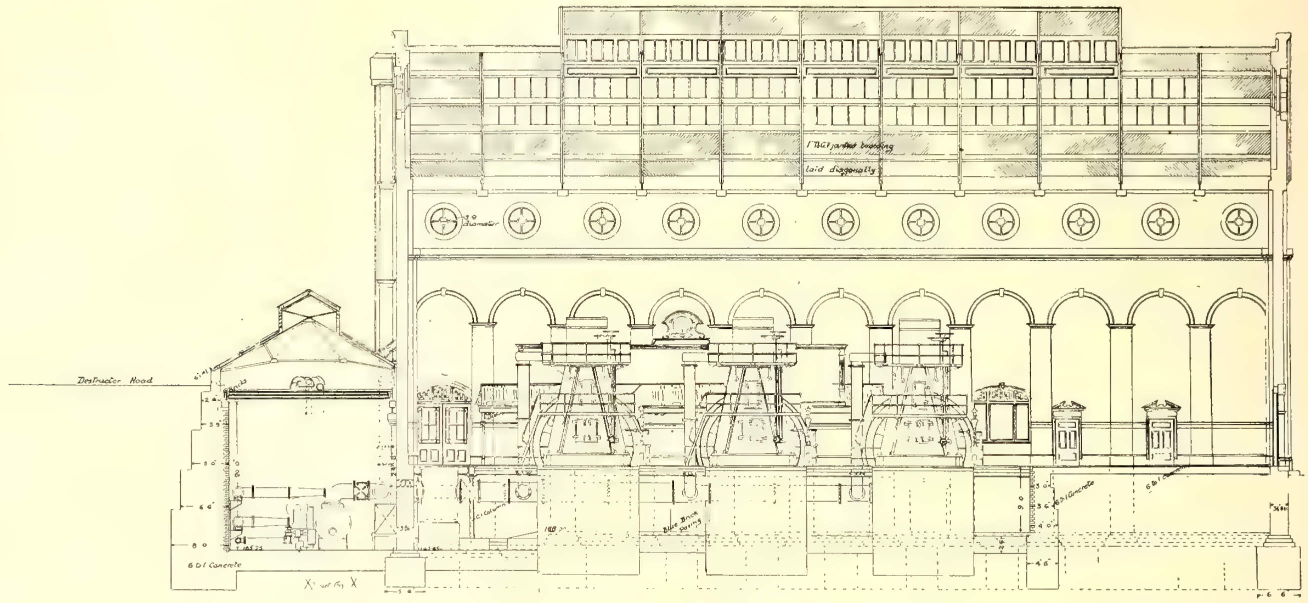
MAIN CAR HOUSE, ABBEY PARK ROAD

The main car house stands on a site of about 4¼ acres, in close proximity to the generating station. As will be seen from the plan it does not abut on the main road, a space 100 ft. deep having been reserved for building purposes. It consists of the car house proper, fitting shop, carpenters' shop, painters' shop, armature room, blacksmiths' shop, brass and general stores, mess room, recreation room, caretaker's house, offices, committee room, boiler house, stables, cart shed, motor house, men's lavatory, oil stores, etc. The buildings are, like the generating station, faced with red standstock bricks and stone dressings.

The car house proper consists of three bays, each 35-ft. 1½-in. span and containing three tracks, accommodating altogether fifty-five cars. The rails are supported throughout on piers, thus forming pits 4 ft. 6 ins. deep under the whole area, excepting for a short space at each end. The entrances to the car house and to the shops are fitted with Kinnear rolling doors.

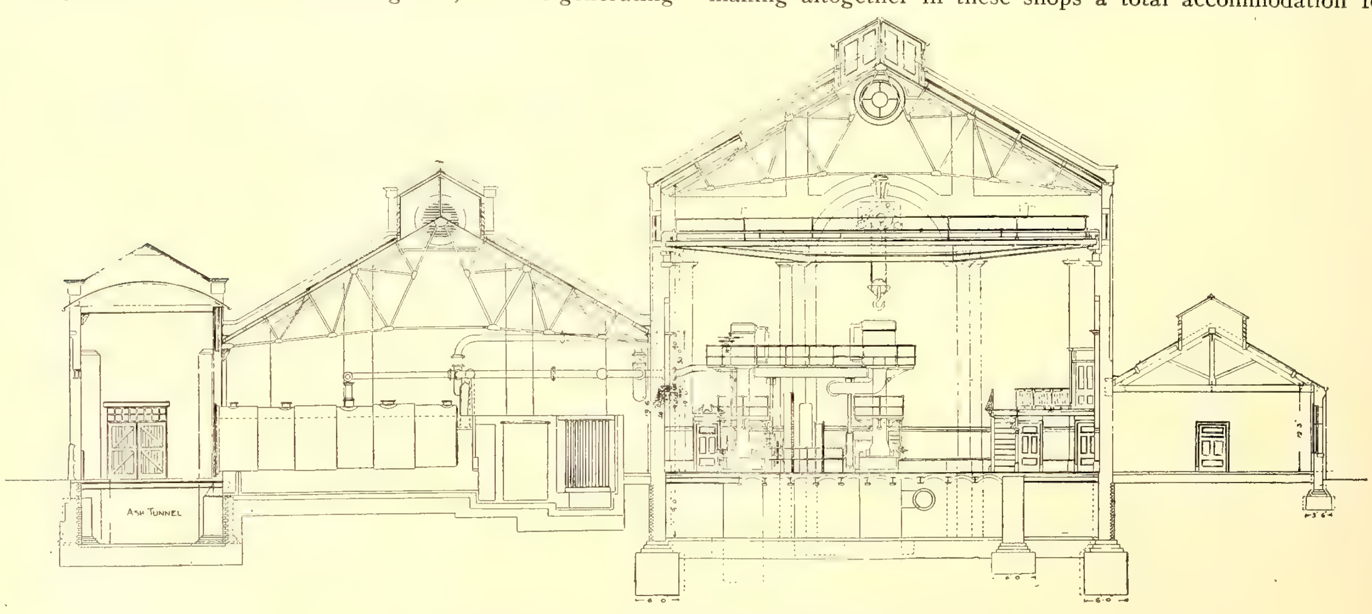
The fitting shop averages 130 ft. x 41 ft. 6 ins., and is 25 ft. high to the eaves. It contains two tracks, the rails for which are supported on piers as in the car house proper. This shop will accommodate eight cars.

On one side of these shops space has been reserved for installing a complete equipment of electrically-driven machine tools, the greater portion of which are to be laid down immediately, including a 12-in. and 6-in. lathe, wheel-turning lathe, radial drill, etc. Provision has also been made for an electrically-driven overhead crane.



LONGITUDINAL SECTION OF MAIN GENERATING STATION

The carpenters' shop is 80 ft. x 35 ft. 4½ ins., containing two pits. The painters' shop, which is an extension of the carpenters' shop, is 70 ft. long. Space has also been reserved in these shops for a complete equipment of woodworking machines and the necessary benches. These two shops are divided by two Kinnear rolling doors, and together will accommodate ten cars, making altogether in these shops a total accommodation for seventy-three cars. The stores and workshops are heated on the low-pressure hot water system.



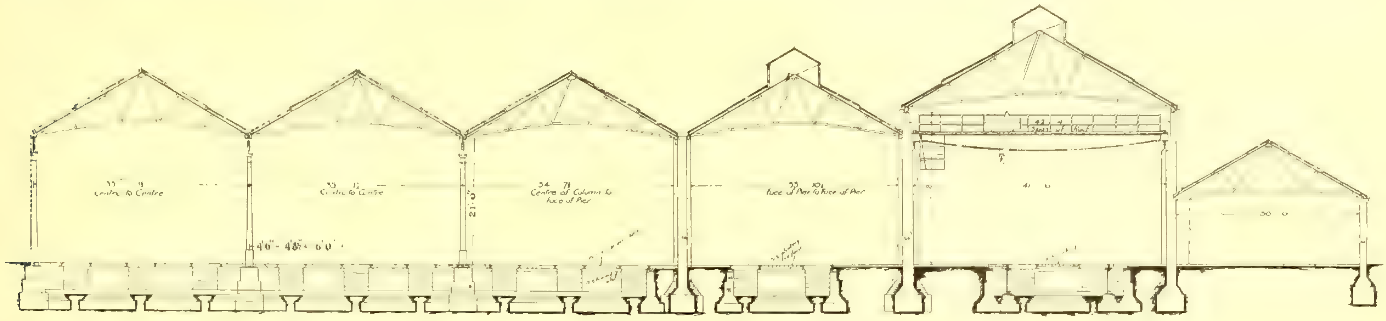
CROSS-SECTION OF MAIN GENERATING STATION

Two small district car houses have been erected on the same lines as the main car depot, one in Narborough Road and one in London Road; each of these contains two tracks with pits under, and will accommodate six cars; an office and small mess room are attached to each.

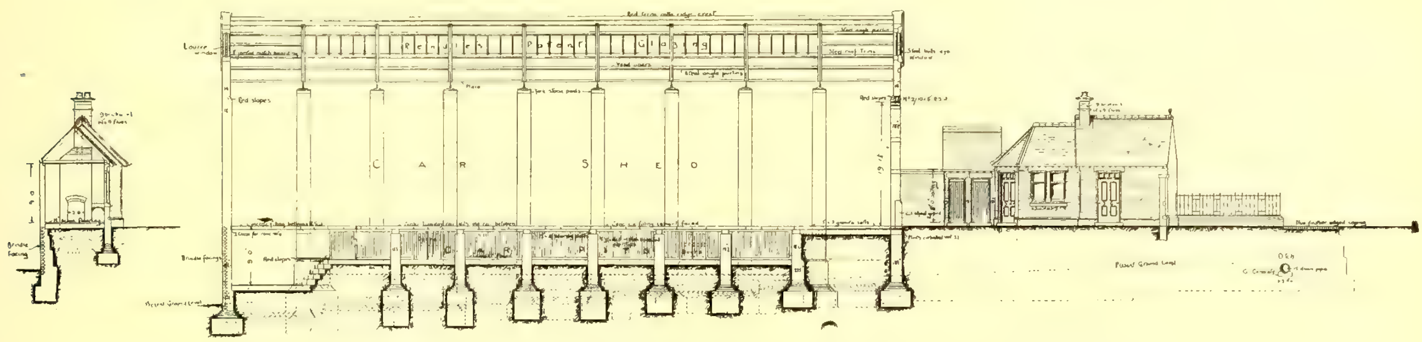
CARS

The cars are of the double-deck single-truck type with reversed stairways. They were supplied to the number of fifty-nine by Dick, Kerr & Company, Ltd., and were built mainly to

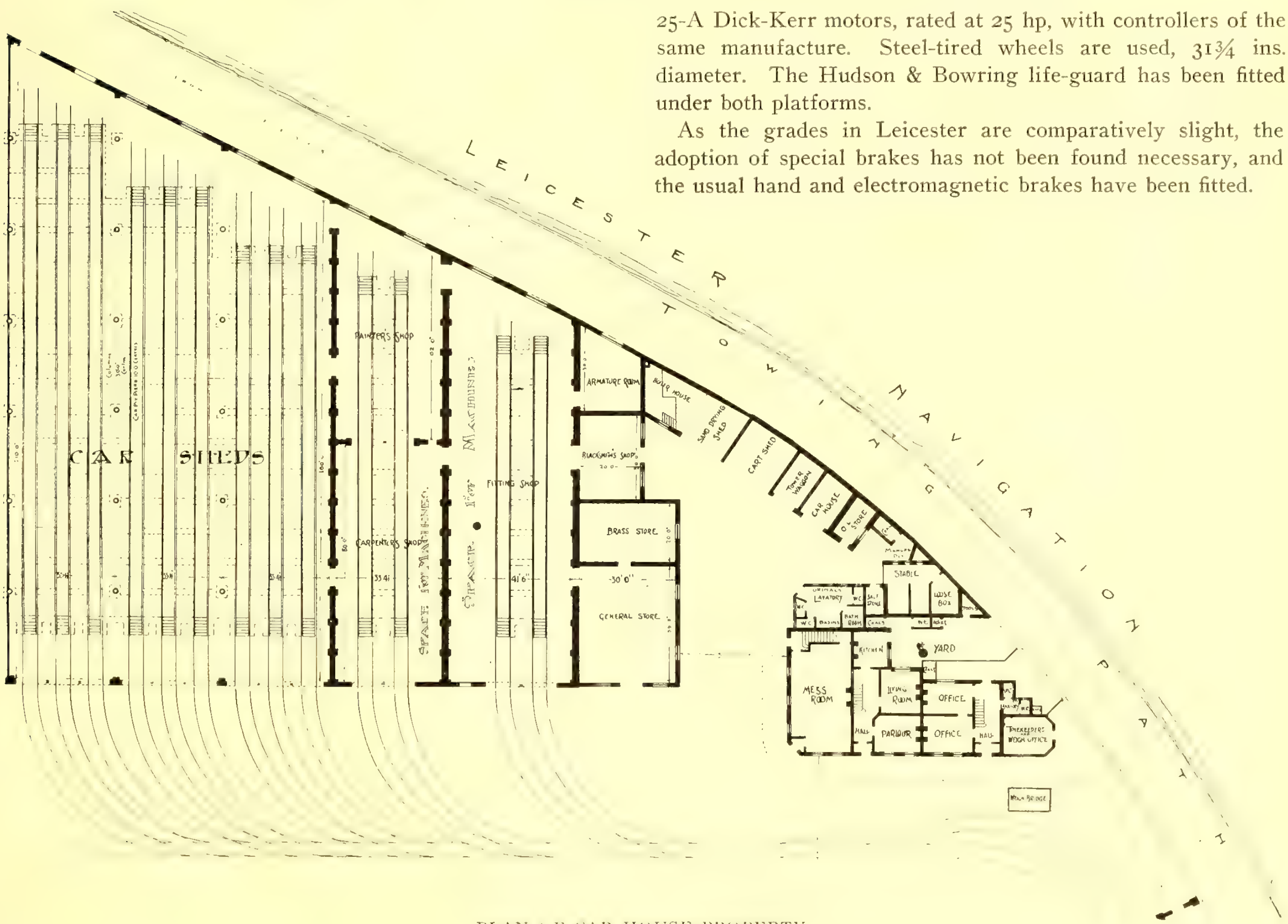
the design and specification of Mr. Mawby. The seating capacity is twenty-two inside and thirty-four outside, and over all dimensions 27 ft. 6 ins. over fenders by 6 ft. 10 ins. width over



CROSS SECTION OF MAIN CAR HOUSE



LONGITUDINAL SECTION AND SIDE ELEVATION OF LONDON ROAD CAR HOUSE



PLAN OF CAR HOUSE PROPERTY

sills. The illustrations and photographs show clearly the general appearance of the car, also the interior and exterior decorations. The floor frames are of well seasoned oak. The platforms are supported on four steel angles which are bolted to the underside of the main flooring. A system of truss rods is provided to keep the car bodies from hogging, and also to pull up the platforms should they show a tendency to sag.

The cars are mounted on 21-E Brill trucks, which carry two 25-A Dick-Kerr motors, rated at 25 hp, with controllers of the same manufacture. Steel-tired wheels are used, 31¾ ins. diameter. The Hudson & Bowring life-guard has been fitted under both platforms.

As the grades in Leicester are comparatively slight, the adoption of special brakes has not been found necessary, and the usual hand and electromagnetic brakes have been fitted.

On several of the cars a new patent type of folding step, to be known as the "Leicester Folding Step," has been fitted for practical trial to meet the suggestions of the Board of Trade, who point out that the efficiency of the life-guard is often impaired by the steps, which are liable to strike a person falling in

front of the cars before the life-guard can come into action. This step is designed to fold up when the gate is closed, and is so made that it is practically impossible for it to be raised when the gate is open, while owing to the automatic device with which it is provided it is equally impossible to keep the gate closed without having the step raised. This arrangement overcomes any difficulty which might arise from passengers attempting to leave the car at the forward end before there has been time to get the step into place.

ENTRANCE TRACKS AT MAIN CAR DEPOT

The interior woodwork of the car is of quartered oak, and the decorations of embossed and quartered oak. Over the side windows is a fine cornice of embossed mouldings, and all panel work in the doors and partitions has been fielded. Over the end doors there is an ornamental head-piece extending up to the underside of the roof boards, and on each side of the doors are ornamental casings. The ceiling is of three-ply bird's-eye maple veneer, and the inside seats and backs are of three-ply perforated veneer. The seats are left bare without carpeting, as it is considered to be a more cleanly and sanitary arrangement. The windows in the end doors have the Leicester coat of arms engraved on them.

Special means have been adopted efficiently to ventilate the interior of the cars, as shown by the illustrations. The effect of this construction and arrangement of ventilation is that the interior of the car is constantly provided with a circulation of fresh air, a hinged sash on each side of the end door in each end of the car being provided. These sashes are also provided with perforated louvre panels on the outside. An exhaust for the foul hot air has been provided by a recess made in the roof of the car, which is just above the hinged windows. This recess not only connects direct with the interior of the car, but also with the roof space between the millboard ceiling and the main deck, and this space, which in ordinary tramcars is a dead air space, without means of escape, is thoroughly ventilated by this arrangement. If required, a further outlet for the hot air in the top of the car may be provided by perforating the millboard ceiling to connect with this space and indirectly with the ventilators on the outside of the car. This exhaustion of the air by the ventilators through the recess roof space cannot be closed, so that the escape of the foul hot air must take place continually, whenever the car is in motion, and without dangerous or annoying draughts.

The top deck is fitted with special "dry" seats of the multi-slat type. The reversed stairways at either end of the cars are of a special improved type, by which the view of the motorman is much less obstructed than in the old form.

The cars are lighted by a number of electric lamps mounted in handsome polished brass fittings; other lamps are erected in destination indicators, so that the point to which a car is traveling can be easily ascertained at night.

Mechanical bells are used, operated by means of a brass rod running the entire length of the car, and fitted with lever handles. The bells can also be operated from either end of the top deck.

The cars are painted chocolate and cream, a combination of color which is at the same time durable and pleasing to the eye; the paint work is relieved with gilt decoration and scroll work, and on the center panel of each car is represented the arms of the Corporation.

OVERHEAD ELECTRICAL EQUIPMENT

The overhead equipment has been designed and arranged with a view to obtaining the greatest possible immunity from breakdown, also that the fittings should appear as artistic as possible. The design of the center, span and side-bracket pole ornamentation, which is original, and which is shown by the illustrations herewith, was prepared by Mr. Mawbey in conjunction with the Leicester Art School. Span-wire construction has been adopted generally, but where streets and roads are wide enough center poles have been introduced. In the center of the town, where suitable attachments could be obtained, poles have given way to rosettes, except at junctions, these being erected on poles throughout. Each center pole has been fitted with two incandescent gas lamps, and the base is protected by a neat elliptical guard curb. Side bracket arms have been used on one short length to the number of nine, each 17 ft. 6 ins. long, also on the siding to the power station.

MAIN CAR DEPOT—ABBEY PARK ROAD

The weight of the straight-line poles is 840 lbs., and that of the curved and anchor 1180 lbs. The total length is 31 ft., made up of three sections shrunk together. The poles are planted

6 ft. in the ground, the foot resting on a concrete template 6 ins. thick, which in turn is bedded on 6 ins. of cement concrete. The pole bases are 6 ft. 6 ins. high, the greatest diameters being 16 ins. and 18 ins. respectively for the two sizes.

The trolley wire is No. 000 B. & S. gage throughout, except at the car houses, which are wired with No. 0; and the span and guard wire are of galvanized steel, 7-12 and 7-16 respectively. Flexible suspension and double insulation have been adopted throughout. "Ætna" insulation and line fittings of extra strong design have been used throughout, the insulator bolts being of drop forged mild steel, screwed ¾ in.

Eighteen-inch ears have been used on the straight and 24-in. on the curves throughout. Special double and single pull-offs have been used on all junctions and curve work, the distance between the bolt and the eye being 5 ins. Galvanized iron thimbles have been used wherever eyes have been spliced in either span, pull-off, anchor or guard wires.

Straight under-running section insulators are fitted at each half-mile section, and the feeders are connected to the line at these points. The connecting cable between the section and feeder pillars and the line is 61-20's, insulated with pure and vulcanized rubber, lead covered and double braided, and is carried from the pillar to special drawing-in boxes at the foot of each of the section poles, and thence up the inside of the pole, the pole being bushed with gun-metal bushes top and bottom. From the top bushes of the pole the cables are carried out to the trolleys along the span or bracket, as the case may be, and served with P. & B. tape, a copper ferrule being sweated to the end of each cable and clamped into the section insulator.

In the car houses the trolley wire is carried in a pitch pine troughing running the entire length of the shed, and suspended from roof trusses by wrought-iron clips. The main car house is supplied by a separate feeder direct from the power station, ar-

VIEW OF UPPER PART OF CAR, SHOWING METHOD OF VENTILATION

ranged so that when the rest of the system is shut down the cars in the car house may be run off the battery. Where the lines pass under railway bridges the trolleys are carried in troughing suspended from the underside of the bridges in such a manner that it is impossible for a passenger, even by leaning over the car rail, to touch the "live" wire.

Four sizes of section and feeder pillars are used. These are fitted with white marble panels, which carry the various quick-break switches, kicking coils and safety fuses for automatically disconnecting the overhead line in case of failure. The feeders are connected up to the main switchboard at the power station through automatic circuit breakers, which are set to cut out any one of the feeders should a short circuit occur on any of the sections supplied by that feeder, thus ensuring that should a trolley wire break on any portion of the line either the fuses in the nearest section pillars would "blow,"

CENTER POLE—LONDON ROAD

or the circuit breaker at the station would open, rendering that portion of the line dead.

Each pillar is also fitted with a Garton lightning arrester, and an ebonite panel carrying the test and telephone terminals. All holes in the panels are fitted with ebonite bushes and washers.

SIDE VIEW OF STANDARD DOUBLE-DECK CAR

A specially designed telephone shutter, operated by a separate key, has been fitted to each pillar, arranged so that it is unnecessary to open the pillars in order to use the telephone, the jack being inserted from the outside, thus obviating the danger of anyone accidentally coming in contact with the "live" fittings in the pillar when using the telephone.

The telephone instruments are carried on the cars, one being supplied to each car.

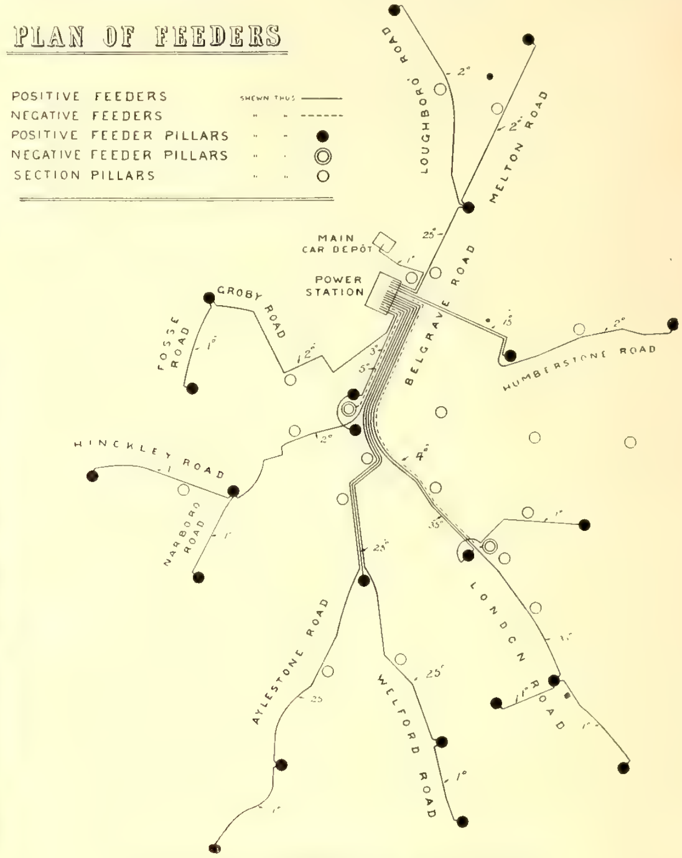
Two negative feeder pillars are erected to meet the present requirements, one at the Clock Tower and the other at Highfield Street, approximately 1100 yds. and 2700 yds., respectively, from the power station. They contain the usual instruments to meet the Board of Trade requirements.

All section and feeder pillars, and the poles up which the

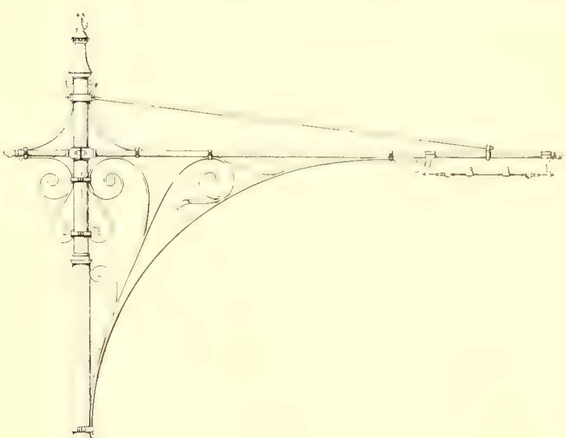
feeder cables have been carried, are bonded direct to the rails by a 0000 copper bond, to prevent the possibility of their becoming "alive" owing to breakdown of the insulation at these points.

SIDE BRACKET POLE—VICTORIA PARK ROAD

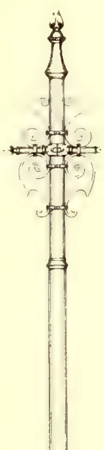
and drawn in by W. T. Glover & Company, Ltd., of Manchester. Stoneware conduits are used, and are of the patent self-centering type with composition joints, supplied by T. Wragg & Sons, Ltd., of Swadlincote. The total quantity of conduits sup-



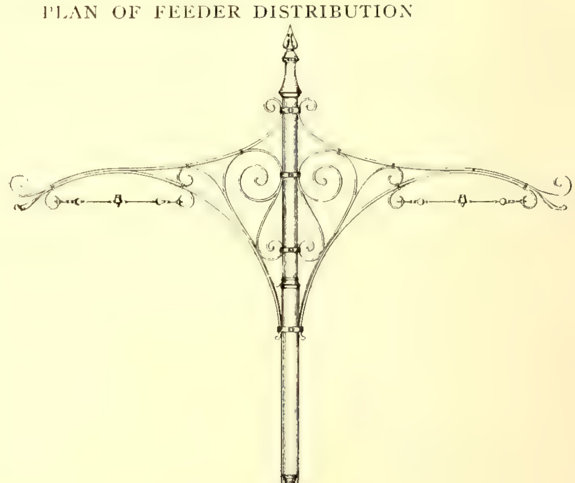
PLAN OF FEEDER DISTRIBUTION



STANDARD SINGLE-BRACKET POLE



SPAN POLE



STANDARD DOUBLE-BRACKET POLE

The whole of the equipment, including poles, wires, section and feeder pillars, etc., has been supplied and erected by R. W. Blackwell & Company, Ltd., London.

FEEDER CABLES, ETC.

All of the cables in connection with this work were supplied

plied was equivalent to about 80,000 yds. of single way. Throughout the entire system the conduits are laid at the side of the track. The cables are single conductors, insulated with diatrine impregnated paper and lead covered, jointed by means of lead sleeves wiped on to the lead of the cables. At intervals

of approximately ¼ mile the lead covering of the cables is earthed to the rails by means of bare copper bonds, as a preventive against electrolysis.

Three negative feeders have been carried out to different points of the system, and are connected to the rails through special feeder boxes, having the necessary Board of Trade instruments mounted therein. Each cable bears a brass label in every box, denoting its size, voltage and termination. The sizes of the feeders range from .1 sq. in. to .5 sq. in., the total length being over 20 miles. A complete system of telephone and pilot cables is also drawn into separate ducts along each feeder route, and connected up in every feeder and section box.

All lead-covered cables terminate in the basement of the power station, connection being made to the switchboard with fire-resisting cable of Glover's latest type. In addition to the feeder cables terminating on the switchboard with fire-resisting cable, the whole of the back connections and cable work in the station is also of this description.

All of the feeders and pilots were submitted to a pressure test of 1000 volts alternating current for one hour. They were then tested for insulation resistance.

RE-EXAMINATION OF STREET RAILWAY EMPLOYEES FOR DEFECTIVE SENSES

BY RAY R. RIDEOUT

In the last few years we have seen many improvements and changes for the better in the operating methods of electric railways. Where a few years ago street railway companies were content with the passenger traffic of our large cities and towns, we find them to-day, in many instances, reaching out and becoming active competitors of the steam railroads for long-distance travel. This means that on many of our interurban roads cars are run at a very high rate of speed as compared with that of several years ago. With the increased speed the responsibility of those who man the cars becomes greater, and with the greater responsibility comes the question of what safeguards the companies are taking to make sure that the men are reasonably capable of performing their duties in a safe manner.

Steam railroad companies, one after another, have adopted the system of regularly examining their employees to ascertain whether their color perception, vision and hearing are in such condition as to allow them to continue their work in safety, and a similar system of examinations, conducted by the writer, has been established on the elevated division of the Boston Elevated Railway Company. The methods employed in this department were described in a recent issue of this paper.

On most electric roads acute color perception is not essential; but vision, in which the percentage of deterioration is far greater than in color perception, is a very important factor. Under the present conditions a man is given an examination when coming with the company, but in most cases is never again re-examined. After a time his vision may become so defective that he would be unable to see an obstruction on the track, an open switch or a passenger boarding the further end of his car until too late to prevent an accident. Unless he becomes nearly blind, the matter probably never would be brought to the attention of his employers.

On steam roads, test glasses are used, and many applicants who would be afflicted with short-sightedness as they grow older are rejected, while on electric roads this practice is not generally in use; therefore, opportunity for serious defects is greater on electric railways.

A large number of the street railway companies of to-day have been formed by the consolidation of smaller companies, many of them old horse-car lines, on which the applicant for a situation was not required to pass any test before entering the service, in which case he is actively engaged in operating a car without ever having been examined. If the management of any road that has been in operation for ten years or over should conduct an examination of their motormen and conductors, they would undoubtedly learn some very interesting facts. It is very doubtful if any up-to-date road would entrust the safety of its patrons in the hands of those whom they know are utterly disqualified; but how are the officials to know whether this is being done if their employees are never examined?

The rolling stock, wires, track and power house must undergo a thorough inspection regularly, but the men, on whose alertness and quick perception so much depends, are allowed to go on year after year with never a question as to their physical qualifications. Under these conditions serious accidents may be caused by defective senses, but attributed to other reasons, and the company remain ignorant of the true facts.

It is reasonable to assume that regular examination, conducted by a conscientious examiner, would be to the advantage of the men as well as to the company, for under the present method a man's senses may become so defective that he cannot perform his work satisfactorily, resulting in his discharge, while, if this defect had been known to his employers, they could have given him suitable employment, thereby retaining him in the service. There are good positions with every railway company where faithful employees who have become disqualified for car service by defective senses may be employed with safety. If a man is allowed to go on in his own way he might be utterly unaware of his failing senses, and continue to do that which would aggravate his particular trouble; but if, upon examination, defects were found, the examiner could advise him as to the proper course to pursue, and in many cases avert serious trouble.

It is a well-known fact that at the present time railway corporations are interesting themselves in their employees in a manner that was not thought of a few years ago. That they are supplying them with free literature, gymnasia, finely furnished lobbies, are helping to maintain insurance and social organizations, and doing much to promote their physical, mental and social welfare are facts of common knowledge. It seems to the writer that another step in the right direction would be the periodical examination of men employed where acute senses are necessary to the safe performance of their duty.

GERMAN STREET RAILWAY ENGINEERS IN AMERICA

A party of prominent German street railway engineers and managers reached New York last week on a three weeks visit to this country, partly to visit the St. Louis Exposition and partly to inspect American street railway conditions. They consist of Messrs. Koehler, managing director of the Grosse Berliner Strassenbahn; Peiser, chief engineer of the Grosse Berliner Strassenbahn; Rötelmann, managing director of the Süd-Deutscher Eisenbahn Gesellschaft, of Darmstadt; Poetz, managing director of the Strassen Eisenbahn Gesellschaft, of Hamburg; Schultz, of the German military railways, and Freiherr von Bodenhausen, manager of the Westphalischer Stahlwerk, of Bochum, and also one of the directors of the Strassen Eisenbahn Gesellschaft, of Hamburg. The party expects to visit Milwaukee, Chicago, Buffalo, Boston and a few other cities during their visit in this country.

The new Trinidad (Col.) Electric Railroad is doing a splendid business, especially on the line between Sopris and Starkville. The business is so much greater than was anticipated that the equipment of the road will be at once doubled.

RECENT ELEVATED PRACTICE IN BERLIN

BY JOHN P. FOX

The electric elevated and underground railway in Berlin has already been described and illustrated in the STREET RAILWAY JOURNAL, June 7, 1902, Oct. 13, 1900, etc., but a recent visit, with study of details, has brought out some new points. The elevated line not only presents features of great value to those interested in urban rapid transit by trains, but it suggests a

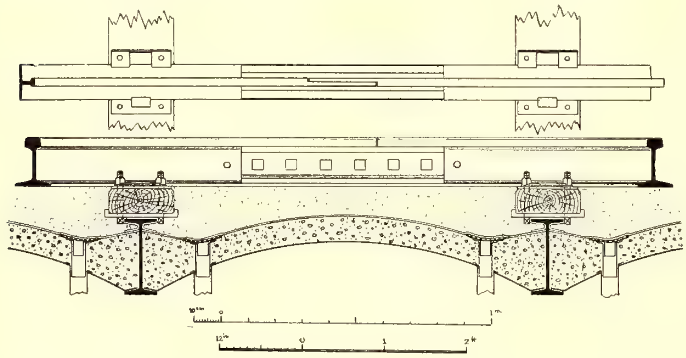


FIG. 1.—EASTERN SECTION, STANDARD FLOORING, LONGITUDINAL SECTION AT OUTSIDE RAILS, WITH PLAN OF RAILS

means of providing express service with surface cars and a solution of the problem of getting interurban cars quickly into and through cities without using the street surface, condemning land, or involving grade crossings. For if an elevated railway can be built complete for less than $300,000 a mile, so clean, decorative and sheltering as to be regarded a positive ornament and benefit to streets, so quiet as to avoid all damages and allow fine residential property to increase in value because of its convenience, it would seem almost worth while for some cities, if interurban companies could not afford the entire expense, to build and rent similar light elevated lines and get the heavy cars off the streets, to the benefit of all concerned.

In view of the growing prejudice against elevated railways in the United States, the solution of the noise problem is important, because, while subways have their places, the fact that elevated lines can be built for far less cost, with less disturbance and more quickly, affording pleasanter and quieter riding than subways, tends to make them desirable wherever possible. It is interesting that the same effectual remedy for noise should have been adopted independently in New York, Berlin and Paris—and that is ballast, on a solid floor, as used by the New York Central engineers on the Park Avenue viaduct, by Siemens & Halske on the elevated line in Berlin, and by the Paris municipal engineers on the viaduct along line No. 2, north, of the Metropolitan Railway. In a recent experiment in this country, where a stretch of elevated track was ballasted, an expert on sound found the total noise from trains reduced apparently 50 per cent, the actual reduction working out at from 80 per cent to 90 per cent. A test of experts on sound in this connection showed that practically none could detect a reduction in sound if less than 30 per cent; but while to reduce noise appreciably requires a great actual diminution, experience seems to have conclusively shown that even the worst conditions on elevated roads can be effectively remedied by the use of ballast, and attention is again called to Berlin and the rise in value already referred to of fine residential property along the elevated line.

Noise received special attention in Berlin from the outset. The flooring of the first part built, the eastern section of the road, did not prove as quiet as desired, though felt was tried as a deadening under the rails, and concrete and gravel filled in the space between the ties over the steel plate floor (Fig. 1). So for the western section, as described and illustrated in the STREET RAILWAY JOURNAL for June 7, 1902, the ties are imbedded in ballast with most satisfactory results (Fig. 6). Some of the well-known experiments tried on the eastern section to get reduction of noise are illustrated herewith. Fig. 4 shows how felt was placed on each side of the rails and held in place by pieces of wood about 1½ ins. thick, with bolts through the track. In Fig. 7 ties of steel and wood rested on fine sand in transverse steel troughs over the I-beams. In Fig. 8 the 3-mm floor plates, which vibrated somewhat, were lined underneath with arches of cork blocks. In Fig. 3 car

FIG. 2.—STRINGERS ON EASTERN SECTION

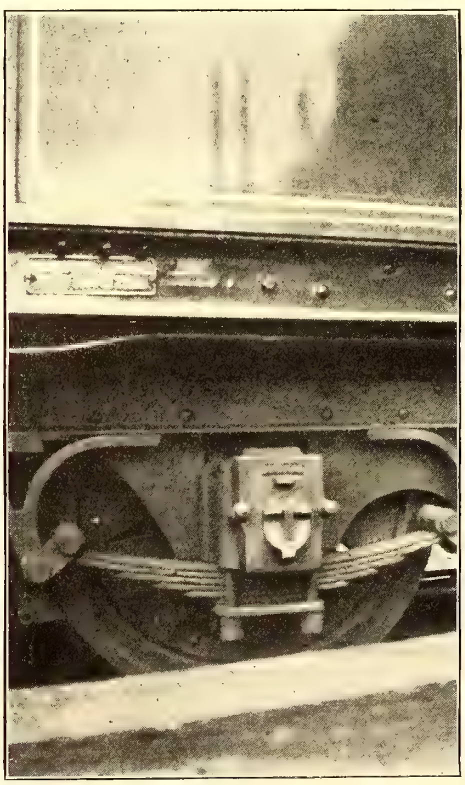


FIG. 3.—WOOD-FILLED CAR WHEELS

FIG. 4.—FELT EXPERIMENT, EASTERN SECTION AT BEGINNING OF WESTERN

wheels were filled with wood, though wood-centered wheels were not tried, for fear they would not stand the strains from motors and braking. None of the foregoing methods seemed effective compared with that illustrated in Fig. 2, where low rails are laid on deep wooden stringers, which again rest on the transverse I-beams. The cutting of the rails into the stringers is avoided by the use of a kind of chair or tie-plate. Fig. 11 shows the latest track construction on the western section. Noiseless joints have been obtained with Haarman rails (Figs. 1 and 5), whose eccentric webs, alternating in position with each rail, overlap with their full thickness at each joint. Creeping of rails is prevented by shoulders on the tie-plates, which engage the fish-plates or other special pieces bolted to the track, as in Fig. 9. To prevent creeping of ties in the ballast groups of ties are connected by stringers. Deflection of curves from expansion and contraction is prevented by the diagonal bracing between the rails. The writer found the gravel ballast exceptionally clean, free from dust, iron rust and oil. On Bülow Strasse the Berlin elevated structure is seen at its best, Figs. 14 and 16. Passing trains are hardly noticeable, either underneath or in the houses. The engineers decided, as the result of much experience with bridges, that the structure would vibrate less if the lower chords of the trusses were carried down to the ground, avoiding the weak spot at the junction of posts and trusses found in ordinary elevated construction. The use of the arch shape made it unnecessary to anchor the posts with expensive foundations, the structure on Bülow Strasse consisting of a kind of succession of tables, with the four legs inclined out at the bottom for greater rigidity, and simply resting on the bases. Two longitudinal trusses suffice where four are generally used. The flooring (Fig. 6) is the most perfect for drainage that the writers knows, 7-mm steel plates being hung between the I-beams, the water draining from the hollows into longitudinal gutters underneath. On the eastern section (Fig. 1), any removal of tie-bolts tended to injure the waterproofing and allow water to get at the I-beams, a thing impossible with the latest flooring. Where the trusses of street bridges have their lower portions imbedded in the concrete of the footwalks (Fig. 12), it has been found corrosion occurs from water standing on the footwalk, and waterproofing will cover all steel just above the concrete.

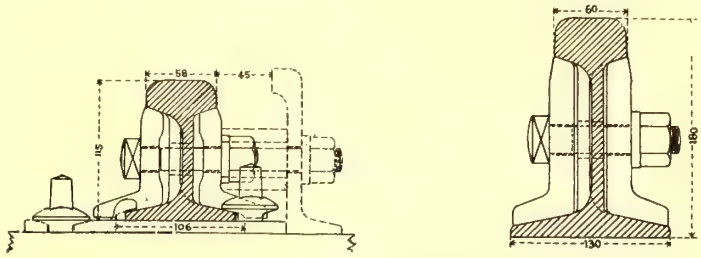


FIG. 5.—SECTIONS OF HAARMAN RAILS, WESTERN AND EASTERN SECTIONS

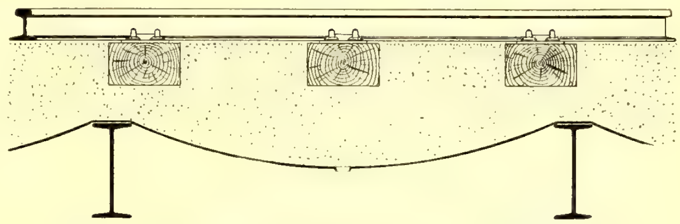


FIG. 6.—WESTERN SECTION, STANDARD FLOORING, LONGITUDINAL SECTION

The tight floor, apparently supported by arches, all painted a light gray, almost white, forms such an attractive shelter over the grass-bordered walk, that the elevated on Bülow Strasse is called the umbrella of Berlin, and every one goes under it, from cab drivers to children, in hot or wet weather. The ride above, in handsome, noiseless cars, between rows of trees and fine houses, over a beach-like roadbed, is so attractive that when the train passes down into the subway, no matter how

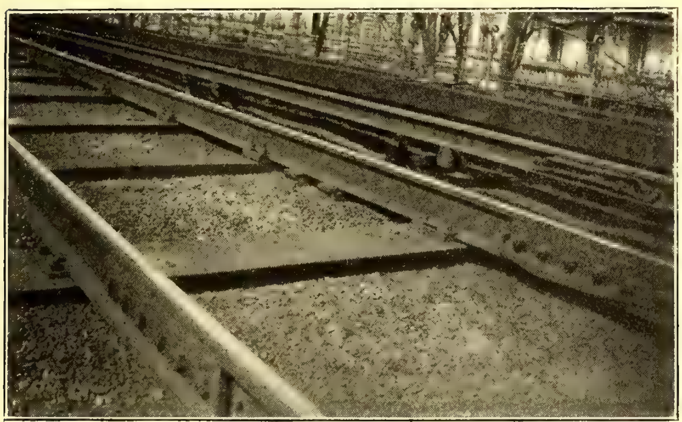


FIG. 7.—STEEL AND SAND TIES, EASTERN SECTION

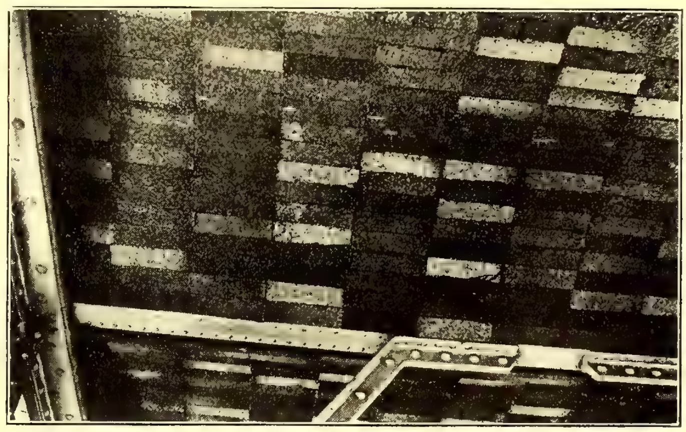


FIG. 8.—CORK ARCHES UNDER FLOORING, EASTERN SECTION

FIG. 9.—TRACK ON SOUTH END OF TRIANGULAR JUNCTION

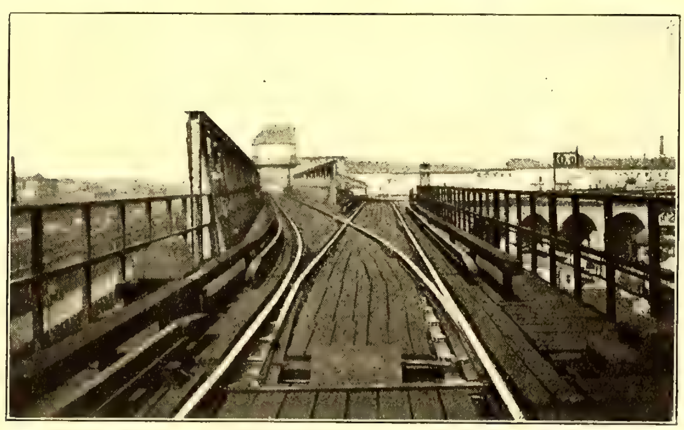


FIG. 10.—ELECTRIC SWITCH ON SOUTH END OF TRIANGULAR JUNCTION

used one is to underground travel, the first impression is a disagreeable one. Expensive as the western section appears the total cost complete per mile with track, but without conductors, was only about $297,210 a mile. By adopting light cars, a fairly light steel structure was possible, in spite of the weight of the floor plates and the ballast, the latter amounting on the western section to about 2575 lbs. per lineal foot of double-track structure, out of a total weight of 4079 lbs. per foot, the steel work, including floor plates, weighing 1109 lbs. per foot. Motor cars without passengers weigh about 20 tons, trail cars 15 tons.

If a solid floor does shut some light off from the street directly underneath, it also shuts off water, sparks and falling objects, the latter sometimes involving serious damages. Such a floor would really in itself never deprive abuttors of light, and, if painted white underneath, like the Park Avenue viaduct, leaves the street at least about as light as the ordinary elevated structure, which quickly gets dark at every point. Snow has given no trouble on Park Avenue, never having required removal even where through spans are used. The greater safety and convenience of a ballasted floor are obvious, the safety of employees and workmen being specially looked after in Berlin, where the space between the ties is never left open, the timbers

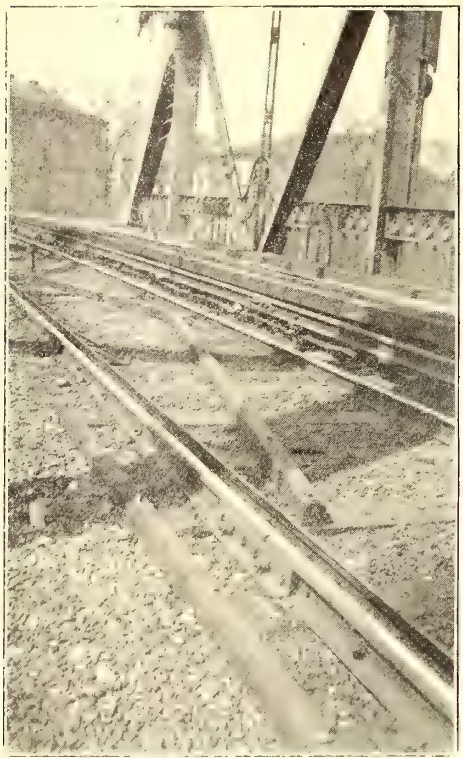


FIG. 11.—FLOORING ON BRIDGE OVER LANDWEHR CANAL, WESTERN SECTION

FIG. 12.—BRIDGE OVER GROSSBEEREN STRASSE, WITH STANDARD ROADBED OF EASTERN SECTION

FIG. 13.—UNDER THE STRUCTURE ALONG HALLESCHES UFER, EASTERN SECTION

FIG. 14.—BULOW STRASSE STATION, EXTERIOR

guarding the third rail are very heavy and strongly supported, footwalks are very safe, one incline between the tracks even

FIG. 15.—INCLINE ON KLEIST STRASSE BETWEEN SUBWAY AND ELEVATED

having vertical posts for men to take hold of when trains pass (Fig. 15).

Much of the prejudice against elevated roads is due, not to the design of a structure, but to its dark or dirty appearance. A solid floor and white paint, perhaps, should be enough to meet this objection, but Siemens & Halske, in Berlin, took no chances, ornamenting in some way every foot of the structure along public ways, calling in many and well known architects to design monumental stations and bridges over the streets. The Berlin structure may seem too decorative to an American, but it was surely a judicious policy to make the entire work a positive ornament to the city. The new line had to build up its traffic mostly, perhaps, by enticing passengers away from the electric surface cars of a progressive and public spirited company, already giving the public unusual facilities. So, for this reason, if for no other, the Elevated & Underground Company made its stations and cars unusually attractive and convenient for the passengers.

FIG. 16.—UNDER THE STRUCTURE ON BULOW STRASSE

The stations, with the exception of one on a curve, have their sides enclosed and glazed, and the unusual feature of roofs completely spanning both platforms and tracks (Fig. 20), even approaching stairs and passageways being enclosed from the weather (Fig. 14). This seems an improvement over the American plan of having exposed platforms combined with waiting rooms, for passengers use waiting rooms comparatively little, and, with platforms completely protected from the weather, they are more ready than otherwise to take trains promptly. The Berlin plan, then, is to have the entire station a waiting room, the seats being sheltered from draughts by

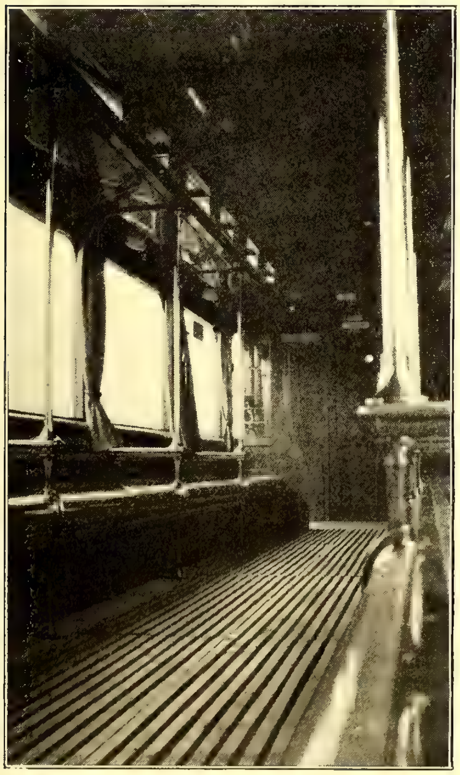


FIG. 17.—INTERIOR THIRD-CLASS MOTOR CAR

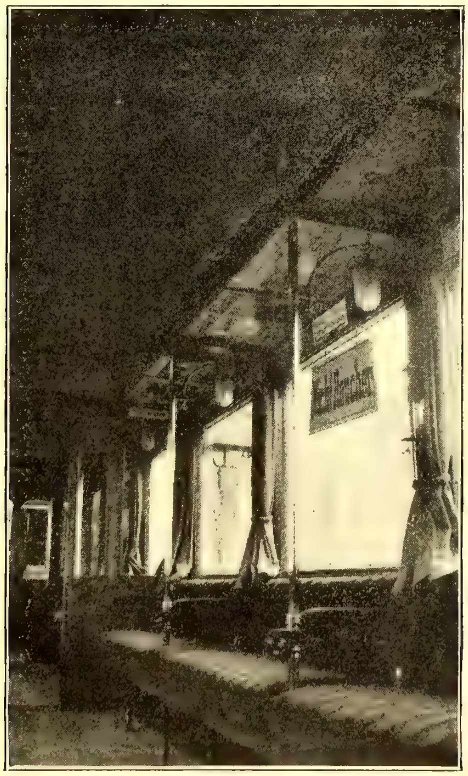


FIG. 18.—SECOND-CLASS CAR FROM NON-SMOKING COMPARTMENT

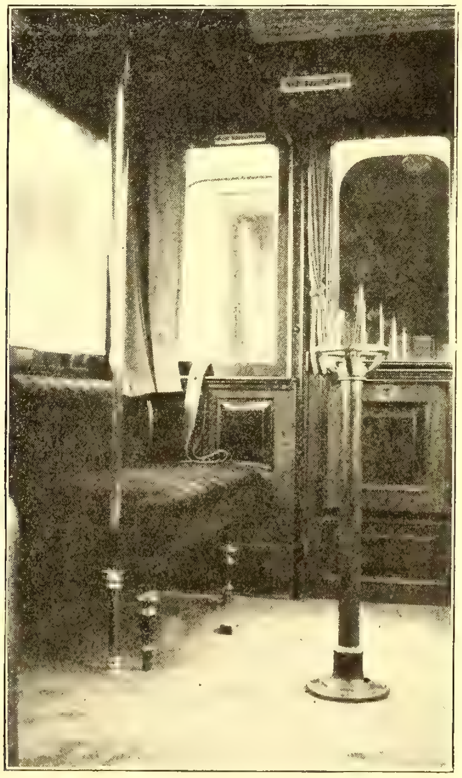


FIG. 19.—END OF SECOND-CLASS CAR, WITH CIRCULAR GRAB-HANDLE AND FOLDING SEAT ON DOOR

wooden screens. Toilet rooms are unnecessary, as public ones can be found on the street below. Stations are completely fireproof, with roofs of corrugated iron and floors of artificial stone. Everything is scrupulously clean, but plain, all money for ornament being wisely spent on the exterior. Only four-car trains are needed now, so the station roofs are only long enough to cover four cars, but they can be extended any time to the full length of the platforms. A clock over the tracks faces both ways. Stairways and passages are wide and free from turnstiles. Some of the platform edges are of white material, like the admirable custom found in London. Every station has train indicators, each sign being like those on the trains, viz., with destination name on a background of the route color, in the subway being brightly illuminated. Station names in the subway are painted on the opal glass of every arc light recessed

FIG. 20.—BÜLOW STRASSE STATION, INTERIOR

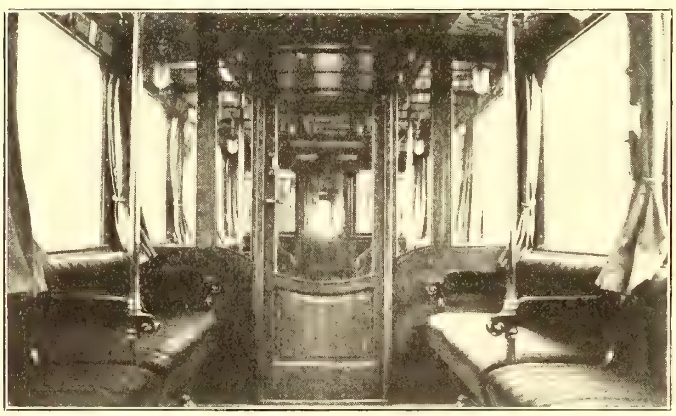


FIG. 21.—SECOND-CLASS CAR FROM SMOKING COMPARTMENT

in the side walls. Ticket offices are usually found on the street level, and an excellent device for economizing in wages is the ticket slot machine, into which one drops a 10 pfennig piece (2.4 cents) and a third-class ticket automatically comes out, without even having to pull a handle. It is surprising that such a practical and saving affair has not been introduced in this country, in view of its successful use in Berlin, by the State railways before the elevated, the ticket machines on the Berlin Metropolitan line even supplying four kinds of tickets at different prices, and giving back change, delivering, two years ago, over a million tickets a month.

The Berlin cars have some very remarkable and important features. The three-car trains consist of a third-class smoking motor car at one end, a third-class non-smoking car at the other end, and a second-class trailer between, divided by a glazed partition and door into smoking and non-smoking compartments. At the rush hours, another third-class car, a trailer, is added. In the third-class cars (Figs. 17 and 22) one can ride about 7 miles for 10 pfennigs (2.4 cents). The seats are of polished wood, light and dark, quite as comfortable as rattan. Why the second-class cars (Figs. 18, 19 and 23) are so called is not apparent, for they are really parlor cars, with a fare of 15 pfennigs (3.6 cents). These cars are the highest class cars run, as there are no "first-class" cars.

The most attractive feature of both classes is the post and arms between every three seats. The posts are greatly superior to straps to hold on to, and would be most useful in American cars, being more quickly grasped than straps, easier to hold, and affording a firmer support. The arms in Berlin give every two passengers out of three a corner to sit in, and much of the day there is a passenger in every corner. Such division of the seats does away with all moving along. Both classes of passengers are allowed 20.6 ins. of space apiece. All the incandescent lights are softened with prism globes, a custom also almost universal in English electric cars and greatly superior to the

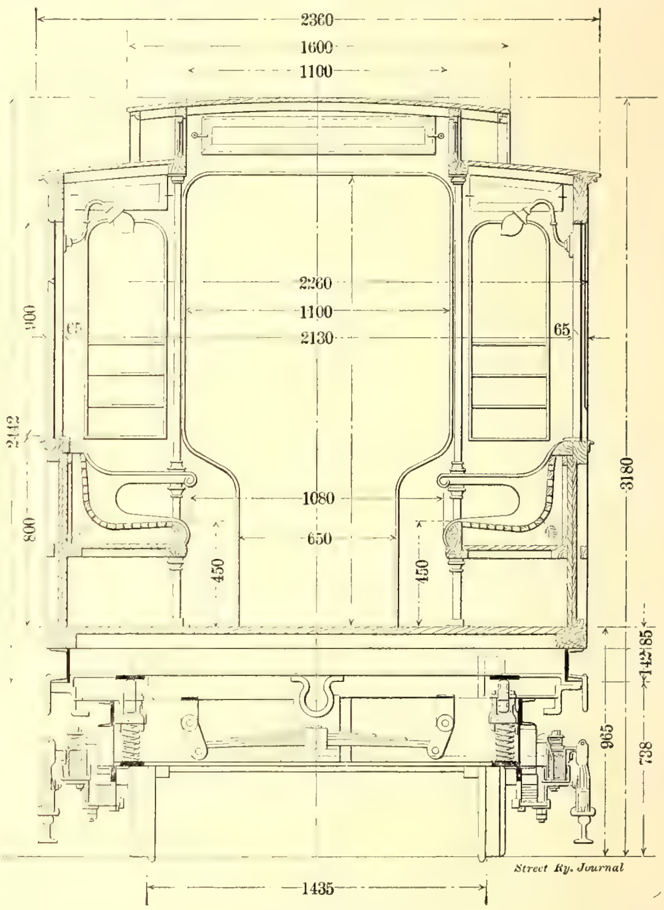


FIG. 22.—SECTION OF BERLIN ELEVATED AND UNDERGROUND MOTOR CAR

use of naked lights. Each car has an emergency lamp ready for use. Electric heaters are placed under the seats.

In the monitor roof the transoms in the front half of each car or compartment open out, so as to force air in, the rear half so as to exhaust the air. The windows in the ends of the cars can be opened any desired amount (Fig. 19). The ceilings are low, but that seems no objection where the means of ventilation are so satisfactory. The side windows are of plate glass, 60 ins. x 35 ins., too large, perhaps, to suit some Americans; but to the writer the size added much to the attractiveness of the cars, for, with window ledges just the right height for elbows, one could sit in a comfortable corner and enjoy riding in a noiseless car through magnificent avenues, lined with splendid buildings. American elevated cars have seats too wide for comfort, and especially for looking out of windows behind. Neither is rattan so comfortable or attractive as the luxurious Berlin seats, upholstered with crimson corduroy or red leather. With the smooth red carpeted floor, the abundance of highly polished metal in posts, arms and handles, the finely designed woodwork, all the work of the latest designers,

no American Pullman can really surpass what is called second class in Berlin.

The economy of the Berlin car can be seen not only in the low cost of the elevated line, but also of the subway, where a headroom was possible of only 10 ft. 10 ins. from rail to roof beams, and a width of 20 ft. 6 ins. between side walls. While cross seats are desirable as acceleration increases they were not possible with the width allowed in Berlin; but the longitudinal seats, as found there, seem fully equal to cross seats, especially as there are no jerks in starting or stopping. Indeed, there seems little need of the many handles with which the cars are supplied, so frequent that a firm support is always within reach from the time one enters a car until he is seated (Fig. 23). Passengers open and shut the doors themselves, there being only one guard to a train. This custom seems perfectly safe, as people are used to it on the steam roads, and then on the elevated line there is no hurry or crowding. In spite of the ease of traveling and a speed limit fixed at 31 m. p. h., one found an average speed of 15 m. p. h., though the stops averaged 25 seconds, the running being the smoothest and quietest of any electric road known to the writer. The cars have no platforms, end doors being only for emergency uses. The abolition of the inside door found in this country is an excellent improvement, the glazed partitions with projections to protect the feet of passengers giving ample shelter from draughts in winter when the side doors are open, especially as the stations are completely enclosed. Our car platforms ought to be so completely vestibuled as to make the inside door unnecessary, especially as the latter allows an opening wide enough for only one person to pass in or out at once, where the Berlin arrangement allows two. With side doors of double width, as in Paris and Berlin, and by the Berlin plan of having all passengers enter at the rear and leave at the front end of cars, our present circulation could usually be doubled.

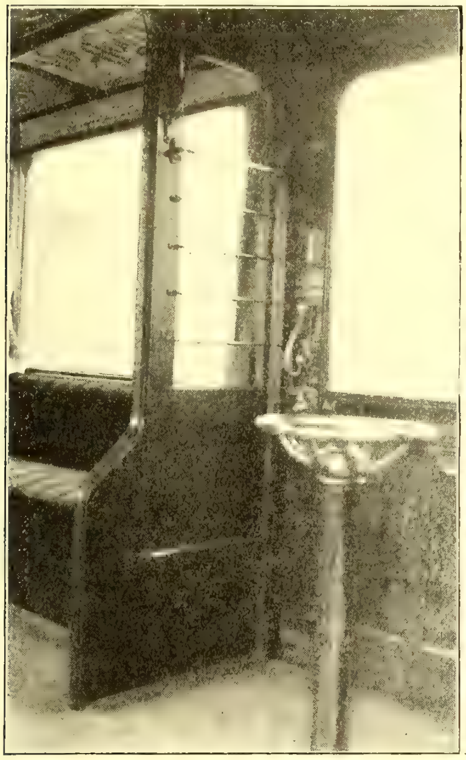


FIG. 23.—VESTIBULE OF SECOND-CLASS CAR, WITH CIRCULAR GRAB-HANDLE

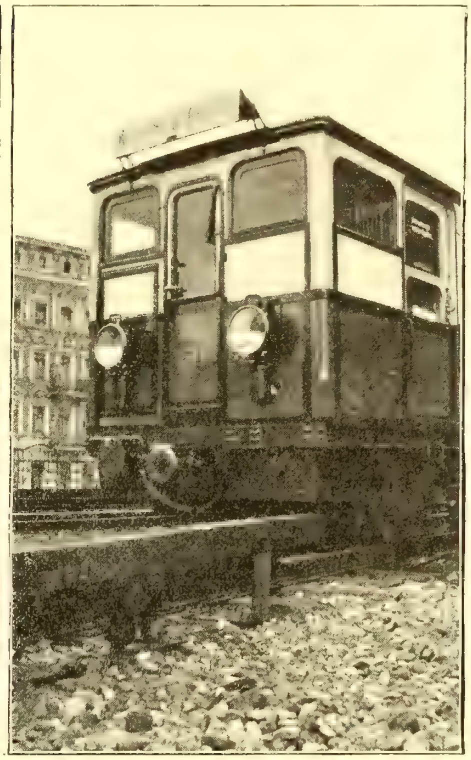


FIG. 24.—FRONT END OF THIRD-CLASS MOTOR CAR


FIG. 25.—MERSEY RAILWAY, DESTINATION SIGN

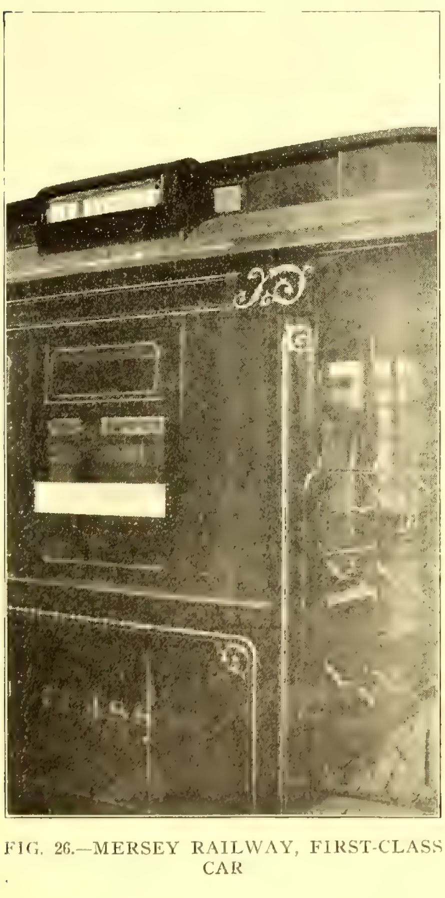


FIG. 26.—MERSEY RAILWAY, FIRST-CLASS CAR

The exterior of the cars is plain (Fig. 24), but tasteful color and cleanliness make the trains attractive. Each headlight has a white lamp and a red lamp inside, the white lights being turned on at the front of the train, the red at the rear. The large triangular destination signs have three names painted on them, each on a background of the route color, so that, with the indicators in the stations, no time is lost by passengers having to ask a guard where a train goes to. The Mersey Railway cars also have signs well adapted for America —blue and white enamel names on a cylinder (Fig. 26), which is revolved inside the car by an arm over a dial (Fig. 25).

Although the shortest radius is 262 ft., roller side bearings are found on the trucks, being used even on the surface cars in Berlin. It is curious that such bearings are not more used in this country to reduce track wear, especially in view of their successful use on the cars of the Brooklyn Bridge, where, with about forty curves of 100 ft. radius to be taken every hour, and no elevation of the outer rail possible, their introduction on the motor trucks not only stopped derailments, but prolonged the life of the rails on curves and cross-overs to an average of two years from a previous minimum of even sometimes less than six weeks when locomotives were used.

VIRGINIA PASSENGER & POWER COMPANY'S YOUNG MEN'S CHRISTIAN ASSOCIATION

BY S. W. HUFF

The Street Railway Journal has contained notices of plans for the organization of a Street Railway Young Men's Christian Association among the employees of the Virginia Passenger & Power Company, of Richmond and Petersburg, Va., and it has been suggested that a more extended notice of the formal organization and launching of this work might be of interest.

FIG. 1.—ASSOCIATION BUILDING IN RICHMOND

It will be recalled by some that about a year ago the Virginia Passenger & Power Company was in the midst of a very bitter and hard-fought strike, with the result that its lines are now being operated by non-union men—a combination of strikers, strike breakers and men who came into the employ of the company after the strike. The company resolved not to countenance any organization among the employees that would bring to the front unwise and radical leaders, but it also realized the necessity and the justice of providing some kind of acceptable home for its men, and, at the suggestion of the principal owner, Frank Jay Gould, the matter was taken up with the officials of the Young Men's Christian Association, and plans mapped out for the organization of such an association among the employees of the company.

Some years back there was a beneficial association among the employees of the Richmond Traction Company (one of the operated companies) and a club house was constructed for them at an expense of about $10,000. Before this building could be completed the street car men's union became thoroughly entrenched among the employees of the company. The beneficial association, or club, was abandoned, and the club building was never used until the strike of last summer, when it was employed for the lodging of strike breakers.

It was found that this building, with some remodeling and improving, was well adapted for the use of the association, and accordingly the company undertook its improvement and the furnishing at an expense of about $5,000. This appropriation was generously augmented by a contribution from Miss Helen Miller Gould of a library, consisting of about 1500 volumes, as well as a music box, talking machine and a number of attractive pictures and mottoes for the decoration of the building, and from Frank Jay Gould of a number of books and a pool table.

The building as remodeled is shown in Fig. 1, and, as will be seen, is of a neat cottage type which well befits its location, near the Reservoir Park, the city's main center of attraction during the summer. The general reception room, in which is located the secretary's desk, pool tables, games, etc., is shown in Fig. 2.

The reading room, which is provided with all the standard periodicals and a number of daily papers of interest in this section, is illustrated in Fig. 3. The library, which adjoins the reading room and which has been so very generously stocked by Miss Gould with books, is shown in Fig. 4, and the general assembly room in Fig. 5. This hall seats about 300 people.

The last, but in reality first in the minds of the employees, is the bath room, as shown in Fig. 6. This, it will be noted, is a handsomely tiled room, provided with hot and cold water and all the most modern appliances for a luxurious bath. Immediately above the bath room is the locker room.

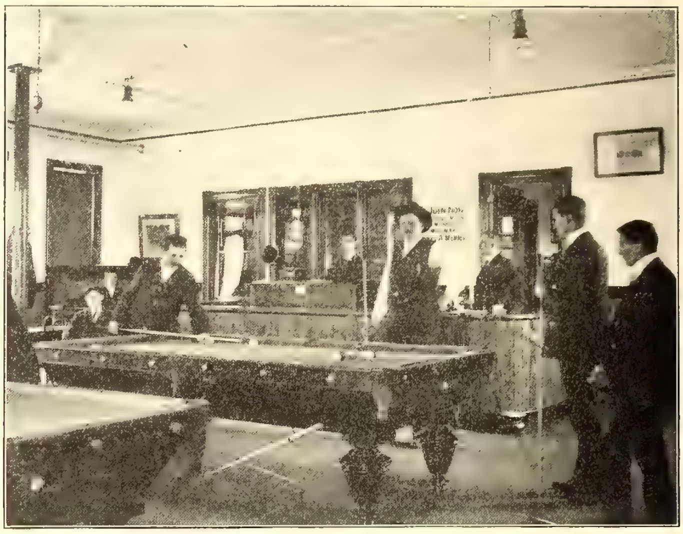


FIG. 2.—GENERAL RECEPTION ROOM.

The building throughout is furnished in a substantial and handsome manner and is brilliantly lighted by Nernst lamps.

On April 23 this building was formally opened by three receptions—one in the morning for the "late straight" men, one in the afternoon for the "swing" men, and the final opening at night for the "early straight" men, and men from the shops, power houses, lines and office and other employees who were unable to attend either of the previous receptions. At this night meeting addresses were made by several prominent Young Men's Christian Association workers, among those from a distance being Messrs. Lougee, Williams and Millar, of the international committee, as well as a number of local people. The building was formally turned over to the employees by the general manager of the company and accepted in responses by

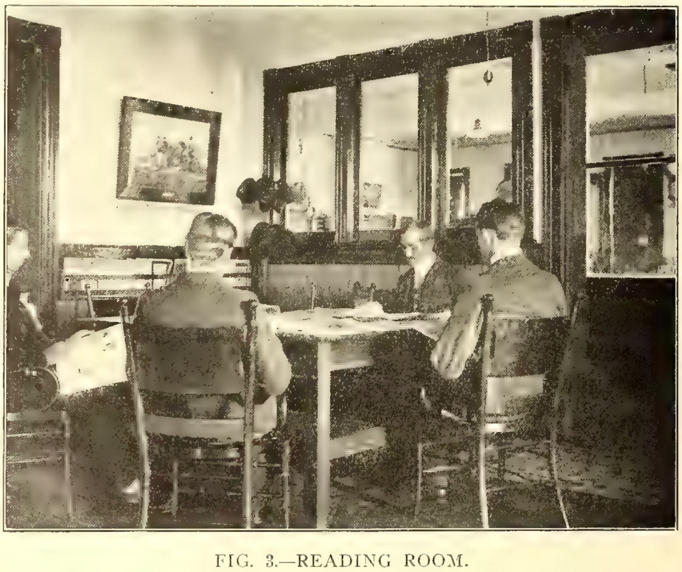


FIG. 3.—READING ROOM.

the men themselves. Miss Gould made the trip from New York to be present at this opening, and with the party of ladies accompanying her from New York and ladies from the families of officials of the company, received the men and their

FIG. 4.—THE LIBRARY

families. The receptions were largely attended and the utmost good feeling prevailed.

The following quotation from an afternoon paper is expressive of this good feeling:

IT'S "MISS HELEN" ON THE CAR LINE NOW.

Presto, change!

The building where, not so many months ago, the call of the trumpets echoed and the jangle of side arms was to be heard, where the walls were covered with racks of rifles and shot guns and men paced uneasily all night and all day, not knowing what the hour would bring forth—this building is to-day as handsome and as cozy a resort for men with Christianly feeling one for the other as ever was dedicated to the broad cause of the Young Men's Christian Association.

A little lady with a smiling pair of eyes and a good, strong handshake for all, was the presiding genius of this new and welcome

FIG. 6.—BATH ROOM

change of affairs. The half hundred and more of the employees of the company assembled to meet Miss Helen Gould, showed how they felt and appreciated the new and goodly order of things.

The handsome parlor car, especially prepared for the visitor, whose reputation is national for her good works and her deep love for humankind, was named the "Virginia." The men have changed it, and when it approached the new Y. M. C. A. Building at the Reservoir this morning, they hailed it as "Miss Helen's Car." It is safe to say that it will always be "Miss Helen's car," and that in Richmond Miss Gould will always be "Miss Helen."

The work thus most auspiciously launched is moving along smoothly and successfully, 440 members having been enrolled out of an available membership of 700. The management is more than pleased with the result and the bearing which the

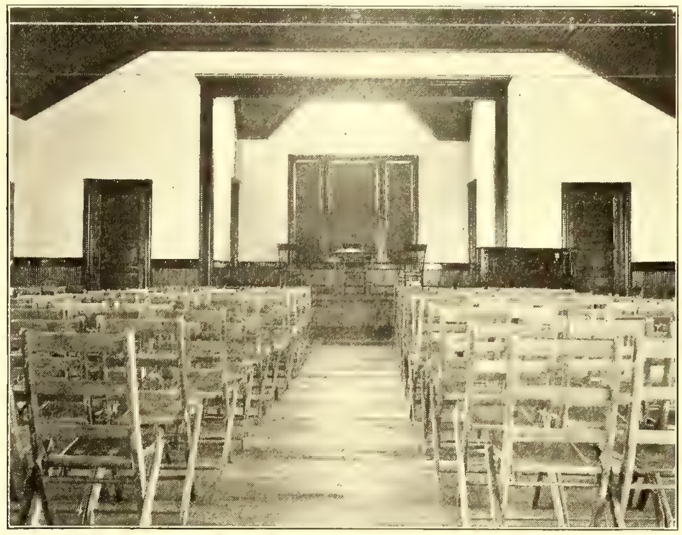


FIG. 5.—GENERAL ASSEMBLY ROOM

association seems to have upon the personnel of its employees. Everywhere it is remarked that the employees of the Virginia Passenger & Power Company seem to feel a deep interest in the welfare of the company. This is only natural, as the men feel that the company has shown an interest in their welfare in a substantial way, and, as a rule, men respond in kind to an interest of this sort unless prevented by some undue and vicious influence, which, it is believed, is not present to any considerable extent among the employees of the Virginia Passenger & Power Company at this time.

The management believes that the money which the company has invested in this building and equipment ($15,000), and the amount which it proposes to contribute toward the maintenance of the work (practically $2,000 per year) is well spent.

It is not unusual to see gathered around the same piano Protestants and Catholics, strikers and strike breakers, the old and the young, singing the same songs or hymns, and all united in one fellowship. It is believed that this mingling of car men, shop men, power house men, line men, track men, office men and officials, all on the same level, along social, religious and educational lines, will work incalculable good for each class and result in a much improved service for the company from each man in his particular sphere of action.

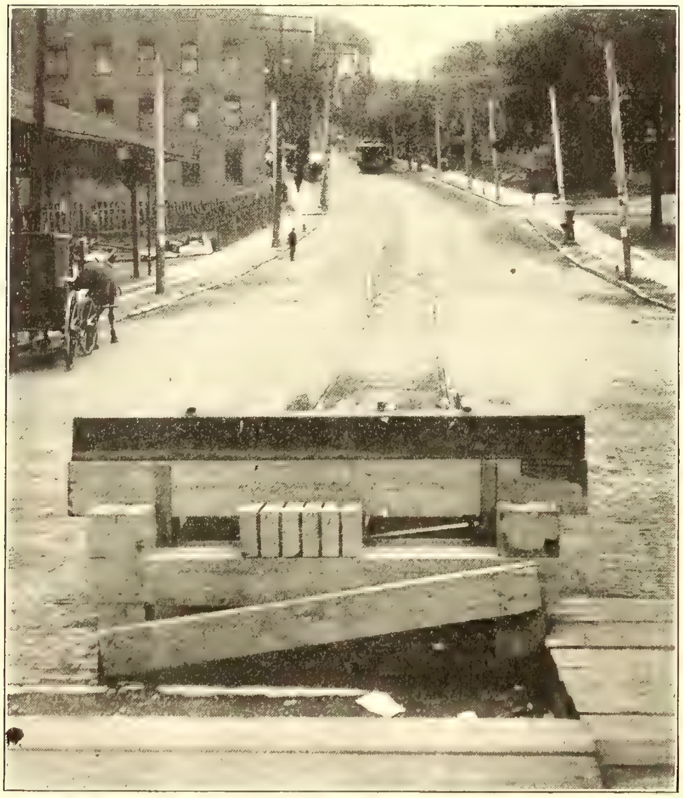
RACE SEPARATION IN COLUMBUS, GA.

H. S. Reynolds, manager of the Columbus Railroad Company, of Columbus, Ga., writes as follows:

"I note in your issue of May 7 an article entitled 'Race Separation in San Antonia, Tex.,' in which it is stated that the street railway company there has proposed a new plan for race separation which promises a solution of the problem. The statement that the plan is new is not exactly correct, as practically the same arrangement has been in vogue in this city for the past three years, the slight difference being that the first seat full of darkies are obliged to take the rear seat, whereas white people can occupy any of the other seats, they not being compelled to take the front one, as is proposed in San Antonio. Also when the car is nearly full it does not make any difference which color first occupies the last vacant seat, but the whites are given the preference. Our conductors are authorized and required by city ordinance to designate to passengers, both black and white, where they shall sit, and we have little or no trouble in the working out of this arrangement."

AN EFFECTIVE EMERGENCY CAR STOP FOR USE AT THE FOOT OF A DANGEROUSLY STEEP HILL

The accompanying engravings illustrate an interesting safety precaution in the form of an emergency car stopping device.



REAR VIEW OF CAR STOP

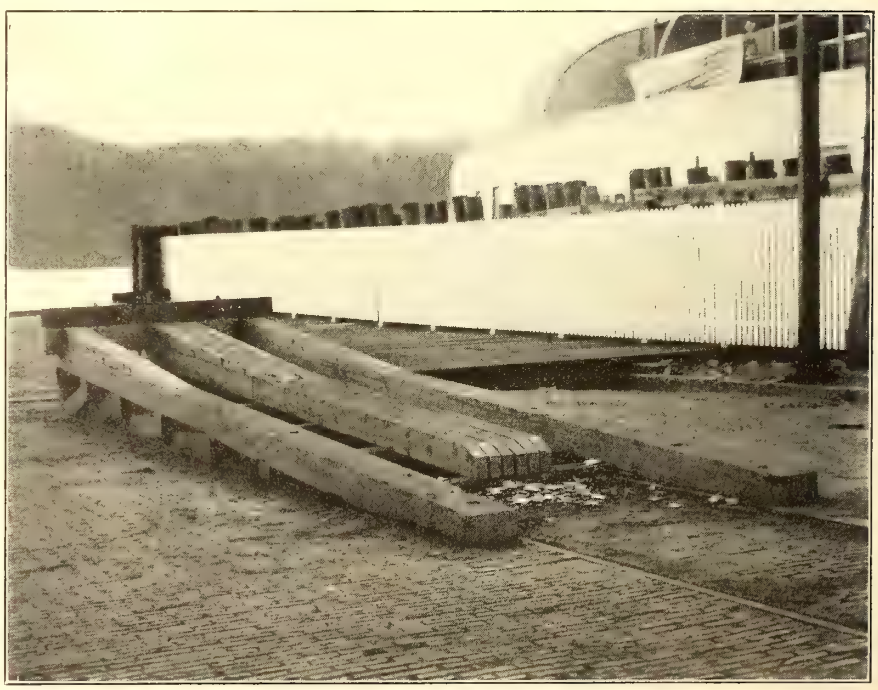
It was designed for the protection of runaway cars on a very steep hill, due to slippery rails, ineffective braking, or other possible cause. The device is of an unusual although simple design. Its effectiveness is not apparent from a hasty examination of the views, but it is the result of a long and careful study of the possible methods of protecting this grade, which is of a particularly dangerous character. This scheme is in use by the Poughkeepsie City & Wappingers Falls Electric Railway Company, at the Hudson River terminal of its Main Street line in Poughkeepsie, N. Y.

The Main Street line in Poughkeepsie is operated over a treacherous piece of track leading from the landing of the Hudson River ferry up to the business portion of the city, which lies upon a very high level. From the Court House down to the ferry landing the line is one continuous stretch of down grade—nearly a mile in length. The latter end of this grade, as it approaches the river, is one of the steepest sections of the slope, and cars are required to make their terminal stop immediately at the foot of this incline, with no length of level track for proper stopping facilities. In the photograph showing a rear view of this emergency stop the general character of this grade may be seen. As will be noticed the line is double-tracked to within a short distance of the terminal, where the two tracks come together at the switch. The dangerous character of this grade may be understood from the fact that in several instances cars have gotten beyond control, owing to the slippery conditions of rail and other causes. Fortunately, however, only one serious accident has resulted here. In this case a car got beyond control and ran to the foot of the hill at a very high speed, crashing through the landing shed upon the dock at the river's edge and going off into the river, carrying with it the motorman and several passengers. The car went down into 40 ft. of water, the depth at that point, and although some of the passengers were seriously injured all were rescued.

As a result of this accident a great deal of study was given to the best way of stopping a runaway car, but it was with difficulty that any remedy was reached which did not seem to provide a more dangerous condition than would obtain if it were omitted. The use of a bumper block would have meant sure death to everyone in the case of a runaway car. At one time a large heap of dirt and ashes was located directly at the end of the track in order that a runaway car might thus be held from going off into the water, and later this was supplemented by several large logs which were chained in a position crosswise of the track near the terminal. This arrangement offered serious obstruction to a runaway car; but its dangerous as well as unsightly character led to the design of the inclined-plane car stop illustrated.

The stop finally selected is remarkable for its extreme simplicity as well as effectiveness. It consists merely of a short incline built up of rough timbers, as shown, and so located that a runaway car will slide up upon it, the lower parts of the truck frame coming in contact with and riding upon the side timbers. The effect of this is to cause the car to be lifted off of its wheels and slid along upon the timbers until the momentum of the rapidly moving car is expended in the friction of sliding. The framework of the slide is strongly and stiffly built, and is anchored securely to the track. The character of construction is clearly shown in the front view.

Recently an opportunity was afforded for severely testing the device. A large amount of slippery mud had been washed upon the rails by street cleaners, and a car descending the grade became unmanageable and ran away. The brakes would not hold the car on account of the condition of the rails. The car was going at a comparatively high rate of speed when it reached the terminal and ran on to the emergency stop. Its speed was, perhaps, not so high as might have been the case with released brakes, or in case of an icy rail, but was sufficient to have occasioned another very serious accident if the inclined plane stop had not been in place. The result was that



FRONT VIEW OF CAR STOP

the car made the incline and slid upon it easily, coming to a gradual and gentle stop. The effect upon the passengers was hardly more severe than would have been the case in the event of a stop on a level by reversing of the motors, and no inconvenience was caused. Later on, when it was desired to place the car in service again, another car was coupled to it and easily dragged it off of the incline onto the track without assistance, and the car was immediately placed in service without the necessity of repairs.

Too much cannot be said in favor of this method of providing for possible accidents of this nature, which are inevitable where extremely steep hills are surmounted. This hill is of a very severe nature, no level space being afforded for the purpose of comfortably and safely stopping the cars; it is practically necessary to stop the cars while still on the hill. The danger is enhanced owing to the hill ending directly at the water's edge, and the case is rivaled by only a few similar instances in other cities where surface lines upon steep hills approach busy steam railroad crossings at the foot of the inclines, making serious accidents inevitable in case of runaways. The photograph, unfortunately, does not indicate clearly the character of this grade, but by reference to the view looking up the hill the steepness may be judged by comparing the height of the crest of the hill with the adjoining factory building.

FIRST ELECTRIC RAILWAY IN PERU

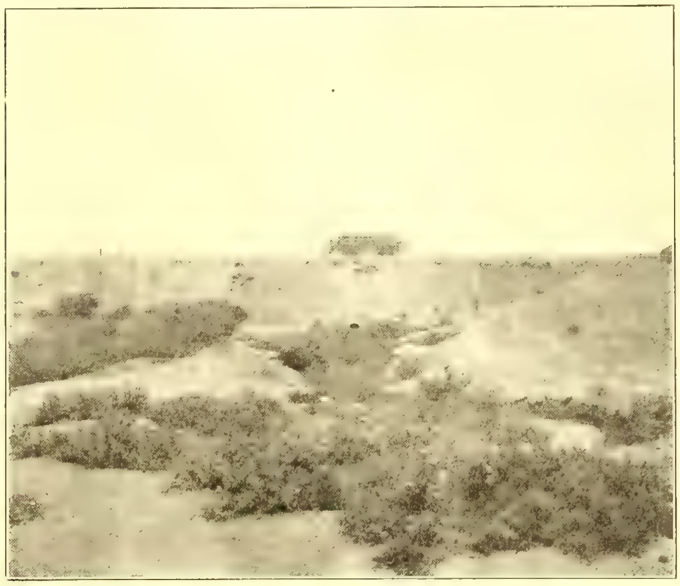
The construction of the first electric traction system in Peru—the Lima-Chorillos Railway—is now completed. The road

MAIN CAR HOUSE, LIMA

CONVERTIBLE CAR

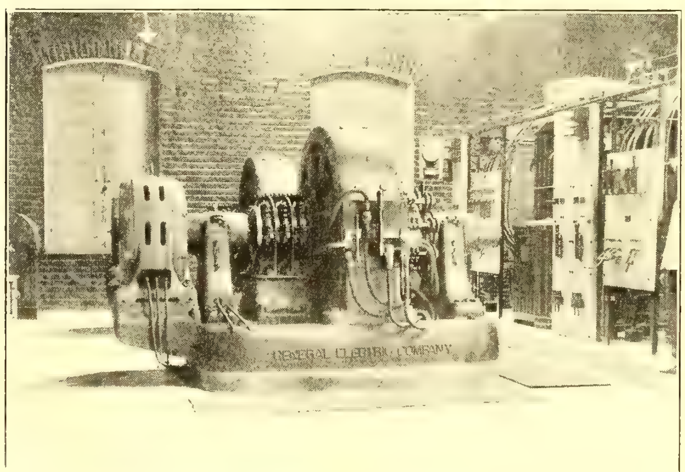
contains about 20 miles of track, and runs between the capital city of Peru and Miraflores, Barranco, Buenpastor and Chorillos, all popular seaside resorts. American equipment is utilized throughout. Power to operate the system is derived from the hydraulic plant of the Compania Santa Rosa Limitada, which also lights Lima, and is located about 35 miles from that city. The equipment includes General Electric generators and Pelton water-wheels. An 800-kw set has recently been ordered.

Semi-convertible cars are used, as this type of car has been



LONG HILL ON THE LIMA-CHORILLOS ROAD

found to be very satisfactory in countries where there are sudden climatic changes, as it can quickly be converted from an open to a closed car to furnish shelter from wind or rain. The rolling stock consists of ten of these cars, supplied by the John Stephenson Company, and divided into two compartments, one for first-class passengers and the other for second-class passengers. The partition separating the two compartments is movable, so that it can be placed in any position desired. The cars are equipped with the automatic emergency car lighting system of the Federal Electric Company, described in the last



INTERIOR OF SUB-STATION

issue, by which the lamps remain lighted even if the trolley leaves the wire. The cars have 28-ft. bodies, are 8 ft. 4 ins. wide and 36 ft. over all, and were described in the Street Railway Journal for Sept. 19, 1903. They are mounted on Peckham 14-B3X trucks, and are equipped with two G. E.-57 motors, each with K-11 controllers. Sterling power brakes are used.

The overhead line consists partly of span and partly of flexible bracket construction. The trolley wire is No. 0000, and General Electric No. 0000 rail-bonds are used.

The Lima-Chorillos Railway is being operated by Peruvian capitalists. A. W. McLimont, an old Thomson-Houston man,

had charge of the construction of the system. The same interests which control the Lima-Chorillos road are building an

VIEW IN SUB-STATION—LIMA

electric railway between Lima and Callao, its port. This line will be about 10 miles in length. The General Electric Company received the contract for the construction and equipment.

DO NOT FAVOR REGULAR EXCURSIONS

The interurban roads of Columbus will have nothing further to do with the efforts of the merchants of that city to work up special trade excursions. Their plan was to give a single-fare ticket to Columbus to any person buying $10 worth of goods in the aggregate from members of the association, or a round-trip ticket to purchasers of more than $20 worth. Some of the roads favored the plan, while others did not. None of them agreed to the terms requested by the association, which proposed that the roads give the association the benefit of reduced rates, issue tickets containing the association's coupons, and permit the ticket agent at Columbus to figure up the amounts of goods purchased before issuing the association ticket. The roads argued that it would be better to run their own excursion and give the public throughout the country the reduced rate, and let the association give a ticket to a circus or some other amusement place. The roads agreed, however, to issue the association's receipt to those who paid cash fare and asked for receipts. As a matter of fact the roads were compelled to give some form of receipt to those that asked for them. As the result of the excursion, the roads have been between two fires. The country merchants and country newspapers accused the interurbans of assisting in a movement designed to carry trade away from the small towns, while the city merchants and city papers denounced the roads for refusing to co-operate with the plan to bring business to Columbus.

The majority of the interurban managers were fully aware of the troubles that such excursions are likely to create. The Columbus interurbans are doing a large amount of package-freight business, consisting largely of goods for the country merchants, and it has been found, too, that the bulk of the passenger receipts comes from people going in and out of the small towns. While such excursions might result in increased traffic for the time being, it is claimed by experienced traffic men that the reaction generally overshadows the temporary gain, not only because people stock up with goods that they might have made two or three trips for under ordinary conditions, but because the promotion of such excursions by a railroad invariably gains for it the ill will of the shopkeeper in the smaller town, and this feeling is apt to be spread broadcast by a biased press.

NOTES ON THE SAN DIEGO AND CORONADO RAILWAY SYSTEMS

San Diego, Cal., is a growing city of about 23,000 population, situated at the southernmost part of the State, on the Pacific Coast, and close to the Mexican border. It has 17 miles of electric railway, owned and operated by the San Diego Electric Railway Company. Less than a mile across San Diego Bay, on a narrow strip of land facing the ocean, lies Coronado Beach, a resort, which, with its tent city and famous tourist hotel, has become known throughout the country as a popular all-the-year-round watering place. In Coronado an electric railway, slightly over 2 miles long, is operated by the Coronado Railroad Company, and makes connection with a ferryboat which plies between San Diego and Coronado. This boat is operated by the San Diego & Coronado Ferry Company. All three companies are controlled and operated by practically the same interests. Some of the interesting features of both railway systems will be described in the following notes:

DOUBLE-DECK CORONADO CAR

Probably the most conspicuous characteristic of the Coronado Railroad is the large double-deck car shown in Fig. 1, which is used throughout the summer and whenever the traffic warrants it. This car is of Brill manufacture, and is 41 ft. in length over all. It has a seating capacity of eighty, and can carry 150 people. The roof of the upper deck is 20 ft. above the rails, and the trolley wire is placed 4 ft. above that. The car is mounted on Brill maximum-traction trucks, equipped with two G. E.-67 35-hp motors. Complete it weighs 13 tons. The ordinary hand brake is provided, and in addition the car is

FIG. 1.—DOUBLE-DECK CORONADO CAR ON PALM-BORDERED AVENUE.

equipped with a simple but efficient rope brake. This latter brake consists of a hemp rope, wound one complete turn about a 16-in. cast-iron drum, that is mounted on the small idle axle of the truck. With this brake the car can be quickly brought to a stop, and although the rope has to be replaced at intervals varying from one to three months, the construction on the whole is an inexpensive but effective one. The rope on the drum is kept lubricated a little, so that it will not tighten up of itself when running loose.

This car has been in use by the company for about five years, and for the conditions under which it is operated serves the

purpose very well. These conditions are that it make trips every 20 minutes between the ferry dock and the hotel and tent city. Its capacity is generally sufficient to handle the crowd, whereas a single-deck car would have to haul a trailer most of the time. At periods, however, when the resort season is at its height, even the capacity of the double-decked car is exceeded, and trailers have to be put in service, as shown in Figs. 2 and 3. Of these three illustrations, Fig. 1 is a view on the palm-bordered avenue leading up to the hotel from the ferry dock, Fig. 2 is a general view of Tent City, with the Hotel Coronado in the distance, the ocean on the left and the bay on the right, and Fig. 3 shows a train unloading at the Plaza in the center of Tent City.

Power for the Coronado Railroad is furnished from a steam plant located near the hotel, for which it also supplies power and light, as well as lights for all of the tents and grounds.

FERRYBOAT

Last summer the new ferryboat, "Ramona," shown in Fig. 4, was put into service for the travel across the bay. This boat is 130 ft. over all, has a draught of 6 ft. and a gross tonnage of 575. It has a carrying capacity of 1000 people, with seats for 400. It is equipped with two high-pressure, surface-condensing, direct-acting engines, giving 720 ihp at full pressure, and driving the boat at a speed of 14 m. p. h.

REBUILDING OF SAN DIEGO CARS

The present management of the San Diego Electric Railway Company has been engaged for the last year or more in putting its entire rolling stock and shop equipment in good operating condition. An important change in the rolling stock has been in converting some of its old cable cars, like that shown in Fig. 5, to the combination California type of car shown in Fig. 6. This latter car, which may be said to represent the company's present standard, is 33 ft. over all in length, and is mounted on two 27-G Brill trucks, equipped with two G. E.-52 motors. The car has glass ends and longitudinal seats in the open ends as well as in the closed compartment. In rebuilding these cars the roofs of three old cable cars were used to cover two of the rebuilt cars. The body was strengthened by a steel plate the entire length of the outside side sills, as shown in Fig. 6.

The general construction of this type of car with open ends has been found to give it an appearance, when viewed as a whole, of being higher in the center than at the ends. In other words, the ends seem to drop down, and in some few cases they actually do so. To obviate this tendency the side plates have been given a gradual incline from where the closed body ends to the end of the car. The total rise in this distance of about 10 ft. on each end is only 3/4 ins., but it is just sufficient to make the car appear to the eye to be perfectly straight.

Hand brakes of the ratchet type are used on the cars, the hand lever working between two semi-circular racks with a pawl that fits into both. The company has found the double rack to be much more efficient than the single one, as it gives even and uniform bearing for the pawl and does not tend to twist the lever out of position.

SHOP FEATURES

There are several problems that the San Diego Electric Railway Company has met in the operation of its shops, which, doubtless, often require careful consideration by other companies operating systems of about the same size. The management found that in order to do its own repair work properly it required a carpenter, a painter, a blacksmith and a machinist. To have good work done wherever it was necessary, these men had to be experienced and capable. However, there was not

FIG. 3.—TRAIN UNLOADING AT THE PLAZA, TENT CITY—CORONADO

enough work of simply the repair nature to keep these men employed continuously, and as it would not do to hire a carpenter or a painter simply when there was work for them, and thus

FIG. 2.—CORONADO, SHOWING TENT CITY AND HOTEL IN DISTANCE—ALSO TRAIN WITH DOUBLE-DECK CAR AND TWO SINGLE-DECK TRAILERS

be unable always to secure men experienced in car work, it was finally decided by the company to rebuild its cars and also to build new ones complete. This plan was successfully put into practice, with the result that skilled mechanics are kept constantly in the employ of the company, thus becoming familiar with its work and methods and turning out work with economy and despatch. Although it costs the company about as much to build a car as one constructed in the East, with freight charges added, the plan of building its own cars is considered

advantageous, since the company is able to build its cars exactly to suit its own local requirements. In the San Diego shop are also made all the heavy repairs for the Coronado Railroad and what work is needed for the power stations or other mechanical equipment for the allied corporations. However, no jobbing work is done in competition with local machine shops.

A factor that has helped considerably to bring the shops to

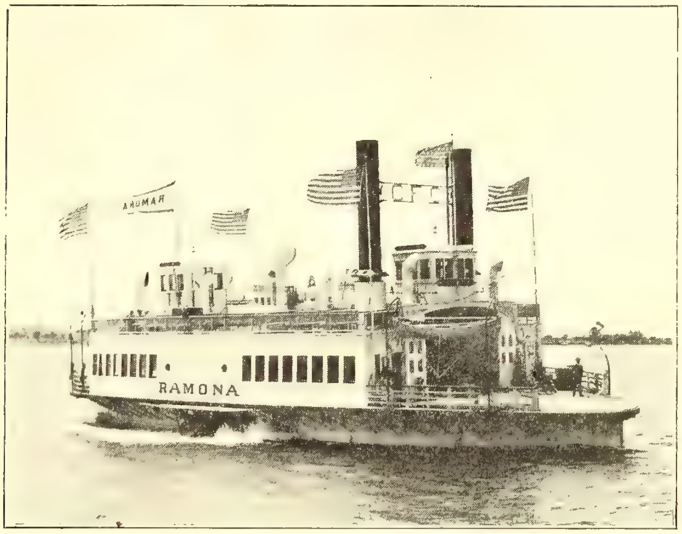


FIG. 4.—FERRYBOAT RAMONA, PLYING BETWEEN SAN DIEGO AND CORONADO.

their present state of economical operation is the policy of making all the tools and apparatus possible when it will save buying manufactured ones, or will lighten the labor of the repairmen. This policy has been developed carefully and successfully under the supervision of the company's chief electrician and master mechanic, Homer MacNutt. None of the devices described below is patented.

FIELD-WINDING MACHINE

Probably the most original apparatus in use in the shops is the field-winding machine illustrated in Fig. 7. The form for the field coil is screwed on to the extended axle of a 16-in. ground-friction wheel, which in turn is driven by a 5-in. friction wheel at the end of a cone pulley shaft. This shaft is normally held by a spring so that the friction wheels do not engage. When it is desired to revolve the coil the foot lever is pressed down, and this, through the medium of rods, pulls the smaller friction wheel into engagement with the larger one. When winding the heavy wire on field coils it is necessary to stop frequently so as to keep the coil in proper shape, and some form of brake is required to keep the coil from slackening or unwinding when the power is taken off. For this machine a very positive brake was devised in the shape of two dogs, which bear on the outside grooves of the large friction wheel. These dogs are hung a little above the center on independent axles, and when the wheel stops they hold it positively against reverse motion. One dog would probably be sufficient, but two are used, so as to increase the reliability of the action. Not the least important part of the apparatus is the revolution counter connected by a rod to a crank pin on the end of the large friction wheel shaft. This registers each revolution of the coil, and the operator does not have to keep track of the number of times mentally. An ordinary engine register is used for the counting device.

ELECTRIC ARMATURE OVEN

In Fig. 8 a view of one side of the main shop room are shown a lathe and thirty-lamp testing rack, and at the right an armature oven served by a swinging jib crane. Mention should be made of this oven on account of its simple construction and the ease with which the armatures are placed in it. The oven is constructed of concrete, about 4 ft. x 5 ft. ground dimensions, and 3 ft. high, with 8-in. walls. The heating coils, consisting of about 5 lbs. of No. 20 iron-tinned wire wound on grids, are placed below the floor level in a small pit, so that all the space in the oven is available for baking. The current required at 500 volts is 5 amps., and an armature can be baked thoroughly in 24 hours. A wooden door, hung with a counter-weight, covers the oven, as shown in the illustration.

The crane that serves the oven was built in the shops, and has a 12-ft. arm, on which travels a Weston triplex block. The armatures are hoisted by a steelyard arrangement with wire rope loops that are passed around the ends of the axle and hook onto the cross-piece of the steel yard.

PINION PULLER AND ARMATURE TRUCK

Fig. 9 shows a device gotten up for removing pinions from an armature shaft quickly and without injuring the pinion or the end of the shaft. It consists of a special 1½-in. x 1½-in. forging, rectangular shaped, with one end open enough to fit over the axles back of the pinion. The jaws formed by this opening bear on the rear face of the pinion. A round cap is used to fit over the thread on the end of the axle and bear against the shoulder of the axle. A slightly tapered key is then driven down in slots provided for that purpose in the cap and end of the forging, and the pinion is quickly forced off its taper. The cap protects the thread as well as the center marks on the end of the shaft. The rectangular piece is held in place by an iron strap that fits over the pinion. As the company has pinions all of one size this puller fits them all; in the case of pinions of different sizes probably two pullers could be made to fit all.

The armature truck shown in Fig. 9 is of simple construction, and has a fifth wheel on the front axle so it can be easily moved about.

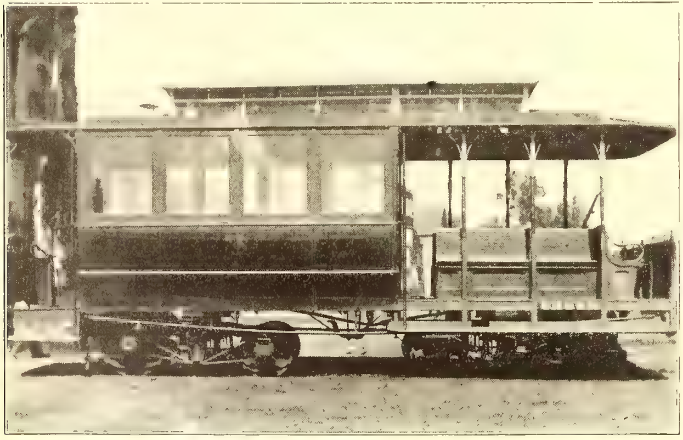


FIG. 5.—CABLE CAR USED TO FORM CAR SHOWN IN FIG. 6

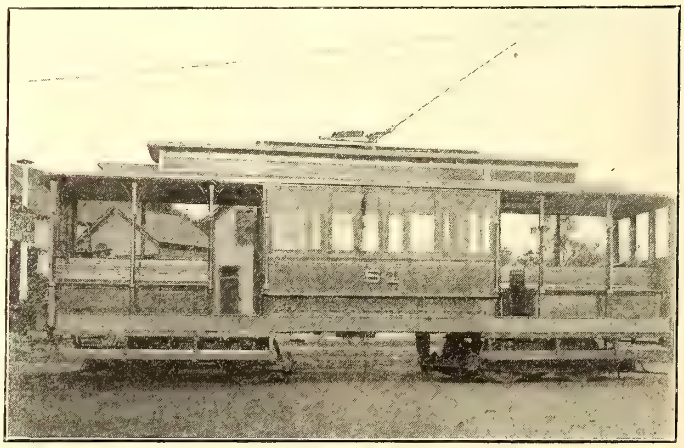


FIG. 6.—CABLE CAR REBUILT INTO ELECTRIC CAR

ARMATURE HORSE AND BAND WINDING DEVICE

The style of armature horse used by the company is illus-

trated in Fig. 10. This horse is mounted on truck casters, and has a swinging tray for holding tools. As shown in the picture it is fitted up for winding bands on the armature. A crank fitting over the pinion is used to turn the armature, while the band wire is pulled through a screw hand vise, that is held by means of a leather strap to a car clamp that passes under the floor of the horse and clamps on top of it at the back. This clamp fits loosely and can be easily moved sideways, so as to be kept directly under the band. The wire passes through wooden blocks held by the jaws of the vise, the latter being screwed just tight enough to give a good tension on the wire. This device is quite simple and inexpensive, and has served its purpose admirably. In order to illustrate the arrangement better in the photograph, a white insulated wire was fitted over the armature instead of the smaller iron wire used for band wiring.

ADJUSTABLE KNOCK-DOWN HORSE

An adjustable knock-down horse that is found useful in many places is illustrated in Fig. 11. It consists of two two-legged, or "A," horses, with an iron bar, ¾ in. x 4 ins., fitting into clamps at the tops. This bar is pinned in at each end with two taper pins put in from opposite sides, so that the bar cannot work loose. Traveling on the bar is a pulley which supports a tackle that may be used for any purpose decided. Different lengths of bars may be used for the horse as conditions may require. One use to which this horse is put with good results is in removing armatures and motors from the trucks of single-truck cars, a few of which the company still has in service. As these motors have to be removed through the car floor, one end of the horse is stationed inside of the car and over the trapdoor in the floor, while the other end is placed outside on the platform. With this arrangement the motor can be easily raised and moved to the platform, whence it can easily be carried to any part of the shop desired.

ARMATURE JACK

The armature jack shown under the horse in Fig. 11 does not differ materially from many in use throughout the country, but, from the fact that it is homemade, it deserves to be mentioned. It is formed of a piece of 6-in. iron pipe, secured to the truck by a flange on the bottom. In the top is driven, or shrunk, a cast-iron nut with a shoulder resting on the end of the pipe. In this nut runs an ordinary jack screw with a saddle or armature rest on top. The screw is turned by a rod or a hand wheel. The jack being mounted on truck casters it can be moved about anywhere in the pit.

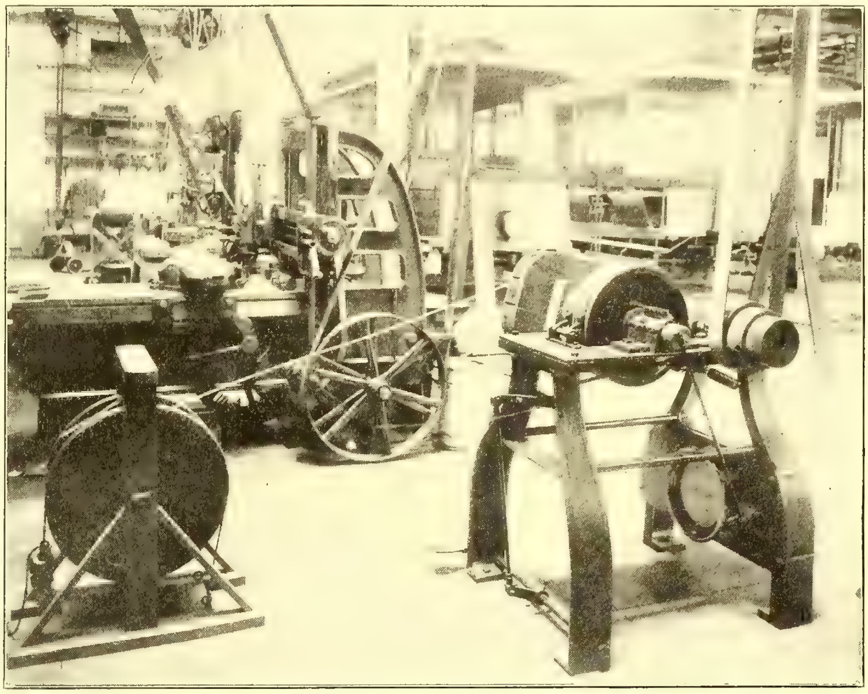


FIG. 7.—FIELD-COIL WINDING MACHINE

CAR-LIFTING ARRANGEMENT

When it is desired to lift one end of a car so that a truck may be removed the arrangement illustrated in Fig. 12 is used. A hydraulic jack on a special horse is placed on each side of the car, and the two jacks are used to raise the car by means of a timber placed under the car and through the horses. When the car is lifted to the desired height the timber is held by iron pins.

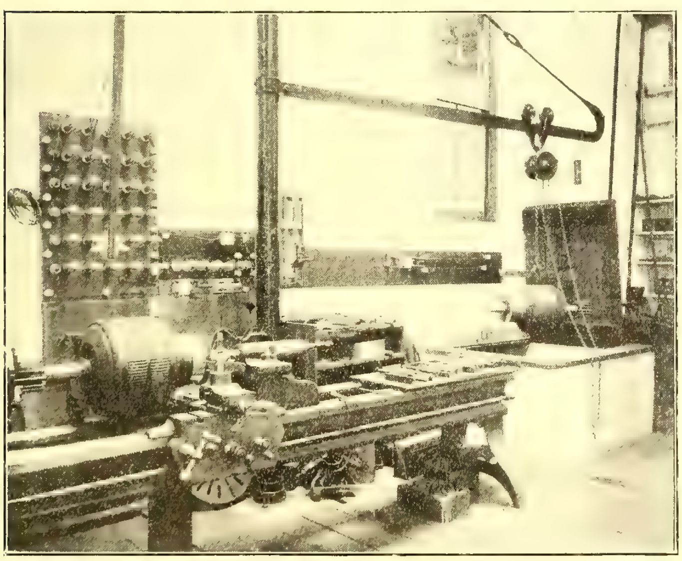


FIG. 8.—SCENE IN SHOPS, SHOWING LATHE, TESTING RACK, ARMATURE OVEN AND SWINGING CRANE

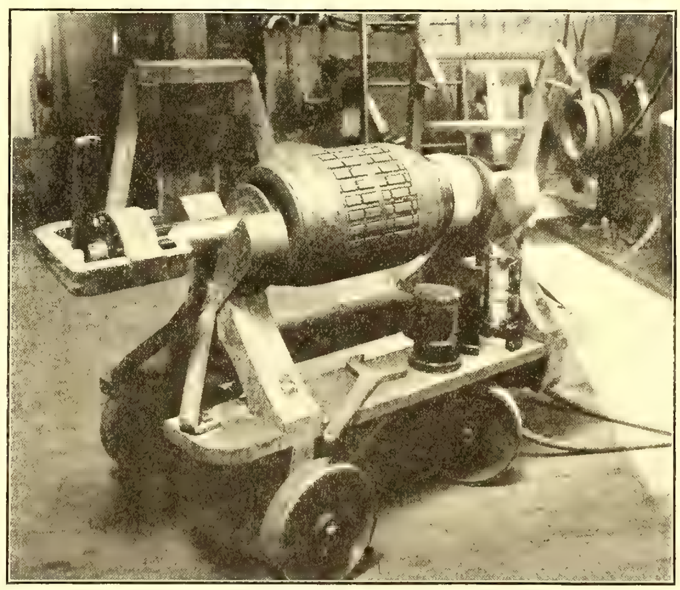


FIG. 9.—PINION PULLER AND ARMATURE TRUCK

OPERATING FEATURES

Some features in the operating department of the company are of interest. One of these is the liberal policy in the handling of the men that has been adopted on recommendation of Wm. Clayton, vice-president and managing director. On two occasions during the last two years the company has voluntarily

increased the wages of the trainmen. On July 15, 1902, the wages were raised from 20 cents to 22 cents an hour without being forced by any movement, it being deemed advisable to make the increase so as to conform more closely with the rates prevailing on the Pacific Coast at that time. Then a few months ago, after there had been considerable agitation in San Francisco and Los Angeles and other Western cities on the wage question, the wages of the San Diego men were again voluntarily raised by the company, this time to conform with the Los Angeles rate, which is 22 cents for extra, 22½ cents for regular, 23½ cents after five years, 24½ cents after ten years, and 25½ cents after fifteen years. The period of service of the men was made to date back through the preceding companies that operated in San Diego, before the present interests took hold. As a result of this broad policy the company has been free from any union and its employees work in harmony with the management.

Besides the two electric railway companies and the ferry company there are five other allied corporations in San Diego and Coronado controlled by the same interests and under practically the same management. It has been found advisable to have a mechanical board and an electrical generation and transmission board made up of the heads of departments to sit on matters of importance or of general interest to all companies. The chairman of both of these boards is the chief electrician, and the other members comprise the chief engineers of the stations and the ferryboat, electrician of the hotel company, etc. When necessary the civil engineer of the hotel company sits with the mechanical board.

There is also a board of control, made up of the vice-president, auditor, superintendent and counsel of the companies. This board confers on matters of general policy as affecting the interests of the companies, and when the matters are of a mechanical or electrical nature they are referred in turn to the other boards. After, for example, the mechanical board has carefully considered a problem, and its report is made to the vice-president, if there is need of further investigation the whole matter is submitted to the company's consulting engineer for final consideration and report. In this manner much of the preliminary investigation that a consulting engineer often has to make is saved with its necessary expense, and the engineers of the companies are made to feel that their advice is of value. Of course, it is only such matters as the remodeling of a power station, or something of equal importance that is referred to the consulting engineer.

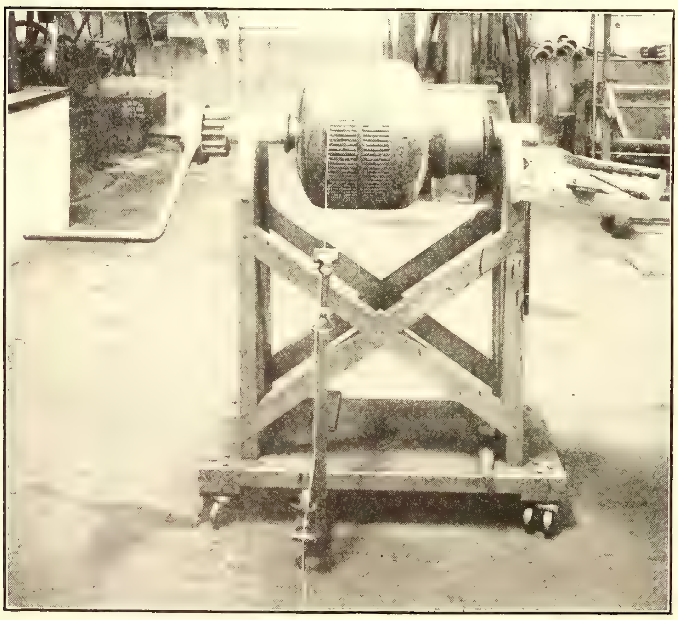


FIG. 10.—ARMATURE HORSE AND BAND-WINDING DEVICE

One effect of this careful attention to the mechanical and electrical details of the system has been the reduction of the operating cost of the main power station in San Diego. Although it is a belted plant, without modern generators, current is delivered to the switchboard at a cost of 1.1 cents a kilowatt-hour, not including interest and depreciation. Features that help this economical operation are the use of a storage battery on the peak loads and the burning of oil with an improved burner, which atomizes the oil by air pressure. It is also of interest to note that a burner is placed at the rear of the boiler furnace as well as one at the front, thus giving a uniform flame.

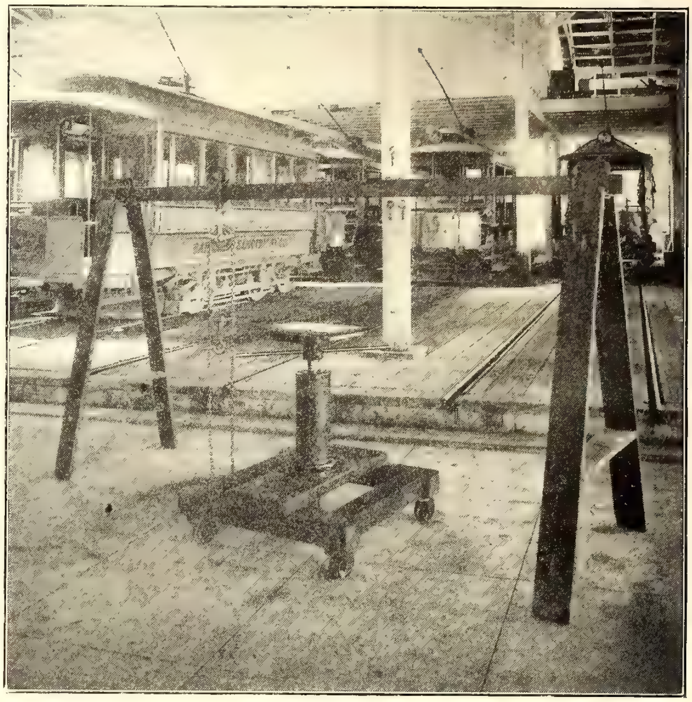


FIG. 11.—ADJUSTABLE AND KNOCK-DOWN HORSE AND ARMATURE JACK

FIG. 12.—CAR LIFTING ARRANGEMENT—SAN DIEGO ELECTRIC RAILWAY COMPANY

With attention to such details as this the company is enabled to operate its cars at a gross expense of 11.97 cents per car mile. In the matter of car oiling the company has recently adopted Galena oil for all purposes, journals as well as motors, with a net cost of 7.9 cents per 1000 car miles, or about 1 cent per car per day.

A very complete system of reports on the various properties is made up monthly in the office of the vice-president and managing director, to be submitted to the president and directors. These include an operation report which is accompanied by an itemized report listing materials and supplies used and labor charged, so that any unusual item in the operation report may be quickly traced and explained. Mr. Clayton also sends in with the report a personal report, which precedes the other in importance and calls attention to important work of the month.

A vertical filing system has been devised by Mr. Clayton for preservation of office correspondence and records that has several good features. All correspondence referring to a certain subject is placed in an envelope of letter size, such envelopes being numbered consecutively and filed vertically in a large drawer. Then these envelopes are indexed in a subsidiary index which is made up in the loose leaf form. Each page has columns for the envelope number, date of correspondence, location (whether in the file or one of two or three vaults), "Subject" and "Remarks." Under "Subject" is cited briefly the nature of the correspondence, the explanation being sufficient to determine exactly the nature of the contents of the envelope, while under "Remarks" is given further information if necessary. Then a Schlicht's standard expanded index is used to index in abbreviated form all the subjects alphabetically.

When one is desirous of looking up a matter, reference is made to the expanded alphabetical index, which, under a certain head, such as "Transfers," may give four or five numbers of envelopes. Of course, reference could be made directly to these envelopes, but the subsidiary index is provided to save time, as by quickly referring to the numbers in this special index the number of the envelope desired is quickly determined. The pages of the subsidiary index, being loose, can be easily removed and kept up to date, new pages being inserted as necessary for new subjects or additions to the existing ones. The subsidiary index is the special feature that makes the system valuable and convenient for reference.

The officers of the San Diego Electric Railway Company include the following-named gentlemen: President, A. B. Spreckels; vice-president and managing director, William Clayton; secretary, treasurer and attorney, Harry L. Titus; general superintendent, B. M. Warner; purchasing agent, George Holmes; auditor, A. H. Kayser; chief electrician and master mechanic, Homer MacNutt. The Coronado Railroad Company has the same officials except that J. D. Spreckels is president. Charles McLagan is chief engineer of the San Diego Company.

SHOP KINKS ON THE WESTERN OHIO

G. H. Kelsay, master mechanic of the repair shops of the Western Ohio Railway Company, at Wapakoneta, Ohio, has recently added to the equipment of his shop several interesting devices. The accompanying plan (Fig. 5) shows the arrangement of the various tools in the shop as well as the various departments in the building, which includes the despatcher's office, motormen's and conductors' room, store room, oil house, etc.

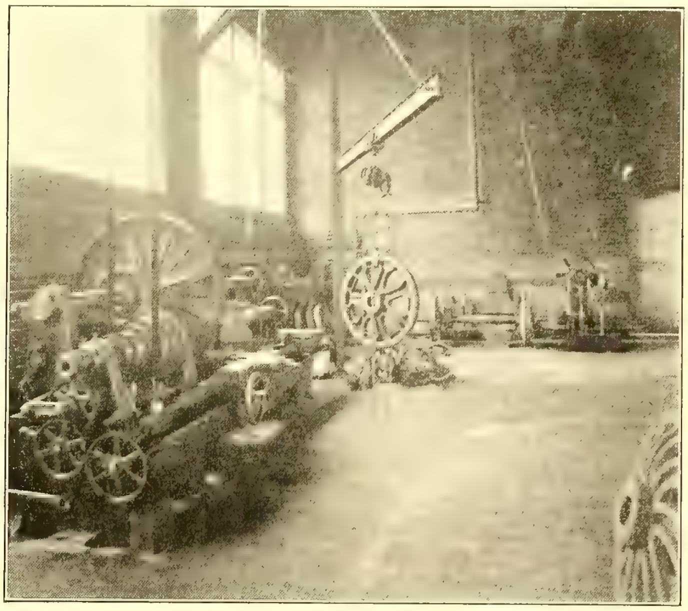


FIG. 3.—WHEEL LATHE AND GRINDER SERVED BY JIB CRANE

One of the most ingenious appliances in the repair shops is the transfer table shown in Fig. 2, and is designed to remove the trucks from the car body by taking them out at the side, which requires less time than hoisting the car and taking them out at the end. The table is also designed to hoist the car body as well as to move sideways. This is accomplished by fitting the table at the center with a pneumatic lift, having a vertical motion of about 10 ins., and which works telescoping in a frame dropped from the main frame of the transfer table. The lower end of this hoist can be seen in the view underneath the table. Air for operating the pneumatic hoist is taken from a 100-in. tank, which supplies the various pneumatic devices in the shop.

FIG. 1.—COMPRESSOR AND RESERVOIR

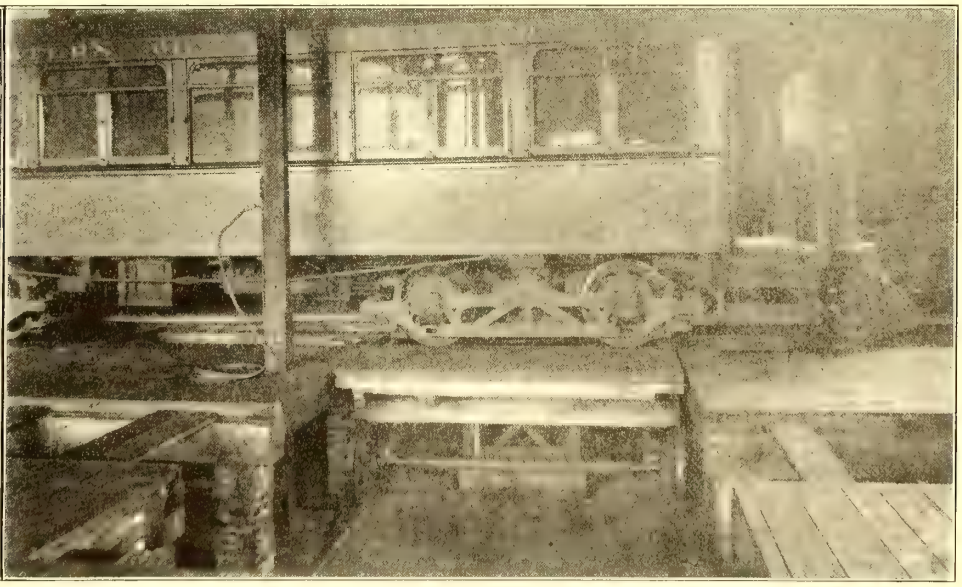


FIG. 2.—TRANSFER TABLE AND HOIST FOR CHANGING TRUCKS

In removing a truck from a car the truck is first located at a central position on the table. The table, truck and end of the car are then hoisted about 10 ins. Two 6-in. x 6-in. planks are then slipped under the end sills of the car to support the car

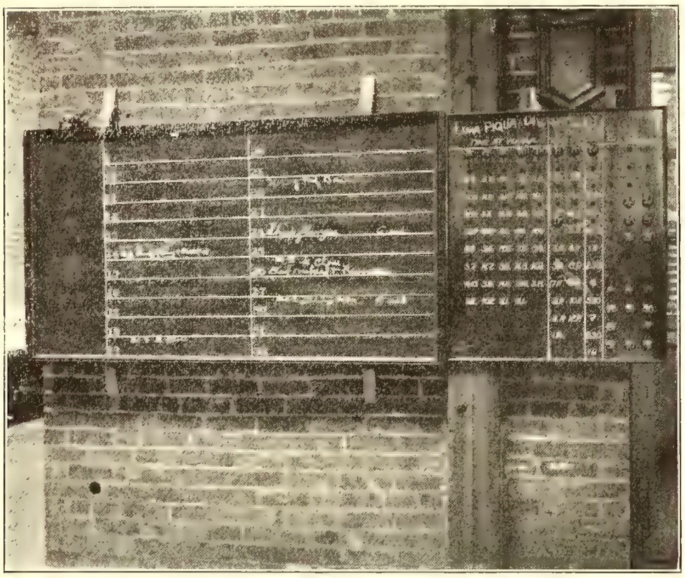


FIG. 4.—BLACKBOARD FOR RECORDING PROGRESS OF CARS IN SHOP

body, and rest on a frame work across the pit track. The transfer table is then dropped to its normal position, the brake rods and cables disconnected and the transfer table, with the trucks, are pushed out. As the transfer table is light and runs easily,

Air is used extensively in shop work, and in the view of the transfer table can be seen one of the air plugs with hose attached. The air compressor outfit (Fig. 1) is located in the front part of the shop, and consists of a 7-hp Christensen motor-driven compressor, supplying a 100-in. tank suspended from the roof. The compressor motor is controlled by the usual automatic starting switch. It is the intention to build a testing table adjoining the compressor outfit for testing gages, valves and whistles.

Wheels are bored on a double-spindle McCabe lathe, 26-in. and 48-in. swing. The illustration (Fig. 3) shows a wheel ready to go into the lathe. Boring wheels in a lathe saves a large investment for a boring mill, and the tool may be kept busy with other work as well. They are able to turn out wheels at a very fair rate; the best time made in centering wheel, boring and taking it out was 55 minutes, the wheel being faced and bored to 5 ins. from a 4½-in. sand core. Adjoining and at right angles to the lathe mentioned is a heavy wheel press, and a 3000-lb. swing crane covers both tools. The center of the shop is covered by a 4-ton traveling crane, and the swing crane mentioned swings in the field of the traveling crane, making it possible to take a load from one crane to the other. There is a wheel and axle storage track on the side of the building adjoining the wheel press and lathe, and wheels are rolled in through a door where they may be reached by the swing crane.

The machine shop contains the following tools: Wheel press, 26-in. and 48-in. double spindle lathe, 18-in. and 10-ft. bed lathe, radial drill, 13-in. sensitive drill, grindstone, emery wheel, No. 4 power hack saw, diverter winding machine, air compressor and 4-ton traveling crane. The carpenter shop contains a saw bench, 30-in. surfacer and a 16-in. wood lathe.

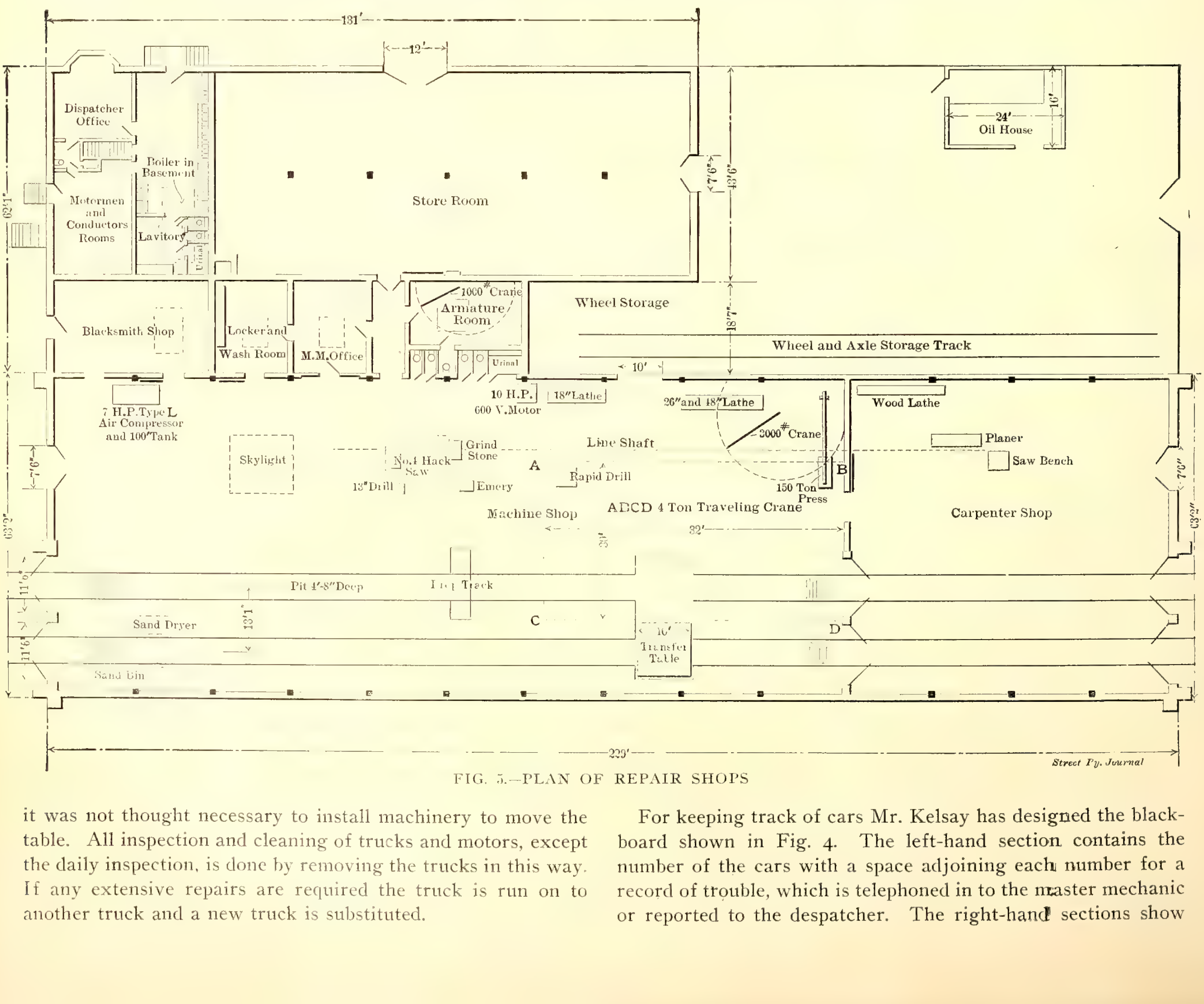


FIG. 5.—PLAN OF REPAIR SHOPS

it was not thought necessary to install machinery to move the table. All inspection and cleaning of trucks and motors, except the daily inspection, is done by removing the trucks in this way. If any extensive repairs are required the truck is run on to another truck and a new truck is substituted.

For keeping track of cars Mr. Kelsay has designed the blackboard shown in Fig. 4. The left-hand section contains the number of the cars with a space adjoining each number for a record of trouble, which is telephoned in to the master mechanic or reported to the despatcher. The right-hand sections show

when cars on the three divisions of the road will be at points nearest the repair shop. For example, the first column shows that car No. 22 has the first run on the Lima-Piqua division, and will pass Wapakoneta going south at 4 a. m., north at 7 a. m., south at 9 a. m., and so on. The second list shows when the cars on the Wapakoneta-Celina division are due at Wapakoneta, while the third division shows the time that cars on the St. Mary's-Minister division are due at St. Mary's, the point nearest Wapakoneta. It will be noticed that there chalk lines cross, connecting the two last mentioned divisions. This indicates that Car No. 17, an express car, alternates on the two divisions. The last column shows the extra cars and those that are in the car house or repair shop.

GENERATING AND DISTRIBUTING SYSTEM OF THE BROOKLYN RAPID TRANSIT COMPANY

In a paper recently presented before the Brooklyn Engineers' Club, Charles B. Martin, first assistant electrical engineer of the Brooklyn Rapid Transit Company, presented some interesting statistics of the generating and distributing system of the company.

Both direct and alternating-current generation and distribution are used. All the latter, with the exception of that purchased from the Edison Company, is developed at the central power station of the company, located on Third Avenue and Second Street, and described in the Street Railway Journal for Oct. 5, 1901, and Feb. 14, 1903. In this station there are also two direct-current 2700-kw units.

The direct-current stations and their capacities are as follows:

	KW
(1) Kent Avenue	11,900
(2) Central Station	5,400
(3) Southern Station	4,800
(4) Third Avenue	4,400
(5) Thirty-Ninth Street	3,500
(6) Brooklyn Bridge	800
Total	30,800
Alternating-Current Stations—	
Central	16,200
Sixty-Fifth Street (Edison)	2,850
Total	19,050

The overhead feeder system of the company consists of 700 miles of 500,000 circ. mils and 13 miles of 1,000,000 circ. mils weather-proof wire; 40 miles of 1,000,000 circ. mils and 3½ miles of 2,000,000 circ. mils lead-covered underground wire. For the high-tension circuits connecting from the central and Edison stations to the various sub-stations, 65 miles of cables have been installed. The company has the following sub-stations:

Halsey	6,000
Bridge	5,000
Tompkins	3,500
Essex	3,000
Coney Island	3,000

There is in process of completion a sixth sub-station at Parkville with a capacity of 2000 kw.

Owing to the large summer traffic to the shore routes in the outskirts of Brooklyn, several of the sub-stations are located at or near these points; direct-current boosters are also largely employed. A total of thirteen sub-stations are contemplated and are to be erected as the city develops. During the winter some of the apparatus in these outlying stations is moved into the congested districts and thus made to follow the load.

The tracks are bonded with two No. 0000 bonds in the outlying sections, but near the stations and sub-stations this is increased to six No. 0000 bonds. Wherever special work is encountered two 500,000-circ. mil wires per rail are placed around it. The elevated structures are also fully utilized for the return circuit. The Brooklyn "L" structure having four longitudinal girders is regarded as equal to 22,500,000-circ. mil wires; whereas, the Kings County, having but three girders, is equal to but 16,000,000-circ. mil wires. These girders are bonded with either one 1,000,000-circ. mil or two 2,000,000-circ. mil bonds, in accordance with their nearness to a station or sub-station.

In closing, the speaker presented two load diagrams showing the different characteristics of a week-day and a Sunday load. In the former, that for May 6, there are two pronounced peaks. The evening peak begins to decrease at 7:15 p. m., but does not reach its lowest point until about 4:30 a. m. It remains at low ebb until about 5:15 a. m., when the cars are started out for the morning load. The morning maximum is reached at about 8:15 a. m., but it does not follow that the greatest number of passengers are in the cars at that hour, for while the cars going to New York are well filled, there is added the load of returning empty cars, and this accounts for the lateness of the morning peak. The load then gradually falls off but turns between 1 o'clock and 2 o'clock, becoming maximum at 6:15 p. m. (about 73,000 amps.), and this maximum is greater than in the morning, due to the greater concentration of traffic.

The load diagram for a May Sunday has an entirely different characteristic. There is but one maximum peak, and that varies between 75,000 amps. and 80,000 amps. between 2:45 p. m. and 8:30 p. m. The Sunday maximum is invariably reached at 4 o'clock in the afternoon.

Reasoning from the week-day diagram it might be thought that the generating apparatus designed to stand a heavy overload for one hour would be suitable for this system, but, as has been stated, the Sunday maximum load exists at times for six hours, and, consequently, the generating apparatus must be able to stand full load for practically an indefinite period.

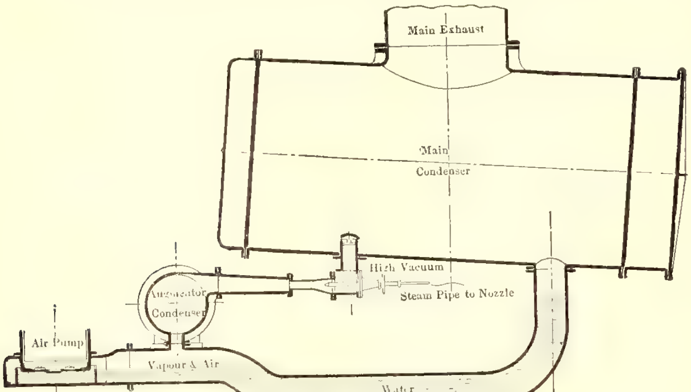
ENGLISH RECORDS OF PARSONS STEAM TURBINES

In a paper read before the May meeting of the British Institution of Electrical Engineers, the Hon. Charles A. Parsons presented some interesting figures on turbine economy. Referring to machines of his design he states that under the conditions of, say, 140 lbs. steam pressure, 100 degs. F. superheat and a vacuum of 27 ins. with the barometer at 30 ins., the steam consumption of turbo-generators are, in round numbers, as follows:

A 100-kw plant takes about 25 lbs. of steam per kilowatt-hour at full load, which figures become 22 lbs. for a 200-kw plant; 20 lbs. for one of 500 kw; 19 lbs. for one of 1000 kw; 18 lbs. for a 1500-kw plant, and 16 lbs. for a 3000-kw plant. These figures are based upon averages of a large number of tests which have been made from time to time. Without superheat the consumptions are about 10 per cent more, and each 10 degs. F. superheat up to about 150 degs. F. affects the consumption by about 1 per cent.

Every inch of vacuum between 23 ins. and 28 ins. affects the consumption on an average of about 3 per cent in a 100-kw machine, 4 per cent in a 500-kw machine, and 5 per cent in a 1500-kw machine, the effect being more at high vacua than at low. The maintenance of a good vacuum necessitates a suitable condenser, which implies sufficient tube area and also ample way for the steam between the tubes; proper velocity of water in the tubes; sufficient supply of cooling water and a sufficient means of cooling the condensed water so as to keep the air pump cool, and full provision for extracting by the air pump and other means the inevitable small quantity of air which must leak in. It is stated that by attention to these requirements it is unnecessary to increase the size of the condenser beyond

that used in ordinary practice. In the case of the most recent condensers for steam turbines, from 10 lbs. to 12 lbs. of steam is condensed per square foot per hour, at which rate of condensation a vacuum may be obtained at from 27½ ins. to 28 ins. at full load. The amount of cooling water generally allowed is about fifty times the full load steam consumption, which will increase the vacuum under normal conditions by about ¾ in. or 1 in. over that obtained by the usual circulating allowance of thirty times the steam used. With a proper arrangement of pipes and condensers in a plant taking 18 lbs. of steam per kilowatt-hour and assuming 50 per cent efficiency in the pump and motor, the power used by the circulating



VACUUM AUGMENTER

pump is only 1 per cent; by circulating water thirty times the steam consumption it would be .6 per cent, which small reduction is not to be compared with the gain of 4 per cent or 5 per cent in the turbine by the use of increased circulating water.

The paper described a vacuum augmenter which has recently been introduced and which is illustrated. A pipe is led from near the bottom of the main condenser to an auxiliary condenser, having generally about 1-20 the cooling surface of the main condenser. In a portion of this pipe a small steam jet is placed which acts in the same way as a steam exhauster and sucks nearly all the residual air and vapor from the condenser and delivers it to the air pumps. A water seal is provided, as shown, to prevent the air and vapor from returning to the condenser. With this arrangement, if there is a vacuum of 27½ ins. or 28 ins. in the condenser, there may be only about 20 ins. in the air pump, which, therefore, need only be of small size, the jet compressing the air and vapor from the condenser to about half or less of its original volume. The steam jet used only about 1½ per cent of the quantity of steam used by the turbine at full load. Condensation takes place in the condenser much more rapidly and effectually if the air is thoroughly extracted.

In low-voltage alternators rotating armatures are preferable, as the iron and copper losses are much less, especially where there are only two or four poles, but rotating armatures, although satisfactory for 500 volts to 2000 volts, have not been found suitable for the higher voltages of 6000 and 10,000 which are now common, and, therefore, rotating fields and fixed armatures have been adopted in many of the recent alternators. For direct-current dynamos the same remarks apply, only here sparkless commutation has to be provided for. Carbon brush blocks cannot be used, as at these speeds the brushes are apt to vibrate, and so diminish the intimacy of contact and cause heating and undue wear. The result is that it has been found best to form the brushes of wire, gauze or foil, preferably of brass, and these must be sufficiently flexible to maintain a good contact with the commutator over the whole section of the brush. It follows, therefore, that the properties of the carbon brush blocks in giving sparkless commutation without alteration in the lead of the brushes, cannot in turbine-driven dynamos be utilized, and other means must be adopted to secure sparkless commutation at varying loads. One way is to shift the brushes automatically according to the change of load, and this can be effected by connecting the brush gear to a steam cylinder controlled by a spring and supplied with steam from the point where the steam enters the turbine. At this point the pressure of the steam is proportional to the load of the dynamo, and therefore the piston in the steam cylinder being controlled by a spring proportional to the load, and thus shifts the brushes to the point of sparkless commutation. Another method is to provide commutating poles as proposed by Prof. Ryan and others, but the best method is to provide compensating winding as proposed by Prof. Forbes, Deri, etc. By these means, with the improvements recently adopted, absolutely sparkless commutation can be secured with fixed brushes, up to, in plants for traction purposes, 100 per cent overload.

Up to the present there are about 600,000 hp of turbines of the Parsons type at work and on order in England and on the Continent, in various sizes ranging up to 7000 kw.

The following tests of different sized turbines are quoted in the paper:

TEST OF PARSONS TURBINES

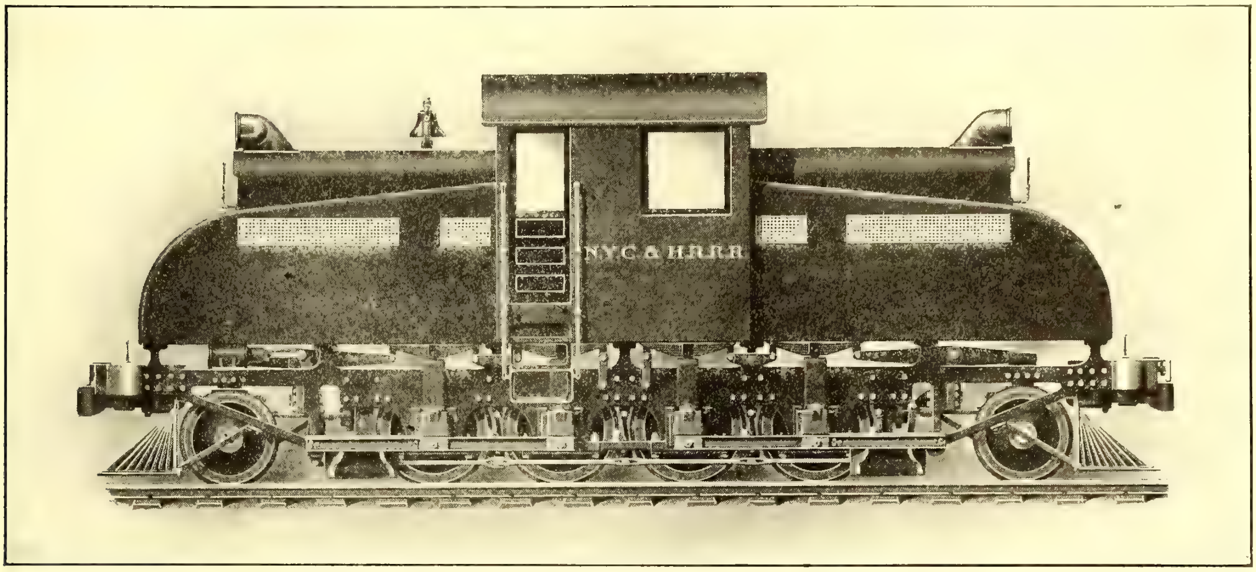
	Steam Pressure at Stop Valve	Superheat. F°	Vacuum, Inches	Speed. Revs. per Minute	Load in Kw	Pounds Steam per Kw hr.
75-kw d. c. Turbo-Generators—Banbury	141.2	84.2	27.1	4,140	75.7	26.4
	144	0	27.0	4,140	75.2	29.2
	142	0	27.1	4,140	56.6	31.2
135-kw Turbo-Generator—Findlay, Durham & Brodie	150.8	99.0	27.15	3,600	138.3	22.8
	151.0	81.0	27.3	3,600	66.9	27.6
200-kw d. c. Turbo-Generator—Shipley	150	57	27	3,000	204.2	22.23
	151	55	27.9	3,000	101.2	26.67
	156	181	27.3	3,000	202.5	20.39
	151	166	28.0	3,000	100.27	24.41
375 kw Turbo-Generator—Dundee	152.9	----	27.4	3,000	376.9	21.6
	149.4	148.9	27.5	3,000	374.06	19.25
350-kw Turbo-Generator—Pennsylvania Salt Co	150	71.3	27.82	3,360	359.5	20.64
	152	65.7	28.27	3,151	185.5	23.44
	140.2	92.3	17.4	3,430	353.5	25.54
	143.4	82.5	17.4	3,255	177.2	32.26
300-kw Turbo-Generator—Hulton Colliery	161.0	0	0	3,000	296.6	34.2
	158.0	0	15.33	3,000	297.4	29.36
	157.0	0	19.33	3,000	305.1	27.43
	152.0	0	22.33	3,000	303.4	25.59
	154.0	0	25.33	3,000	308.15	24.19
	158.0	0	26.58	3,000	303.2	23.15
300-kw Turbo-Generator—De Beers Explosives Works	150.0	53.3	27.88	3,000	312.1	20.06
	153.0	50.0	27.78	3,000	231.8	21.45
	150.5	40.2	27.9	3,000	154.5	23.75
1500-kw Turbo-Alternator—Newcastle-on-Tyne	196	76	27.45	1,200	1,442	18.0
	197	84	27.35	1,200	1,015.5	19.8
	196	76	27.95	1,200	714.0	21.4
	199	77	28.35	1,200	360.5	25.2
	200	68	28.45	1,200	------	----
After 16 months' use the following figures were obtained	203	92	26.11	1,210	1,823	17.7
	207	66	26.46	1,208	1,513	18.23
1500-kw Turbo-Generator—Sheffield Corporation. With Vacuum Augmenter and including 450 lbs. steam per hr. used by it	113.6	108.3	26.69	1,455	1,316.5	18.75
	111.6	156.4	27.12	1,500	1,061.6	18.66
	141	113	27.72	1 500	512.7	22.3
	154	47.5	27.72	1,500	0	0
Without Vacuum Augmenter	115.6	143	25.18	1,500	1,029.3	20.7
	137	119	25.97	1,500	534.25	24.02
	150.3	72.4	26.62	1,500	0	0
		NON-CONDENSING TURBINES				
250-kw d. c., Messrs. Guinness, Son & Co.	144	0	0	3,047	251.55	37.80
	142.6	0	6	3,047	255.82	41.38
	138	0	11.1	3,055	253.15	44.15
	143	0	11.0	3,115	125.45	59.58
500-kw Turbo-Generator—Metropolitan E. S. Co	142	0	0	1,800	506.2	33.39
	147	0	15.67	1,800	509.06	29.07
	144	0	18.57	1,800	514.9	28.33
	145	0	20.67	1,800	512.2	27.22
	146	0	22.57	1,800	509.85	26.89
	154	0	0	1,800	0	----
	151	0	26.1	1,800	0	----

The Detroit, Monroe & Toledo Short Line Railway has begun through service between Toledo and Sibleys. At Sibleys, passengers will be transferred to the lines of the Detroit United Railway for Detroit. The running time from Toledo to Sibleys, which is 19 miles from the center of Detroit, is two hours.

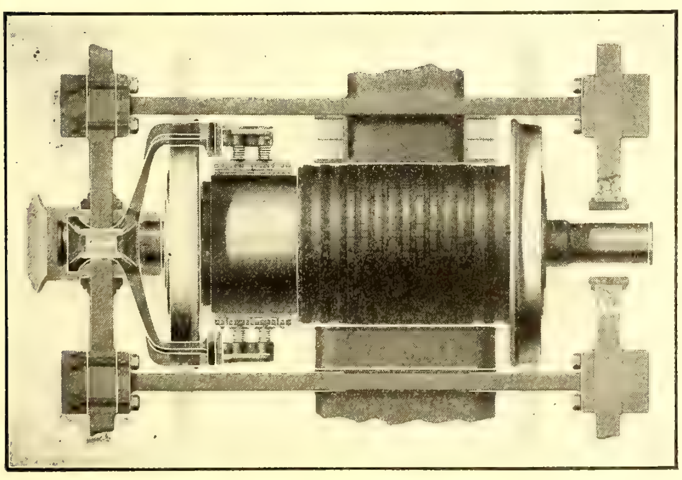
THE NEW YORK CENTRAL ELECTRIC LOCOMOTIVE

The new electric locomotives which are being built for the New York Central & Hudson River Railroad Company, at Schenectady, by the General Electric Company and the American Locomotive Company, differ radically in their electrical features from any electric locomotive hitherto constructed.

The motors are bipolar gearless, the magnetic circuit, the field windings and the motor poles being integral with the locomotive frame and spring supported. The pole faces, which are laminated, are vertically tangential to the armature, thus providing for vertical movement of the locomotive frame with attached poles without affecting the armature air gap. The armature is assembled on a quill, which is pressed solidly on the axle. The dual weight of the assembled rotating part, including the armature, axle and wheels, is less than on many steam locomotives, and there being no uncompensated reciprocating parts there is a perfect rotative balance.



SIDE VIEW OF ELECTRIC LOCOMOTIVE



PLAN VIEW OF MOTOR

This design was submitted in accordance with specifications prepared by the Electric Traction Commission appointed by the railroad company, the members of which are William J. Wilgus, fifth vice-president, New York Central & Hudson River Railroad; John F. Deems, general superintendent of motive power of the railroad company; Bion J. Arnold, Frank J. Sprague and George Gibbs. The secretary to this commission is Edwin B. Katte, electrical engineer of the railroad company.

The commission, after careful deliberation, had prescribed the conditions which must be fulfilled by electric locomotives taking the place of steam locomotives as far as Croton on the Hudson River line and as far as North White Plains on the Harlem division, a distance of 34 miles and 24 miles, respectively.

The conditions were, briefly, that the successful bidder should furnish an electric locomotive capable of making two regular successive trips of 1 hour each between Grand Central Station and Croton, with a total train weight of 550 tons, a single stop in each direction and a lay-over not to exceed 20 minutes. In addition to this it was provided that a similar schedule should be maintained with somewhat lighter trains making more frequent stops. Finally, it was provided that with a total train weight of 435 tons, the electric locomotive should be able to run from Grand Central Station to Croton without stop in 44 minutes, and, with 1 hour lay-over, be able to keep up this service continuously. This last schedule is the equivalent of the present timing of the Empire State Express, though the latter has a somewhat lighter train.

Specifications embodying these conditions were prepared by the commission and sent to all the principal electrical manufacturing companies both here and abroad. It will be observed that no restriction was placed on bidders as to whether direct or alternating current was to be used. The successful bidders were the General Electric Company in conjunction with the American Locomotive Company. The choice of a direct-current type of locomotive was dictated largely by its known reliability of service, owing to the amount of experience which had been accumulated with the direct-current motor.

The new electric locomotive will be 37 ft. in length over all. The wheel base will consist of four pairs of motor wheels and two pairs of pony truck wheels, the length of the total wheel base being 27 ft., and of the rigid wheel base, consisting of the four pairs of motor wheels, 13 ft. The diameter of the driving wheels will be 44 ins., and of the truck wheels 36 ins. The driving axles will be 8½ ins. in diameter. It will be what is known as a double ender and will weigh approximately 190,000 lbs.

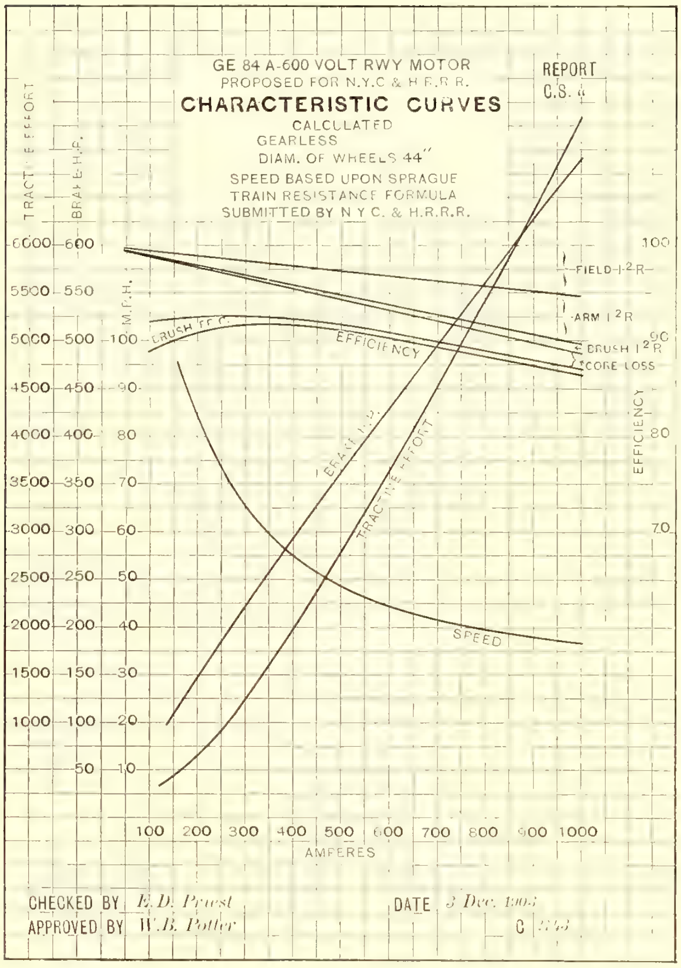
The frame will be of cast-steel, the side and end frames being bolted together at machined surfaces and stiffened by cast-steel cross transoms. The journal boxes and axles will be designed to permit sufficient lateral play to enable the locomotive to pass easily around curves of 230-ft. radius.

The superstructure of the locomotive is to be of steeple form, so designed as to offer the least practicable wind resistance

consistent with the adequate housing of the apparatus and its convenient operation. The cab is designed so as to afford a clear view of the track. The whole of the superstructure is to be of sheet steel with angle-iron framing, and the doors and windows of the cab are to be fireproof.

The driving power of the locomotive will be furnished by four 600-volt direct-current gearless motors, each of 550 hp. This will make the normal rating of the locomotive 2200 hp, with a maximum rating of about 2800 hp, or about 50 per cent greater than that of the largest steam passenger locomotives now in service.

The armatures will be mounted directly on the axles, and will



be centered between the poles by the journal boxes, sliding within finished ways in the side frames. The armature core will be of the iron-clad type, the laminations being assembled on a quill which will be pressed on the axle. The winding will be of the series drum-barrel type. The conductors will be designed so as to avoid curents, and will be soldered directly into the commutator segments.

The commutator will be supported on the quill. The commutator segments will be made of the best hard-drawn copper, and will have the ears integral with themselves. The brush holders will be made of cast-bronze and mounted on insulated supports attached to the spring saddle over the journal, maintaining a fixed position of the brush holder in relation to the commutator.

Unlike the ordinary four-pole motor, where the magnetic circuit is made through a separate box casting, the magnetic circuits in this type of electric locomotive are completed through the side and end frames. The pole pieces are cast in the end frames, and there are also double-pole pieces between the armatures carried by bars which act as part of the magnetic circuit.

The pole pieces will be shaped so that the armature is free to move between them with ample clearance on the sides. As the poles move up and down with the riding of the frame on the springs, they will always clear the armature, and provision is made so that the armature will not strike the pole pieces even if the springs are broken. The field coils will be wound on metal spools bolted to the pole pieces, and will consist of flat copper ribbon.

The Sprague-General Electric multiple-unit control will be used on this type of electric locomotive. There will be two master controllers in the cab, so placed that the operating engineer looking ahead will always have one of these under his hand. The control system will permit two or three locomotives to be coupled together in any order in which they happen to come, and to be operated as one unit by the engineer in the leading cab.

The control system will also be semi-automatic in its action, as it will provide a check on the rate of acceleration of the train, which the engineer cannot exceed, while he may accelerate at any slower rate if he so desires. Should two locomotives break apart the control current will be automatically and instantly cut off from the second locomotive without affecting the ability of the engineer in charge to control the front locomotive under his charge. The control system is designed for a minimum of 300 volts and a maximum of 750 volts.

The weight which will rest upon each of the driving wheels of the electric locomotive will be about 17,000 lbs. Proper distribution and division of the weight among axles will be accomplished by swinging the main frames from a system of elliptical springs and equalizing levers of forged steel, the whole being so arranged as to cross equalize the lead and furnish three points of support.

The locomotive will be provided with all the usual accessories of a steam locomotive, including an electric air compressor to furnish air for the brakes, it will have whistles, a bell and an electro-pneumatic sanding device and electric headlights at each end. The interior of the cab will also be heated by electric coils.

In actual performance this locomotive is expected to give better results than any engine hitherto placed upon rails. With a light train the locomotive is expected to give speeds up to 75 m. p. h., and with heavier trains similar speeds can be attained by coupling two locomotives together and working them as a single unit. Its tractive force will be greater than that of any passenger locomotive now in existence, and it is believed that in the simplicity and accessibility of its parts and in the provision made in its design to insure continuous operation with the minimum chances of failure, that it marks an entirely new and successful type of electric locomotive.

RECENT IMPROVEMENTS IN THE CURTIS STEAM TURBINE

In a paper read last week before the American Society of Mechanical Engineers, W. L. R. Emmet described certain details of and improvements in the Curtis steam turbine which had hitherto not been made public.

The step bearing consists of two cast-iron blocks, one carried by the end of the shaft and the other held firmly in a horizontal position and so arranged that it can be adjusted up and down by a powerful screw. The lower block is recessed to about half its diameter, and into this recess oil is forced with sufficient pressure to balance the weight of the whole revolving element. The amount of oil required is small. About 5 gals. per minute is used in the 5000-kw machine, but with a good alignment it could be satisfactorily operated with a much less amount. The oil, after passing between the blocks of the step-bearing, wells upward and lubricates a step-bearing supported by the same casting. This whole structure is inside of the base, and a packing is used between the oil chamber and

the base, so that oil or air cannot get into the vacuum chamber. A small steam pressure is maintained between the sections of this packing, in order that these objects may be accomplished with certainty. In many cases these same step-bearings have been operated with water instead of oil, in which case no packing is necessary, the water being allowed to pass into the base. In some of the latest designs water will be used exclusively, the lower surface of step-bearing being of wood and no packing being provided.

The extreme conditions to which these step-bearings are subjected, and a complete lack of precedent for such designs, led at first to many doubts concerning the success of this feature. Experience has, however, shown that these doubts were without foundation. Practically no troubles or interruptions have resulted from this cause, and the step-bearings have shown a ruggedness and stability far beyond the company's expectations. The step-bearing surface cuts immediately when lubrication is stopped, but the metal from it is removed very slowly, and it has the power of re-establishing itself almost immediately when oil flow is again started.

In its newer designs the company is providing a powerful brake bearing on the lower surface of a chilled iron ring carried by the lower wheel. This brake can be conveniently operated from the outside, and can be used to take the whole weight of the revolving part in case the step-bearing support should fail. In ordinary operation the shoes of this brake will be set about .01 in. below the brake ring. It is thus in a position to receive the revolving part in case the step-bearing support should fail. Another and more important function of this brake is to stop the machine when it is desired to do so. One of the 5000-kw vertical shaft machines will run for four or five hours after the steam has been shut off, unless load is put upon it or a brake is applied.

Improvements have also been made in the governor, which now opens and closes the ports connected with the first stage nozzles mechancially instead of by electrical means. The controlling valve is so designed that it always passes positively from one of its seats to the other. No matter how gradually the force is applied it opens both ways on the principle of a pop safety valve. It is thus always firmly seated and is free from the deterioration which leakage would cause. The total number of these valve required imposes a light load upon the governor, which is made strong enough to give any desired accuracy of speed regulation without the possibility of lag or sticking.

In conclusion Mr. Emmet gave some economy figures on a 2000-kw turbine as originally designed. This turbine operates a 6600-volt, 25-cycle generator at a speed of 750 r. p. m. It is temporarily installed in the General Electric Company's power station at Schenectady, with a surface condenser having 6000 sq. ft. of cooling surface. The following results were obtained under different running conditions. The tests on March 12 and on May 11 were made upon different machines of similar design. Considering the different conditions the results are consistent:

	March 12			May 11
Load in kilowatts	637	1000	2000	2270
R. p. m.	750	750	750	750
Gage pressure	150	160	155	100
Superheat F.	215	242	242	250
Corrected vacuum	28.2	28.9	28.73	28.1
Lbs. steam used per kw-hour	20.1	16.3	15.3	16.2

Such analysis of results as the company has been able to make indicates that a different proportioning of certain parts will give a substantial improvement over these figures.

The Indiana Appellate Court has decided that when an individual buys or builds a street railway, his liability to passengers injured by the negligence of his motormen and conductors is measured by the same rule that applies to street railway corporations.

THIRD MEETING OF THE OHIO INTERURBAN RAILWAY ASSOCIATION

The attendance at the third meeting of the new Ohio Interurban Railway Association, held at Columbus, May 26, was somewhat disappointing. Managers from all over the State intimated that their spring park and excursion business had opened up in an unusually large volume, and that they could not spare the time to attend the meeting. It was decided that in view of the fact that the association had been successfully organized, and that the original object of the adoption of a form of interchangeable transportation had been accomplished, it would be advisable to dispense with the monthly meetings during the summer months. It was, therefore, resolved to hold the next meeting some time in October, probably at Toledo.

The interchangeable coupon book, which has been referred to in these columns several times of late, will become operative on a number of Ohio and several Indiana roads within the next few weeks. At the Cleveland meeting in April two forms of an agreement between the various roads for handling the interchangeable transportation were submitted, and the question of adoption was left to a mail vote. It was decided by this vote to adopt the plan proposed by the transportation committee, which plan was outlined in the report of the Cleveland meeting, published in the May 7 issue of the STREET RAILWAY JOURNAL; with an additional clause taken from the plan proposed by H. C. Lang, of Cleveland, providing that each road party to the agreement shall give an approved bond of $10,000, to insure other roads against failure to carry out the terms of the interchange agreement. The bonds will probably be taken out through one company. Representatives of the majority of roads present agreed to sign the contract as soon as it had been made out, and the books will be issued immediately thereafter.

A number of managers reported that they had received numerous inquiries for the transportation, and there is little doubt that the book will meet with wide sale among the traveling public. The book adopted will not only unquestionably have a tendency to induce commercial travelers to patronize the interurban roads, but it will prove an excellent advertisement for the roads in the agreement, because the cover of the book contains a list of all the towns touched by the various roads.

The transportation committee made important recommendations on the plan proposed by F. J. J. Sloat, for the adoption of a fixed schedule of prices to be charged for the operation of cars of one company over the tracks of another. As outlined in the report of the Cleveland meeting, Mr. Sloat intimated that the rates should vary according to weight of cars, size of motors, gear ratio and speed. The committee advocated that it would be advisable to adopt a fixed rate based upon the average earnings per car mile of interurban roads in this district. It was pointed out that a number of roads owned several varieties of cars and equipment, and that it would frequently be impossible for them to determine in advance what cars would be available for special trips. The committee recommended that a scale of 20 cents per car mile be adopted for special cars only, and that where arrangements for the operation of regular through trains over the tracks of another company were made, the parties concerned settle the rate between themselves. On the above basis it was understood that the foreign company furnish the crew and power, and stand liable for the car while on its tracks, and the originating company take all receipts and furnish a pilot for the car.

Mr. Stebbins, of the Appleyard system, thought that the advantages of terminal facilities should enter into the price. He considered it worth more to handle a foreign car within the city than outside the city, as it interfered with city service and tended to congest the terminals. He stated that funeral cars from other roads frequently operated to the city limits on his

line, and paid $5 for a 10-mile run. He thought in such a case 20 cents would be too small. On the other hand, in cases of through shipments of freight (the Columbus roads handle freight at steam freight rates) he thought 20 cents would be too high.

Warren Bicknell, Lake Shore Electric, stated that 20 cents was about the average earnings for interurban roads, and he considered that many roads were standing in their own light by attempting to charge too much for such service. He thought that if another road originated business and brought it to him without any effort on his part, there was no reason for charging more than his own cars could earn on business that had to be created to a large extent. He stated that the Cleveland roads have been in the habit of charging $1 per mile for the distance between terminals, or at the rate of 50 cents per mile for live and dead mileage, making the charge whether the party returned or not. Much of this business has been with the Cleveland funeral car, which covers all points in Northern Ohio. In cases where parties desire to return after the usual hour of closing the power house, a charge of $5 per hour is made in addition to the regular charge, although in this case the time for dead mileage is not counted extra. He thought the 50-cent rate too high, and has suggested a lower rate to the Cleveland roads. He favored a uniform rate for all Ohio roads.

Mr. Fravel, of the Dayton & Western, said his company had spent a great deal of money securing terminal facilities, and did not think cars should be permitted to operate over these portions at as low a rate as on the interurban portions of the line. They have charged other companies 40 per cent of the gross earnings of the car where it runs into Dayton.

Mr. Carpenter, of the Western Ohio, said his company had an arrangement with the Dayton & Troy, and sent cars over its line at a flat rate of a certain amount per car. Describing the limited service between Lima and Dayton over the two lines mentioned, Mr. Carpenter said that each company furnishes one car and one crew, which run through. The earnings are divided equally, but the Dayton & Troy receives an additional amount, figured in car mileage, because of the greater length of its line.

The transportation committee will endeavor to arrange a schedule of prices, giving due consideration to the points brought out, and was given power to act.

Mr. Anderson opened the discussion on the subject, "What compensation should interurban companies give newspapers for advertising?" He said that the Dayton managers had informally discussed this subject and had suggested a uniform rule. At present his road, in dealing with the larger papers, makes a contract for advertising, and agrees to furnish one pass, good for one round trip each day in the year. The pass is made out to the editor or manager, and in case another employee of the company desires to use the book, it must be presented with a signed slip stating that the bearer is authorized and on business for the paper. Trip passes are also issued from time to time at the discretion of the company. Dealing with country papers, they agree on the rate and issue monthly trip passes to the value of the space. The proposition of hauling packages of paper, he stated, was a perplexing one. The papers with which they advertise have been permitted to ship packages without charge, and the publishers have seemed to consider that if they gave the motorman a copy it was a fair compensation for handling them. Occasionally, when papers have been lost or miscarried there have been strenuous complaints. The newspapers argue that an extensive circulation of their papers among country people aids the business of the interurbans through the advertisements of city merchants. Mr. Anderson admitted this might be true to a certain extent, but arguing conversely, the increased circulation with country people made the papers more valuable, and he thought the papers should pay something more than a few free copies for transportation of packages. With publications with which it does not advertise, the Dayton & Xenia makes a rate of ½ cent a pound, no package less than 5 cents.

A manager from the northern part of the State said his company gave no transportation to newspapers, and incidentally it cut down its free transportation to the lowest possible point. Transportation was its stock in trade, and it was just as reasonable to expect a merchant to give free dry goods to a paper with which he advertised. This company pays cash for its advertising and expects cash for its transportation, and it asks nothing but fair treatment from the newspapers.

An Indiana manager said he had started out with the same views as the speaker before, but he had decided it was poor economy. At present he gives the newspapers about what they ask for if they keep within reasonable limits. He thought it an excellent plan to have a distinct understanding with each paper, and specify what each is entitled to, charging if they exceed that limit.

Another manager said his company had been imposed upon by several papers. They had secured transportation for advertising, and in working up circulation in the neighboring towns they had gone to young men who were attending college in the large city and had given them transportation in return for subscription work, thus depriving the company of regular commuters' business. He said the majority of roads had been wide open on the subject of transportation to papers, and he would like to see the association adopt a standard form of contract.

A gentleman from Cincinnati, not a railway operator, advised the interurbans to go slow in a matter which might antagonize the newspapers. He said he was familiar with the workings of the Ohio Press Association, and had occasion to know that at present the papers were friendly to electric roads, and were endeavoring to aid their development through the news columns. The papers are constantly publishing items calling attention to attractions on electric lines, and in this way people are induced to travel when otherwise suburban trips might not occur to them. On the other hand, papers are in a position to work great injury to roads by misstatements and exaggerated accounts. He advised managers to meet the newspaper men more than half way, and favor them with a reasonable amount of free transportation.

A well-known manager said the papers in his vicinity seemed to be decidedly antagonistic to the electric roads. He said they exaggerated accidents and frequently printed deliberate misstatements. Recently a paper raised a furore by stating that the interurbans were hauling hogs and other live stock through city streets. The story arose from the delivery of a load of live stock at the city limits; it was not carried into the city, he claimed.

On vote it was decided that the executive committee should formulate a plan for a standard form of contract between interurban lines and newspapers on a basis of transportation in return for advertising.

The question, "How to provide transportation for track men who are hired for a few days only," was opened by Mr. Stebbins, of the Appleyard system. His roads issue trip passes to the heads of departments each week for the men in their charge. The foreman endorses the passes, showing the name, date and points covered. At times the passes are dated ahead, or may be used the following day.

Mr. Rounds, of the Canton-Akron Railway, supplies the foremen and regular track men with badges. Extra men travel with foremen and are vouched for by them. All track men report at car houses.

Mr. Harrigan, of the Columbus, Newark & Zanesville Electric Railway Company, issues monthly passes to foremen, and they furnish the transportation to the men. Regular men have badges, and foremen are made responsible for these.

Mr. Anderson, of the Dayton & Xenia, issues coupon books

to track men. The books are punched for certain points, so that the men can ride only between these points.

Mr. Carpenter said that his track men reported at car houses and worked their own way in hand cars. He considered this plan much better than permitting the men to crowd into cars.

The question of requiring employees and others riding on free transportation to sign a waiver of right to collect damages was discussed in connection with the above subject, and several court decisions were referred to, among them a decision by the United States Supreme Court, in which it was stated that such a waiver signed by an employee of the company was not binding. The executive committee will investigate this subject. A number of roads require all holders of free transportation to sign the "deadhead slip."

On the subject of "Benefit Associations and the Relation of Employers to Employees," Mr. Spring, of the Dayton, Covington & Piqua, said his road had an association of seventy-eight members. The association pays a sick benefit of $5 per week. Social gatherings are held once a month. They promote good fellowship and a better feeling among the men. The company contributes to the association.

Mr. Bicknell, of the Lake Shore Electric, said that he made it a point to be on friendly, although not too intimate, terms with all his employees. He makes frequent trips over the system and talks with the motormen, conductors and section men, asking about their work and seeking suggestions as to how the service can be improved. Once a month he spends half a day at some car house or power station, and talks with the heads of departments. Such meetings have a tendency to bring out defects in the equipment and service, they show each man that his fellows have their troubles and discouragements as well as himself, and they enable a manager to know the men that are worthy of promotion.

Mr. Clegg stated that the Dayton & Troy Railway had an employees' association. Formerly the company distributed turkeys to the men at Christmas time, but last year it offered to pay the expenses of organizing a benefit association, and agreed to start it with $250. The men, however, did not act upon it. Only married men are employed, and as most of them have something ahead the benefit idea did not seem to appeal to them. The company expects to follow the idea in practice at the National Cash Register Company's plant at Dayton, of a noonday "Get Together Club." The heads of departments will take lunch at a house adjoining the company's headquarters. A portion of the expense will be paid by the company. The men will be asked to discuss various phases of their work in an informal manner, and ideas will be illustrated by "chalk talks," a blackboard to be provided for the purpose. Subjects will be bulletined from time to time.

Mr. Rounds, of the Canton-Akron Company, described the plan he has adopted for getting ideas from the men. This is referred to in the article on this system in the last issue of the Street Railway Journal.

A prominent manager expressed himself as strongly in favor of meeting the men regularly and discussing matters of operation, but he did not believe in a company agitating the formation of benevolent associations. He said that it was but a short step from an association to a labor organization. When men are not bound together it is much harder to bring about a strike and much easier to settle differences with employees.

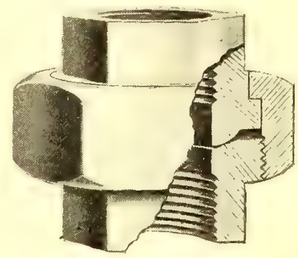
"How to Keep Cars Clean and Neat" was discussed by Mr. Rounds, Canton-Akron Company. His cars are of exceptionally handsome and elaborate design, and he finds it of great advantage to clean cars frequently. He employs women for scrubbing cars, and the cars are thoroughly swept out at the end of each run.

Mr. Harrigan, of the Columbus, Newark & Zanesville Electric Railway Company, hires several women who clean cars at night. Cars lay over at the Zanesville terminal and are swept out.

Mr. Kelsey, of the Western Ohio Railway, uses air very largely for dusting cars. This is done out of doors by means of a long hose from the air lines in the house. The method is rather expensive, but it cleans the dust and dirt from the corners, and aside from this it is of great value in blowing copper and carbon dust from the motors, circuit breakers and controllers.

BRONZE UNION

The union shown in the accompanying illustration is manufactured by Franklin Williams, Monroe-Taylor Building, New York, and is especially designed for high pressure and continuous service. It is made of "Tuxeda" bronze, an alloy said to possess unusual soundness and great tensile strength. The ends are both hexagonal, extremely heavy, insuring against spreading and for the convenience of any smooth-faced wrench, and permitting quick manipulation. The joint is made by a slightly tapered seat, to which is fitted a ball nose well ground in. The surface of contact is small and self-seating, preventing trouble caused by disalignment of pipe, due to unequal expansion. On account of the small inside area its shortness increases its strength.

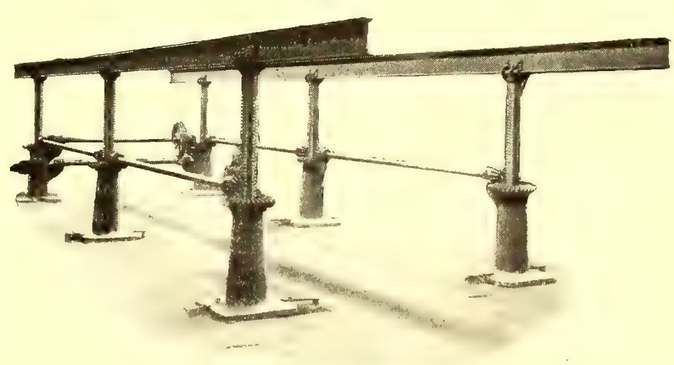


BRONZE UNION FOR HIGH-PRESSURE PIPING

This union is extensively employed in the Manhattan power station of the Interborough Rapid Transit Company, the Newark power station of the Public Service Corporation of New Jersey, and many other places where high-pressure piping is used. It answers every requirement demanded of a flange, even up to the 4-in. size, and will last a long time. In general, the coupling has been made so that it will not leak or "give" under the most severe usage.

NEW CAR HOIST

The accompanying illustration shows a new type of car body hoist manufactured by the Pittsburg Machine Tool Company, and intended for car house use. The columns are located in a pit below the level of the tracks, and the car is run in over the I-beams on the regular track. Timbers are thrown across the I-beams under the body of the car, and the power is applied to the lower shaft at the head of the machine and the car is



HOIST FOR RAISING CAR BODIES

quickly raised. This lower shaft at the head of the machine is made the right size to accommodate the regular street car motor, and any standard motor can be attached at a trifling cost. When the car body is raised the trucks can easily be run out. A similar hoist is in use in the repair shops of the St. Louis Transit Company, and was described in a recent issue of this paper.

SELECTIVE SIGNALING ON THE BOSTON & WORCESTER ELECTRIC RAILWAY

The Boston & Worcester Street Railway Company has had in use since November last a system of selective signaling in connection with its telephone system of despatching cars. By this system, which was installed by the Blake Signal & Manufacturing Company, of Boston, and which has proved very satisfactory, the despatcher can summon promptly to the telephone the crew of any car which is on the road, and give such orders as may be necessary. The advantage of this system in despatching, as well as in winter for directing the movements of the snow-fighting force, are too obvious to require elaboration.

The method of operation employed by the Boston & Worcester Street Railway is as follows: The entire line is covered by a first-class telephone system. At all important operating points or turn-outs a signal has been installed. All telephone and signal stations are furnished with an autographic register, which renders in triplicate the orders received at the station. Fig. 1 shows the semaphore set at "clear," Fig. 2 at "stop" position, and Fig. 3 shows interior of booth with telephone on left, autographic register on right and cord suspended over telephone for resetting of signal. Fig. 4 shows interior of despatcher's office.

A detailed description with diagram of connections (Fig. 5) of signal is given herewith. The basic principle of the signal depends on the fact that the period or time of vibration of a pendulum of certain length is always the same, and varies directly as the length of the pendulum. Each signal box upon the line contains an electromagnet and a pendulum. The electromagnets are all in series on a single wire, ground return being used preferably, though, in case of need, metallic circuit could be employed. The pendulums for each signal are of different lengths, and receive impulses from the electromagnets, which may be energized at various intervals to correspond with the periodicity of their respective pendulums.

The despatcher, either by the use of a constant speed shaft on which he places toothed wheels for making and breaking contacts at various intervals corresponding with the periods of the various pendulums, or by means of setting in motion a pendulum corresponding in length and, consequently, synchronous with the pendulum of the signal which he desires to set, sets up impulses at certain intervals in all of the electromagnets. These impulses are felt by all the pendulums, but are only cumulative in increasing the arc of vibration of that pendulum whose period is synchronous with the predetermined period of electromagnetic impulses. After from ten to twenty seconds, depending on the length of pendulum, the pendulum swings through an arc of sufficient length to trip the lock holding the semaphore in a vertical or "clear" position, and the semaphore at once falls to horizontal or "stop" position. When the semaphore has reached horizontal position it automatically closes a lamp switch which gives the illuminated signal needed for use at night. Each signal is equipped with two incandescent lamps, so that, in the event of one lamp being burned out when the semaphore is set at "stop," the other lamp is automatically connected to a periodically interrupted circuit and gives a flashing danger signal. When in a horizontal position the semaphore

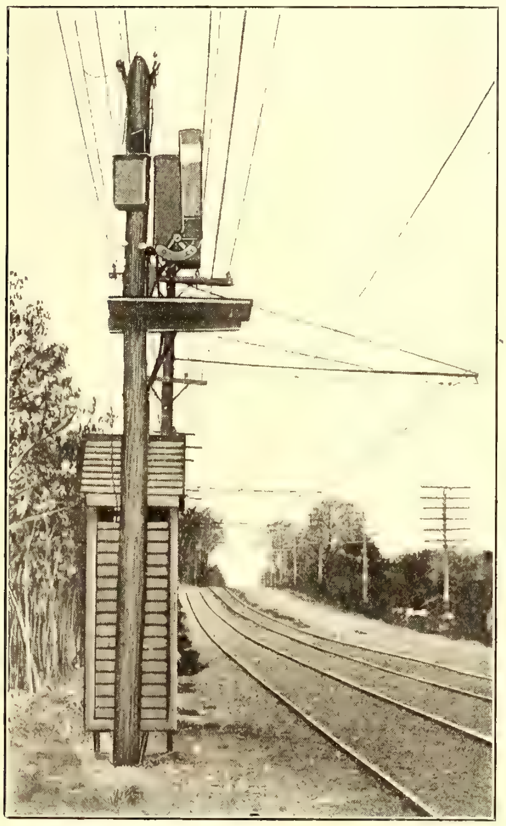


FIG. 1.—SEMAPHORE SET AT "CLEAR"

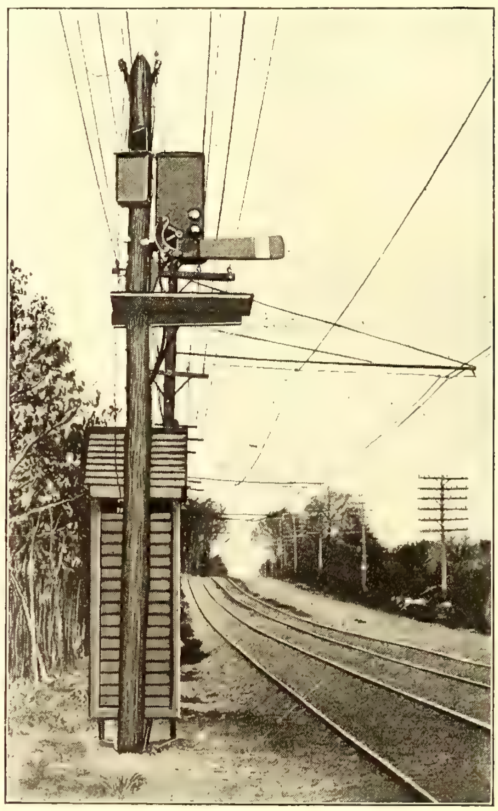


FIG. 2.—SEMAPHORE SET AT "STOP"

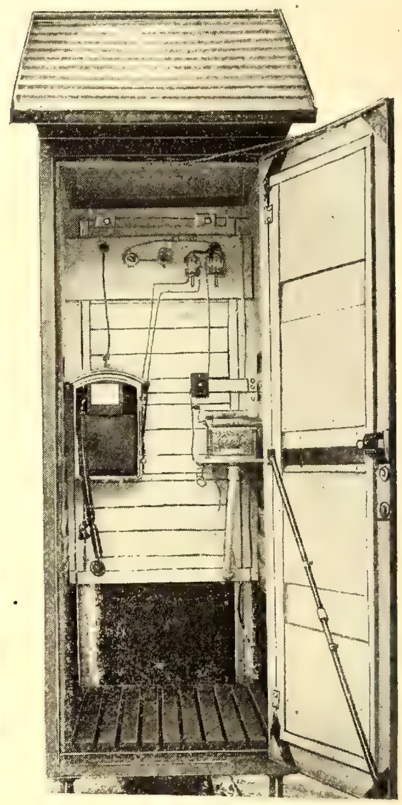


FIG. 3.—INTERIOR OF TELEPHONE BOOTH

The despatcher wishes to communicate with a car crew approaching station No. 9. He picks up a 3-in. toothed disc, numbered to correspond with the signal which he wishes to set, and slips it on a constant-speed motor-driven shaft located directly at hand. This throws a 4-ft. semaphore to a "stop" position at the station required, at the same time illuminating a red lens for a night signal.

As soon as the semaphore is properly set at "stop" the despatcher is automatically notified of this fact by the operation of a magnetic sounder in his office. The car arrives at the station, the conductor unlocks the booth and calls the despatcher by telephone, saying, "Brown and Hayes at No. 9 for orders." The despatcher then transmits his orders to the conductor, who writes them on the autographic register, repeats them back to the despatcher, takes one written copy for himself, hands one to his motorman, and the third copy is wound on a roll within the register, where it is accessible only to the management. The conductor then pulls a cord which sets the semaphore at "clear" position ready for future operation.

also automatically closes a circuit which gives a magnetic sounder signal to the despatcher, notifying him that the signal has been set as desired. Regarding the difficulty of maintaining a motor at constant speed with the widely varying voltages of electric railway circuits this difficulty has been successfully overcome by the use of a governor placed on the motor shaft.

The use of the master pendulum instead of a motor removes the necessity of using current to operate the motor, and is, besides, absolutely positive in action.

The amount of current used in energizing the electromagnets

FIG. 4.—INTERIOR OF DESPATCHER'S OFFICE

and operating the signals is .08 amps., with a voltage of 650, equivalent to 52 watts for the few seconds necessary to operate signal, or an average of about .000217 kw-hours for each time a signal is set.

A 1-6-hp-motor is sufficient for revolving the toothed discs in the despatcher's office, and is in operation only while signal is being set. The master pendulum in the despatcher's office for making and breaking the contact periodically is more reliable, and, therefore, preferable to the 1-6-hp motor. It would also have the advantage of consuming even less power than the motor. The system is, of course, extremely flexible, since the length of the line it can cover as well as the number of signals on any one circuit can be readily varied to suit any conditions that may arise. Should the despatcher find that a car has disregarded a stop signal, thereby causing two cars on a single-track division to move toward each other, he can cut off all current from the line by throwing the switches placed on the motor stand shown in Fig. 4.

The signal should be installed preferably entirely independent of the telephone, a single No. 10 galvanized iron wire with ground return being sufficient for line connections. The electromagnet coils in each signal have a resistance of 250 ohms. The drop across each electromagnet is designed to be from 15 volts to 20 volts. The amount of resistance in the despatcher's office and at the end of the line may be varied according to the initial voltage, the number of signals on any one circuit and the length of the line.

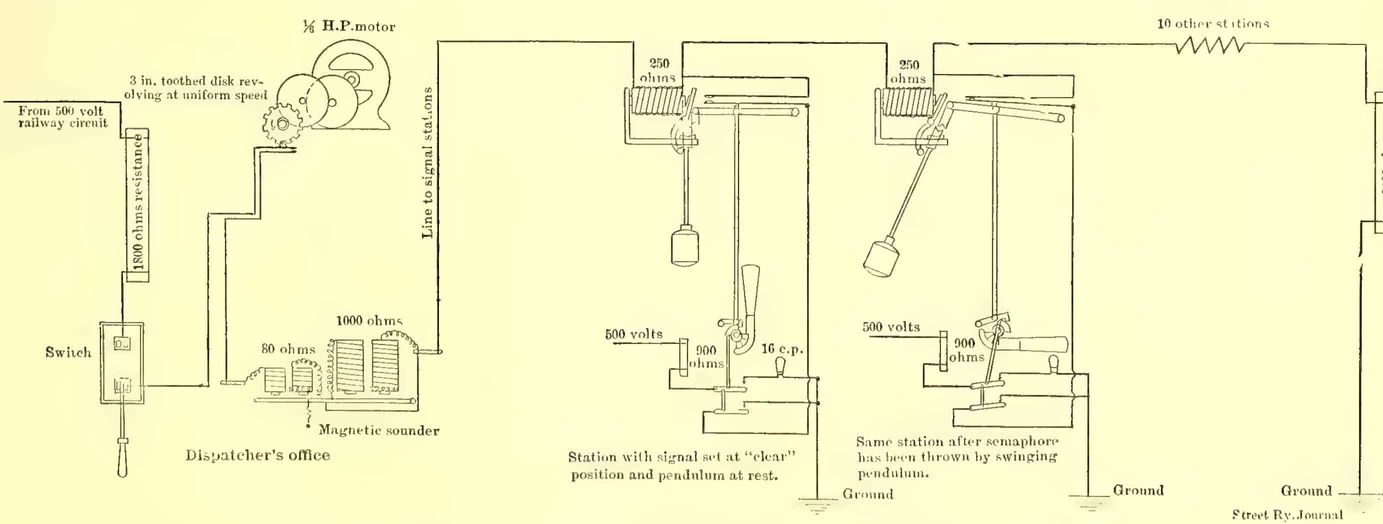
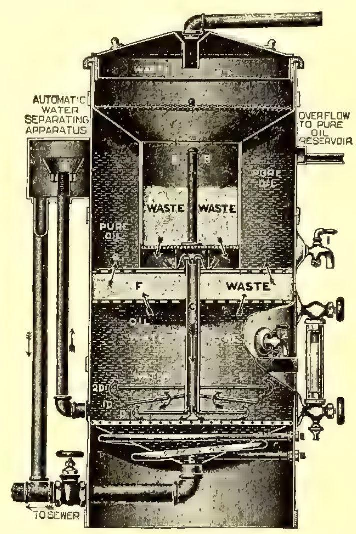


FIG. 5.—DIAGRAM OF CONNECTIONS OF SELECTIVE SIGNALING SYSTEM

OIL FILTER

The Burt Manufacturing Company, of Akron, Ohio, has for some years been making what it calls its style "B" oil filter. This filter will take the condensation from the oil separators and exhaust heads, automatically separate the oil from the water and purify the oil at the same time.



AUTOMATIC OIL SEPARATOR AND FILTER

The oil and water is poured in the top of filter and then passes into chamber B, through a layer of waste, thence through tube C to filter plate D, where it spreads out in a very thin film, which constantly changes surface and grows thinner as it travels from the center to the circumference, thus exposing every particle of waste oil to the action of the water. It then flows upon plate D' and D", going through the same process in each case. It is then in a finely divided separated state and thoroughly mixed with water, which washes it out, and from which it separates by gravity all the remaining impurities. These impurities settle in chamber E, and can be removed by opening the gate valve at bottom of filter. From plate D" the oil again filters through the stratum of filtering material F, and from there it rises to the pure oil chamber.

SEMI-CONVERTIBLE INTERURBAN CAR EXHIBITED AT ST. LOUIS FAIR

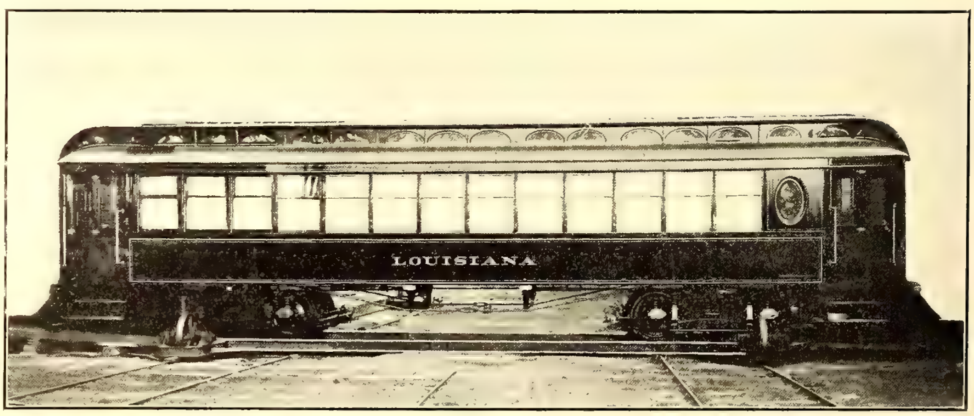
Prominent among the cars exhibited at the Louisana Purchase Exposition is an interurban type of semi-convertible car built by the American Car Company, of St. Louis, under the Brill patents. The semi-convertible car exhibited by the latter company was described in a recent issue of the Street Railway Journal. This car has curved sides, semi-accelerator doors, and single platform steps, and is intended for city and suburban service. The car shown by the American Car Company has the same window system, and is very convincing evidence of the applicability of this system to interurban types. The arrangement provides a car equally suitable for summer and winter service. The windows may be raised to any desired height so that passengers may be protected from the rush of wind while running at high speed, or they may have a practically open car when moving at a moderate rate. As the illustrations show, the window pockets in the side roofs do not alter the appearance of the car appreciably, nor does this arrangement affect the construction or in any way detract from its strength.

SEATING ARRANGEMENT OF SEMI-CONVERTIBLE CAR

The interior is finished in solid mahogany with beautiful marquetry of light woods. The ceilings of birch are painted in a harmonious tint and tastefully decorated. The woodwork of the deck is done in semi-Empire style, with the side panels of the ceiling offset 8 ins., an arrangement which permits the lights to be placed at an angle with the moldings between these side panels and the wide center panel, giving a very attractive appearance. The deck ventilators are composed of opalescent glass with a mottled surface, and the same glass is used in the leaded oval windows of the saloon and heater compartment. The windows and doors are glazed with thick polished plate, and handsome beveled mirrors are set in the sides of the saloon and heater compartment. The corners of this compartment have large, round pillars with handsomely curved capitals, which are united with a graceful arch and transom. A single door is provided at this end of the car while the other end has twin doors. The carving of the woodwork, embellishment of the heavy bronze trimmings, and the metal work of the light is of the graceful acanthus form. The entire color scheme, including the dark green leather of the seats and aisle carpet, is refined and exceedingly pleasing. The seats have high roll-top backs, and are of the "step-over" type with levers so placed as not to come in contact with the bodies of seated passengers, and as the ends of the seats next the windows are placed within the line of the posts and against the side lining, maximum seating and aisle space are obtained. The length of the seats is 36 ins., and the width of the aisle 23½ ins. The seat and aisle, therefore, take up 7 ft. 11½ ins., and as the outside width of the car over the sheathing is but 8 ft. 4 ins., the claim of the builders that maximum seating and aisle space is obtained by not having wall pockets appears to be substantiated.

The windows in the vestibules are arranged to drop into pockets in the wainscoting. The interior woodwork of the vestibules and the platform doors are also of mahogany. The platforms are 5 ft. from end panels over vestibules. The platforms are dropped and supported by heavy angle-iron center timbers and are reinforced by outside knees. They are protected by angle-iron bumpers of Brill manufacture. Other patented specialties bearing the same name are channel-iron draw-bars, "Dedenda" gongs, "Dumpit" sand-boxes, conductors' bells and others. The trucks are also of this make and are the well-known high-speed type 27-E-2 with solid forged side frames, 6-ft. wheel base and 33-in. wheels.

The general dimensions of the car are as follows: Length over the end panels, 38 ft. 8 ins., and over crown pieces, 48 ft. 8 ins.; width over sheathing, 8 ft. 4 ins.; from center to center of posts, 2 ft. 8 ins.; thickness of corner posts, 3¾ ins. and of side posts, 3¼ ins.; size of side sills, 4¾ ins. x 7¾ ins., and end sills, 5¼ ins. x 7¾ ins. The sill plates on the inside of the side sills, to which the bases of the posts are secured, are 13 ins. x ⅜ in.; height of tread of lower step from railhead, 16 ins.; from tread to tread of steps, 11¼ ins.



SEMI-CONVERTIBLE CAR TO BE EXHIBITED AT ST. LOUIS FAIR

ENCASED SPRING POP SAFETY VALVES

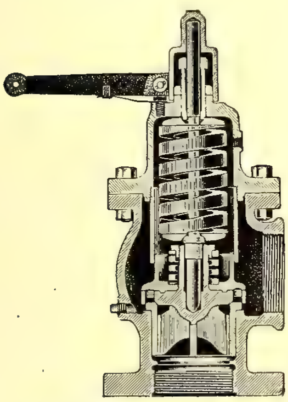
The Crane Company, of Chicago, has brought out a number of improved forms of pop safety valves for stationary, marine, locomotive and portable boilers, also a variety of cylinder reliefs, water reliefs, high pressure and hydraulic relief valves for all purposes and pressures. The construction of these valves embodies a self-adjusting feature which automatically regulates the "pop" of the valve. In other words, it maintains the least waste of steam between the opening and closing points, an improvement which will be readily appreciated, as there is no necessity of readjusting to regulate the pop on changes in the set pressure.

In all pop safety valves it is necessary to have a "pop" or huddling chamber into which the steam expands when the main valve opens, thereby creating an additional lifting force proportionate to this increased area and greater than the force of the spring, thus holding the valve open until the pressure is

relieved. Means must also be provided to relieve this "pop" chamber of pressure, to allow the valve to close promptly and easily. This is accomplished by this company's self-adjusting auxiliary valve and spring, which are entirely independent of the main valve and spring.

The steam in the "pop" chamber finds a passage through holes or ports into an annular space provided in the auxiliary valve or disc, and by reason of the light auxiliary spring this pressure lifts the auxiliary valve and allows the steam in the "pop" chamber to gradually escape, thus permitting a greater range in setting pressures with the least waste of steam and at the same time supplying a cushion or balancing medium, thereby preventing any chattering or hammering and affording the easiest possible action in closing. The manufacturer of these valves claims that this feature is embodied in no other valves, and unlike other pop valves, in changing set pressures within reasonable limits of the spring capacity, nothing further need be done than to simply turn down or out (for a higher or lower pressure) on the screw pressure plug at the top of the valve.

This company's encased spring valves are constructed with a casing or chamber enclosing both springs, protecting them against the action of the steam, particularly high pressure, which, blowing with great force and velocity throughout all parts of valve before reaching the atmosphere, would otherwise have a tendency to disarrange the springs and other parts operating in connection therewith. This form of valve is also particularly useful, in fact necessary, where a number of valves may be connected to one main exhaust or discharge pipe. The encased spring chamber, extending over a greater portion of the top surface of main valve, prevents any retarding action of the steam due to back pressure, which might be caused by one or more valves opening slightly in advance of another, in having any material effect on the free opening of the other valves.



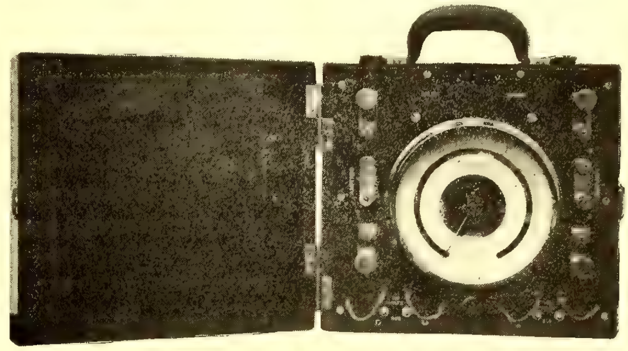
SECTION OF ENCASED SPRING POP SAFETY VALVE

The valves have bevel seats at an angle of 45 degs. from their center line of axis. The seats are made of composition or with solid nickel bushing, as may be required. The cam lever is capable of lifting the valve off its seat one-eighth the diameter of valve opening, whether or not there is pressure on the boiler. The cam lever may also be thrown over far enough to lock the valve open, should occasion require, or it is desired to blow off all or a portion of the steam from boiler through the safety valve. The cap is made with handles or cross bars and fastened to the stem by a key pin. The stem in turn is securely attached to the main or wing valve, and having a square section operating in a square socket, or recess in the main valve, affords means of turning the valve on its seat, thereby removing any incrustation or saline matter that may accumulate. The encased springs are made of best steel and with self-adjusting spring discs. The valves can be taken apart without removal from the boiler and without disturbing the outlet pipe. All parts are suitable for pressures up to 250 lbs., valves for higher pressures being made to order.

The composite marine type pop valves made by this company have been approved by the United States Board of Supervising Inspectors of Steam Vessels, and complies fully with all the rules and regulations governing the United States Steamboat Inspection Service. They will be passed by all local inspectors on the basis of 1 sq. in. of valve area to 3 sq. ft. of grate surface, and on water tube, coil or sectional boilers, carrying pressures exceeding 175 lbs., on the basis of 1 sq. in. of valve area to 6 sq. ft. of grate surface.

LONG SCALE PORTABLE INSTRUMENTS

Electrical engineers who employ the portable standard instruments in general use for the making of exact measurements of electrical quantities or in the conduct of tests, know how difficult it is to take accurate observations in those portions of the scale where the divisions are narrow, and the consequent uncertainty regarding results and difficulty in checking up a series of measurements taken with different instruments. The fact that only a portion of the scale is accurately legible,

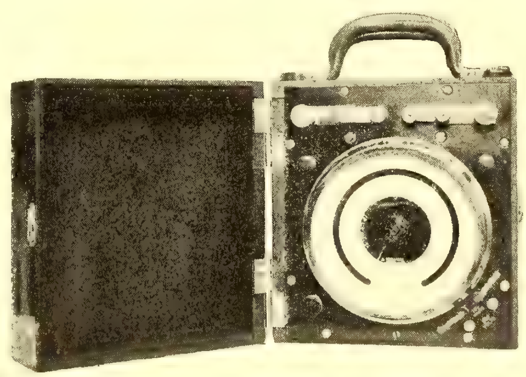


PORTABLE POLYPHASE WATTMETER

and that it is not always possible to have at hand instruments of the proper range to cover all capacities properly, make it at times impossible to avoid the use of comparatively illegible divisions; and, as result, the curve sheets of tests and tables of measurements show irregularities which rob the work of all value.

To obviate such troubles the department of standards of the Westinghouse Electric & Manufacturing Company has designed a line of portable instruments, three of which are illustrated herewith. The assortment comprises voltmeters, ammeters and single-phase and polyphase wattmeters.

The voltmeter is zero reading, this form having been found most suitable for measurements for which a voltmeter is used. In this form the readings are determined by the deflection of the milled head required to bring the index pointer to zero. Each instrument is made in two capacities, which in connection with the very long, open scale enables the readings to be taken over a wide range of voltage with great accuracy. It is astatic, and, therefore, unaffected by external fields, and may

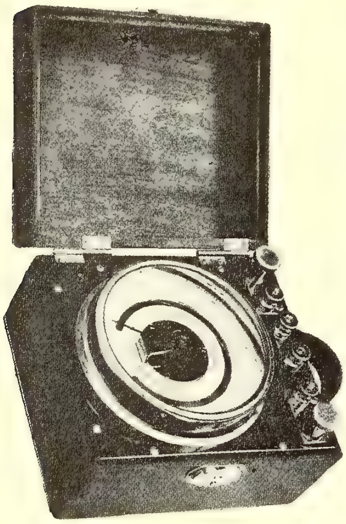


PORTABLE SINGLE-PHASE WATTMETER

be used on either alternating or direct currents without a change in calibration and without requiring "reverse" readings to be taken on the latter. It is regularly made in capacities up to 600 volts, but may be furnished for any higher range desired by the use of a multiplier. The action is entirely deadbeat.

The ammeter is similar in external appearance to the voltmeter, with the exception of the terminals, which are designed for the use of heavier connecting wires, and the absence of the knurled head with its indicating pointer, this instrument reading direct. It is furnished with coils wound in two sections,

which, by means of small connectors on the top, may be connected in series or in parallel, thus greatly increasing the range of the instruments. The scale is very long and open, being similar to the voltmeter in this respect. This instrument can be used on alternating currents only, but it is accurate over a very long range of frequencies, and may be used on circuits varying from 3000 to 8000 alternations without appreciable error. It is also unaffected by changes of wave form on the circuit. The moving element is extremely light, and being dead-beat will accurately follow any variation of current.



PORTABLE AMMETER

In the wattmeters the scheme of sub-dividing the coils as adopted for the ammeters is carried out for both the series and potential windings, thus giving in one instrument four ranges in capacity. In addition to this, as the scales are uniformly spaced from zero to maximum, readings may be taken at any point with equal accuracy so that one instrument will give a range several times that of any other heretofore obtainable.

The wattmeters are suitable for use with alternating currents only, but like the ammeters they may be used over a considerable range of frequency. The polyphase instrument consists of two single-phase mechanisms connected to one shaft, and indicating on a single dial the sum of the forces of the two mechanisms. It may be used for either two-phase or three-phase circuits, and will indicate correctly the total energy of a polyphase circuit irrespective of power factor or any unbalancing of the different phases. As they are not affected by external fields or proximity to large masses of iron they afford a very convenient medium for making tests of polyphase motors or other devices of this nature under actual service conditions.

NEW CARS FOR THE INTERNATIONAL RAILWAY COMPANY, BUFFALO, N. Y.

The accompanying illustration shows one of twenty cars for the International Railway Company, of Buffalo, N. Y., recently completed by the J. G. Brill Company. Some of the cars are to be used on the Niagara Falls road, and the remainder on a line running to Olcott Beach by way of Lockport. The cars are to be operated in trains on fast schedules, and are mounted on Brill high-speed trucks No. 27-E-1½, with steel-tired wheels and solid forged side frames. The construction throughout is unusually powerful. The side sills are ¾ in. x 7¾ ins., with 10-in. x ⅜-in. plates on the inside, and 6-in. x ⅜-in. plates on the outside. The center sills are composed of 9¼-lb. 5-in. I-beams, filled on each side with timber, making a total width of 4½ ins. Each end of the I-beams is fastened to end plates with two heavy bolts riveted to the I-beams and bolted through the end plates and sills. The end sills are 4¾ ins. x 8 ins., with sub-sills 2 5-16 ins. x 4¾ ins., extending the full width of the bottom frame and double mortised at the ends to receive the ends of the side sills. The end sills have a 5-in. x ½-in. steel plate on the inside, with the ends turned 8 ins. and bolted with ½-in. bolts through the longitudinal plates. The cross framing is of 5-in. x 2¼-in. white oak, double-tenoned into the sills. The needle beams are 12-lb. 5-in. I-beams, placed 5 ft. apart from center to center. The inside truss rods are 2-in. x ⅜-in. flat iron, and the under truss rods are 1⅛ ins. in diameter, and secured to the bolsters and side sills with 3-in. x ¾-in. wrought iron straps. The platform knees are of white oak, 2¾ ins. x 8 ins.; the outside knees are reinforced by 3-in. x 4-in. x ½-in. angle-iron, and the inside knees have steel plates, 5 ins. x ¾ in., securely bolted to the center sills of the car. The buffers are 3½-in. x 6-in. x ⅜-in. angle-iron of the builder's special type.

INTERIOR OF CAR FOR INTERNATIONAL RAILWAY COMPANY

The general dimensions of the cars are as follows: Length over body, 34 ft., and over vestibules, 43 ft. 5 ins.; width over posts, 8 ft. 2 ins., and over sill plates, 7 ft. 11½ ins.; height from bottom of sill to top of roof, 8 ft. 10¾ ins.; height from rail to top of roof, 11 ft. 10¾ ins.; height from top of floor to underside of ceiling, 8 ft. 2¾ ins.; width over drip rails and guard rails, 8 ft. 5¼ ins.

The cars are divided into two compartments, the one for smokers being 11 ft. 6 ins. long, and the other 22 ft. 6 ins. The windows are arranged to be raised high enough to allow 4 ft. 3 ins. clear from top of floor and lower edge of bottom rail when the sash is up. The windows are of the twin-window style with the deck sashes of corresponding configuration. The sashes in the vestibule, both front and side, have pockets in the wainscoting. The platform doors at the platform entrances are hinged to the vestibule posts. The seating capacity of each car is forty-eight, the smoking compartment accommodating sixteen. The interiors are finished in natural cherry with maple ceilings. The angle-iron buffers at each end have a piece of sheet-steel fastened to the buffer and set at an angle of 45 degs. against the dasher to which it is bolted. This is to prevent persons from securing a foothold on the buffers.

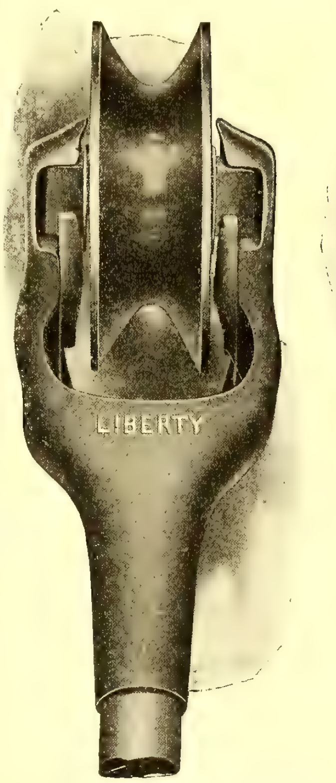
EXTERIOR OF CAR FOR THE INTERNATIONAL RAILWAY, BUFFALO, N. Y.

The Cleveland & Southwestern Traction Company is selling combination baseball and fare tickets for games in Cleveland.

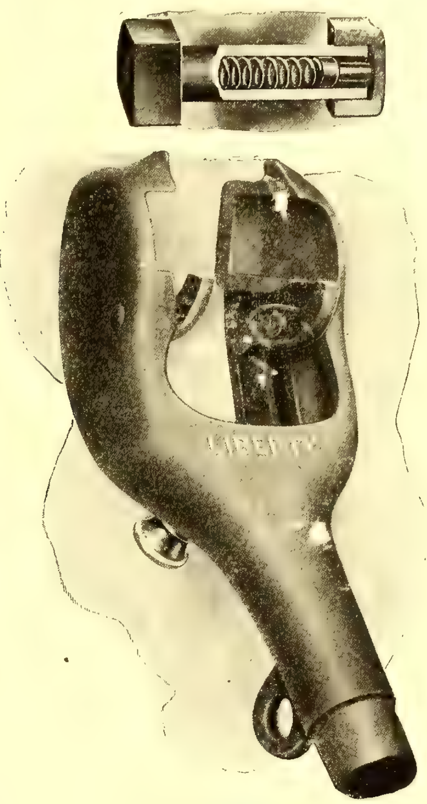
TROLLEY HARP

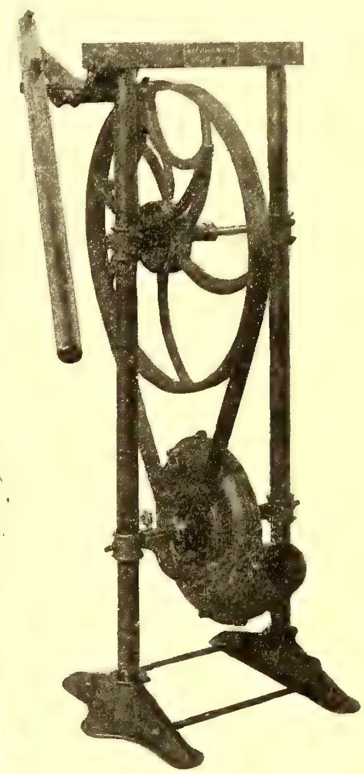
The Liberty Bell Company, of Bristol, Conn., has brought out an improved trolley harp which permits the wheel to turn freely in making curves, thereby avoiding the grinding contact which unduly wears out both wheel and wire. Other important advantages of this harp are the arrangements for readily removing and replacing the trolley wheel, and for insuring continuous contact between the trolley wheel and the harp to prevent arcing.

It is well understood that the movement of the car in turning curves produces considerable friction on a wheel that is not permitted to turn squarely to meet the curve. The method employed by this harp, as clearly indicated in the illustrations, seems to fully overcome this difficulty, thereby, it is claimed, increasing the life of the wheel from 50 per cent to 100 per cent over a wheel which is rigidly held. This saving in wheels certainly indicates a corresponding saving in the overhead system.



TROLLEY WHEEL AND HARP


TROLLEY SHAFT AND HARP


HAND BLOWER

It is claimed for this harp that it practically does away with the necessity of a trolley catcher, as it is very seldom that the trolley will get off, provided the switches and curves are properly constructed. The facility with which wheels can be exchanged in the event of ice storms, or for any other reason, thereby preventing loss of time, is also a very important feature. The best possible form of non-arcing contact is provided, which admits of a perfectly free wheel.

IMPROVED HAND BLOWERS

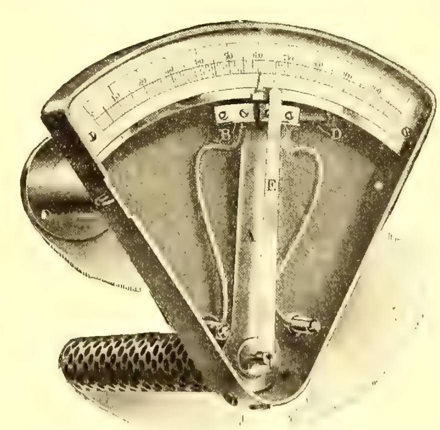
The B. F. Sturtevant Company, of Boston, Mass., recently has made a number of improvements in its style "A" hand blower, and has brought the new design on the market under the name of style "B." These hand blowers have been extensively introduced in connection with new forges of all kinds, and have likewise been applied to old style brick and iron forges as simple, efficient and economical substitutes for the bellows. Not only are they adapted to forge blowing, but can readily be applied as portable ventilating apparatus. They are simple in design, strong, rigid and compact, easy and economical in operation and readily portable. The running gear is simple, effective and strong.

The blower is adjustable on the shaft, and its outlet may thus be set to discharge in any direction and readily connected to the forge tuyere by means of galvanized iron piping. The blower is of cast-iron, strongly constructed in every particular, has a steel shaft running in babbited boxes and a fan-wheel of galvanized steel solidly riveted to a composition hub with extending arms. The frame is carefully designed, well braced, and is so arranged that the slackness of the belt driving the blower may be taken up by lowering the blower shaft, which is supported by collars sliding on the frame. The feet are provided with holes, so that the hand blower may be readily screwed to the floor.

These hand blowers are made in two sizes. The total length on the floor of style B-1 is 18 ins., while the total height of the frame, not including the handle, is 48 ins. The driving wheel is 24 ins. in diameter, the blower outlet is 3½ ins. in diameter, and the complete outfit weighs but 135 lbs. Style B-2 is of slightly larger dimensions, and has proportionately greater capacity for delivering air. The driving wheel is 24 ins. in diameter, the blower outlet is 4¾ ins. diameter, and the complete outfit weighs 155 lbs.

THERMOMETER-THERMOSTAT

The Bristol Company, of Waterbury, Conn., is placing a new instrument upon the market which has been given the name of thermometer-thermostat, since it is a combination of both. There is a demand for an instrument of this character which will give correct indications of the temperature of the atmosphere, gases or liquids at all times, and also serve as a thermostat to make electric connection at any predetermined limits of temperature for operating controlling apparatus, alarms, etc.


DETAILS OF THERMOMETER-THERMOSTAT

The construction and capabilities of this device will be best understood by referring to the interior view shown in the accompanying illustration, in which A is an arm pivoted at lower portion of the case, terminating in a point resting on the arc of the graduated scale, and is held by friction at whatever point

it may happen to be set. Two adjustable contact pieces, *B* and *C*, are carried by this arm. These are capable of adjustment by means of a screw, *D*, which is threaded so as to cause the pieces, *B* and *C*, to approach or recede at equal rates and distances from the center line of the arm upon which they are supported.

These contact pieces are also connected to binding posts, as shown, which are used for making outside connections. These binding posts are located within the case to avoid any possibility of the wires or connections being disturbed without detection. Three holes with insulating eyelets are provided in the lower portion of case, as shown, for the insertion of connecting wires. The high and low contacts can be placed on a single or on independent circuits. The arm, *E*, moving over the graduated scale, indicates the changes of temperature where the instrument is located. This arm is operated by one of Bristol's recording thermometer tubes, placed in the perforated protecting projection extending from the back of the case as shown in the illustration. On the back of the indicating pointer, *E*, there is a raised portion which makes electrical connection with the contact pieces.

A novel feature of the instrument is that the temperature indicating arm, *E*, is not restrained by the thermometer-thermostatic contacts. Thus it will be seen that the controlling effect of the treatment is perfectly adjustable as to position on the scale of the thermometer, and also as to high and low limits of operation, without in any way interfering with the correct indications of the thermometer in case the temperature does not remain, or is not controlled, within the limits for which contact pieces may be set.

For temperatures above the atmosphere a small bulb is located within the closed space or pipe. This bulb is connected with the thermometer-thermostat by a capillary tube filled with alcohol. The temperature at the bulb is communicated to the instrument which may be located at any convenient point.

GROSS RECEIPTS FOR 1903

The 1904 edition of "American Street Railway Investments," the annual "Street Railway Red Book" issued by the publishers of this paper, will be out during the present week. This year's volume contains 362 pages, 57 pages more than that of last year, and the reports of a considerable number of railway companies which have heretofore declined to present financial statements. A very large proportion of the statistics published in the book has been revised by the companies themselves. In addition, a number of other features have been added to the book, which the publishers believe will be of value to subscribers; among them are the populations for 1903 of all the larger cities, the locations of the power stations, repair shops and parks of the different properties, also very much more complete descriptions of the funded debts than have heretofore been published.

A summary of the earnings of 310 street railway companies of the United States is published in the introduction, and is reproduced in the accompanying pages. As will be seen, the number of companies in the highest class, that is, those reporting receipts of over $1,000,000, has increased from thirty-eight to forty-two, and all of these companies record an increase in gross receipts, with one exception, where the decrease is due to local causes.

The average rate of increase of the receipts in 1903 over 1902 is, in the first group, 7.1 per cent; in the second group, 10.7 per cent; in the third group, 16.5 per cent; in the fourth group, 9.5 per cent, and in the fifth group, 14.4 per cent. The general average increase for 1903 over 1902 for the 310 companies compared is 8.5 per cent.

As all of the street railway companies of the United States are not obliged to make annual reports of their earnings to the State or other authorities, it is impossible to say whether this increase would hold good for the entire country.

COMPANIES HAVING GROSS RECEIPTS FOR 1903 OF OVER $1,000,000.

NAME OF COMPANY.	1902.	1903.
Philadelphia Rapid Transit Co., Philadelphia, Pa.	$14,118,158	$15,436,574
New York City Ry. Co., New York, N. Y.	15,098,776	15,273,363
Brooklyn Rapid Transit Co., Brooklyn, N.Y.	12,788,168	13,557,814
Manhattan Ry. Co., New York, N. Y.	11,291,711	12,551,197
Boston Elevated Ry. Co., Boston, Mass.	11,321,030	12,019,371
St. Louis Transit Co., St. Louis, Mo.	6,452,218	7,295,847
Chicago City Ry. Co., Chicago, Ill.	6,413,182	6,435,565
Massachusetts Elec. Companies, Boston, Mass.	6,090,168	6,333,911
United Railroads of San Francisco, San Francisco, Cal.	5,565,216	6,243,219
United Rys. & Electric Co. of Baltimore, Baltimore, Md.	5,094,680	5,571,003
North Jersey Street Ry. Co., Jersey City, N. J.	4,437,310	4,638,891
Twin City Rapid Transit Co., Minneapolis and St. Paul, Minn.	3,612,211	4,063,938
Detroit United Ry., Detroit, Mich.	3,501,754	3,864,944
Cincinnati Traction Co., Cincinnati, O.	3,351,748	3,697,962
International Ry. Co., Buffalo, N. Y.	*4,426,675	3,663,829
Kansas City Ry. & Lt. Co., Kansas City, Mo.	2,910,500	3,187,701
Milwaukee Elec. Ry. & Lt. Co., Milwaukee, Wis.	2,776,294	3,096,324
Third Ave. R. R. Co., The, New York, N. Y.	2,951,202	2,961,659
Cleveland Electric Ry. Co., Cleveland, O.	2,524,949	2,613,049
Washington Ry. & Elec. Co., Washington, D.C.	2,325,775	2,462,294
Montreal Street Ry. Co., Montreal, Can.	2,046,209	2,222,788
Toronto Ry. Co., Toronto, Ont.	1,834,908	2,172,088
Metropolitan West Side El. Ry. Co., Chicago.	2,040,005	2,153,184
Seattle Electric Co., Seattle, Wash.	1,878,101	2,096,726
Jersey City, Hoboken & Paterson Street Ry. Co., Hoboken, N. J.	1,975,525	2,076,148
Louisville Ry. Co., Louisville, Ky.	1,771,887	1,941,599
South Side Elevated R. R. Co., Chicago, Ill.	1,483,841	1,679,310
Toledo Railways & Light Co., Toledo, O.	1,459,092	1,663,793
United Traction Co., Albany, N. Y.	1,479,608	1,624,305
Coney Island & Brooklyn R.R. Co., Brooklyn.	1,507,713	1,605,300
Northwestern Elev. R. R. Co., Chicago, Ill.	1,410,999	1,542,040
Capitol Traction Co., Washington, D. C.	1,402,040	1,435,054
Georgia Railway & Electric Co., Atlanta, Ga.	1,161,372	1,328,995
Worcester Consolidated Street Ry. Co., Worcester, Mass.	1,220,256	1,324,495
Rochester Ry. Co., Rochester, N. Y.	1,068,222	1,324,353
Birmingham Ry. Lt. & Pr. Co., Birmingham.	1,076,767	1,311,851
Connecticut Ry. & Ltg. Co., Bridgeport, Conn.	1,274,820	1,228,633
Cincinnati, Newport & Covington Ry. Co., Cincinnati, O.	1,103,995	1,224,352
Union Ry. Co. of New York City, New York	1,024,259	1,139,582
Oakland Transit Consolidated, Oakland, Cal.	945,865	1,137,041
Union Traction Co. of Indiana, Anderson, Ind.	962,266	1,118,951
Fair Haven & Westville R. R. Co., New Haven, Conn.	986,334	1,074,958
Total, 42 companies	$158,165,809	$169,394,001

COMPANIES HAVING GROSS RECEIPTS FOR 1903 BETWEEN $1,000,000 AND $500,000.

NAME OF COMPANY.	1902.	1903.
Springfield St. Ry. Co., Springfield, Mass	$844,665	$915,876
Northern Ohio Traction & Light Co., Akron, O.	745,043	882,276
Brooklyn, Queens County & Suburban R. R. Co., Brooklyn, N. Y.	826,646	867,371
Chicago & Oak Park Elec. Ry. Co., Chicago	815,284	834,059
Forty-Second Street, Manhattanville & St. Nicholas Ave. Ry. Co. New York, N. Y.	839,144	833,523
Scranton Ry. Co., Scranton, Pa.	722,228	827,778
Hartford Street Ry. Co., Hartford, Conn.	785,587	813,799
Lehigh Valley Traction Co., Allentown, Pa.	740,017	811,668
Washington Water-Power Co., Spokane, Wash.	638,967	801,253
Syracuse Rapid Transit Ry. Co., Syracuse, N.Y	693,284	753,277
United Power & Transportation Co., Phila..	720,560	747,024
Utica & Mohawk Valley Ry. Co., Utica, N.Y.	621,976	701,062
Portland R. R. Co., Portland, Me.	605,802	680,210
Wilkesbarre & Wyoming Valley Traction Co., Wilkesbarre, Pa.	634,216	678,767
Schenectady Ry. Co., Schenectady, N. Y.	350,907	648,763
Duluth Street Ry. Co., Duluth, Minn.	538,030	622,045
New York & Queens County Ry. Co., Long Island City, N. Y.	584,464	619,434
Lake Shore Electric Ry. Co., Cleveland, O..	466,051	616,484
United Traction Co., Reading, Pa.	577,680	600,368
Dry Dock, East Broadway & Battery R. R. Co., New York, N. Y.	585,975	566,992

NAME OF COMPANY.	1902.	1903.
Camden & Suburban Ry. Co., Camden, N. J.	493,305	551,109
Charleston Consolidated Ry., Gas & Electric Co., Charleston, S. C.	†608,470	538,173
Des Moines City Ry. Co., Des Moines, Iowa.	483,150	535,967
Pueblo Suburban Traction & Lighting Co., Pueblo, Col.	410,991	535,038
Savannah Electric Co., Savannah, Ga.	480,510	519,774
Harrisburg Traction Co., Harrisburg, Pa.	466,530	517,485
Total, 26 companies,	$16,279,491	$18,019,575

COMPANIES HAVING GROSS RECEIPTS FOR 1903 BETWEEN $500,000 AND $100,000.

NAME OF COMPANY.	1902.	1903.
Thirty-Fourth St. Crosstown Ry. Co., N. Y.	456,841	495,100
Tacoma Ry. & Power Co., Tacoma, Wash.	442,218	493,587
Central Crosstown R. R. Co., New York, N.Y.	500,252	490,331
Fonda, Johnstown & Gloversville R. R. Co. Gloversville, N. Y.	411,944	485,343
Terre Haute Electric Co., Terre Haute, Ind.	327,957	474,250
Detroit & Port Huron Shore Line Ry. Co. Detroit, Mich.	425,920	459,615
Elgin, Aurora & Southern Traction Co., Aurora, Ill.	410,431	453,380
Milwaukee Light, Heat & Traction Co., Milwaukee, Wis.	354,802	452,931
Cleveland & Southwestern Traction Co., Cleveland, O.	300,846	445,168
American Railways Co., Philadelphia, Pa.	370,384	423,027
Trenton Street Ry. Co., Trenton, N. J.	366,459	421,640
Houston Electric Co., Houston, Tex.	360,018	416,124
Conestoga Traction Co., Lancaster, Pa.	344,227	409,182
Canton-Akron Ry. Co., Canton, O.	202,345	385,752
Holyoke Street Ry. Co., Holyoke Mass.	336,853	369,337
Union Street Ry. Co., New Bedford, Mass.	326,125	366,158
Halifax Elec. Tra'y Co., Ltd., Halifax, N. S.	314,161	365,375
Hudson Valley Ry. Co., Glens Falls, N. Y.	357,177	††349,218
Ottawa Electric Ry. Co., The, Ottawa, Ont.	310,192	348,888
Rhode Island Suburban Co., Providence, R.I.	292,649	338,049
Johnstown Passenger Ry. Co., Johnstown, Pa.	274,168	329,778
Chester Traction Co., Chester, Pa.	305,048	326,805
Lexington Ry. Co., Lexington, Ky.	266,888	315,461
Schuylkill Valley Traction Co., Norristown, Pa.	197,279	302,258
Chicago & Milwaukee Elec. R. R. Co., Chicago, Ill.	190,110	292,247
Richmond Light & R. R. Co., S. I., N. Y.	219,118	291,219
Toledo, Bowling Green & Southern Traction Co., Toledo, O.	246,933	288,301
Manchester Street Ry. Co., Manchester, N. H.	235,172	267,768
People's Ry. Co., The, Dayton, O.	218,492	265,366
Yonkers R. R. Co., The, Yonkers, N. Y.	221,781	260,723
Lincoln Traction Co., Lincoln, Neb.	213,926	251,810
Jacksonville Electric Co., Jacksonville, Fla.	173,209	248,650
Erie Electric Motor Co., Erie, Pa.	214,172	238,628
Binghamton Ry. Co., Binghamton, N. Y.	211,127	238,537
Westchester Electric R.R.Co., New York, N.Y.	222,596	238,413
Lewiston, Brunswick & Bath Street Ry. Co., The, Lewiston, Me.	230,957	231,847
Southwest Missouri Elec. Ry. Co., Webb City.	206,799	230,768
Beaver Valley Traction Co., The, Beaver Falls, Pa.	177,214	227,409
Washington, Alexandria & Mt. Vernon Ry. Co., Washington, D. C.	217,660	224,665
El Paso Electric Co., El Paso, Tex.	161,199	222,777
Sioux City Traction Co., Sioux City, Ia.	199,183	222,045
Atlantic Coast Elec. R. R. Co., Asbury Park.	209,124	221,020
Pottsville Union Traction Co., Pottsville, Pa.	161,649	219,991
Fitchburg & Leominster Street Ry. Co., Fitchburg, Mass.	201,247	218,968
Niagara, St. Catharines & Toronto Ry. Co., St. Catharines, Ont.	172,840	214,824
Cleveland, Painesville & Eastern R. R. Co., Cleveland, O.	189,187	214,631
Albany & Hudson R. R. Co., Hudson, N. Y.	187,882	213,551
Eastern Ohio Traction Co., Cleveland, O.	192.252	202,826
Rockford & Interurban Ry. Co., Rockford, Ill.	167,576	200,633
New Jersey & Hudson River Ry. & Ferry Co., Hackensack, N. J.	166,442	199,891
Middlesex & Somerset Traction Co., New Brunswick, N. J.	180,681	199,534
Altoona & Logan Valley Elec. Ry. Co., Altoona, Pa.	155,462	191,084
Houghton County Street Ry. Co., Hancock, Mich.	170,709	189,804
Twenty-Eighth & Twenty-Ninth Sts. Crosstown R. R. Co., New York.	180,927	186,655
Elmira Water, Light & R. R. Co., Elmira, N.Y.	162,232	184,815
Newport & Fall River St. Ry. Co., Newport, R.I.	170,076	183,341
London Street Ry. Co., London, Ont.	154,704	172,084
Rockland, Thomaston & Camden St. Ry. Co. Rockland, Me.	145,786	170,924
Alton Light & Traction Co., Alton, Ill.	142,021	170,048
Philadelphia & Lehigh Valley Traction Co., Allentown, Pa.	74,182	169,114
Charlotte Electric Ry., Light & Power Co., Charlotte, N. C.	144,669	168,233
Lexington & Boston St. Ry. Co., Boston, Mass.	145,093	164,690
Staten Island Midland R. R. Co., S. I., N. Y.	137,914	153,456
Interstate Consolidated Street Ry. Co., North Attleborough, Mass.	148,299	152,611
Northampton St. Ry. Co., Northampton, Mass.	144,846	151,031
Meriden Electric R. R. Co., Meriden, Conn.	139,283	150,167
Holmesburg, Tacony & Frankford Electric Ry. Co., Philadelphia, Pa.	120,430	150,147
Hoosac Valley Street Ry. Co., No. Adams, Mass.	116,111	148,828
City Passg'r Ry. Co. of Altoona, Altoona, Pa.	117,550	145,834
Dartmouth & Westport St. Ry. Co., New Bedford, Mass.	132,991	145,656
Worcester & Webster St. Ry. Co., Worcester, Mass.	143,842	144,892
Lehigh Traction Co., Hazleton, Pa.	129,653	144,467
Columbus Railroad Co., Columbus, Ga.	106,183	144,103
Montreal Park & Island Ry. Co., Montreal, Can.	130,160	142,868
Consolidated Railways, Light & Power Co., Wilmington, N. C.	126,425	139,684
Jamestown St. Ry. Co., The, Jamestown, N. Y.	116,117	139,519
Phila. & West Chester Traction Co., Phila.	110,409	136,532
Newton St. Ry. Co., Newton, Mass.	134,300	135,304
Pittsfield Electric St. Ry. Co., Pittsfield, Mass.	111,697	134,952
Hartford, Manchester & Rockville Tramway Co., Hartford, Conn.	131,465	133,056
Fairmount Park Transportation Co., Phila.	116,864	128,166
Oakwood Street Ry. Co., Dayton, O.	104,527	127,149
Fries Manufacturing & Power Co., The, Winston-Salem, N. C.	103,660	123,115
Providence & Danielson Ry. Co., Providence, R. I.	97,464	122,518
Kingston Consolidated R. R. Co., Kingston, N. Y.	112,320	118,447
Woonsocket St. Ry. Co., Woonsocket, R. I.	102,962	118,423
Norwich Street Ry. Co., Norwich, Conn.	111,811	117,898
New York & Stamford Ry. Co., Port Chester, N. Y.	100,980	116,309
Williamsport Pass. Ry. Co., Williamsport, Pa.	104,656	116,206
Pittsburg, McKeesport & Greensburg Ry. Co., Greensburg, Pa.	99,308	115,841
Long Island Electric Ry. Co., Brooklyn, N.Y.	125,077	112,901
Haverhill & Amesbury St. Ry. Co., Haverhill, Mass.	113,175	109,389
Ithaca Street Ry. Co., Ithaca, N. Y.	111,090	109,090
Springfield & Eastern St. Ry. Co., Palmer, Mass.	102,788	107,509
York Street Ry. Co., York, Pa.	89,035	107,089
Bridgeton & Millville Traction Co., Bridgeton, N. J.	90,241	106,482
Schuylkill Traction Co., Girardville, Pa.	130,757	104,079
Orange County Traction Co., Newburgh, N.Y.	102,222	103,827
Allentown & Reading Tr. Co., Allentown.	56,850	101,725
Sandwich, Windsor & Amherstburg Ry. Co., Windsor, Ont.	75,601	101,278
Total, 100 companies	$19,638,636	$22,875,139

COMPANIES HAVING GROSS RECEIPTS FOR 1903 BETWEEN $100,000 AND $50,000.

NAME OF COMPANY.	1902.	1903.
Brockton & Plymouth Street Ry. Co., Brockton, Mass.	90,333	99,600
Dayton & Xenia Transit Co., Dayton, O.	80,535	98,911
Newton & Boston St. Ry. Co., Newton, Mass.	78,717	98,608
Poughkeepsie City & Wappinger's Falls Electric Ry. Co., Poughkeepsie, N. Y.	93,740	98,010
Maumee Valley Railways & Lt. Co., Toledo, O.	92,876	97,507
Montville Street Ry. Co., Montville, Conn.	90,038	95,729
Augusta, Winthrop & Gardiner Ry. Co., Augusta, Me.	60,110	91,996
Commonwealth Ave. St. Ry. Co., Newton, Mass.	81,315	91,930
New Bedford & Onset Street Ry. Co., New Bedford, Mass.	69,254	91,721
Newark & Granville St. Ry. Co., Newark, O.	63,499	91,476
Waterloo & Cedar Falls Rapid Transit Co., Waterloo, Ia.	85,636	90,852
Natick & Cochituate St. Ry. Co., Natick, Mass.	79,751	88,923
Sanford & Cape Porpoise Ry. Co., Sanford, Me.	83,847	88,385
Paducah City Ry. (Incor.), Paducah, Ky.	68,278	88,340
Syracuse, Lakeside & Baldwinsville Ry. Syracuse, N. Y.	87,855	87,976
Delaware Co. and Philadelphia Electric Ry. Co., Philadelphia, Pa.	79,136	87,788
Harrisburg & Mechanicsburg Electric Ry. Co., Harrisburg, Pa.	48,201	87,421
Exeter, Hampton & Amesbury Street Ry. Co., Exeter, N. H.	227,496	86,879
Camden & Trenton Ry. Co., Camden, N. J.	81,990	85,579
Stamford St. Ry. Co., Stamford, Conn.	64,233	83,194

NAME OF COMPANY.	1902.	1903.
Niagara Gorge R. R. Co., Niagara Falls, N.Y.	*279,436	82,711
Warren St. Ry. Co., Warren, Pa.	62,332	82,707
Lebanon Valley Street Ry. Co., Lebanon, Pa.	76,847	81,835
Portsmouth, Dover & York Street Ry. Co., Portsmouth, N. H.	80,537	81,606
Danbury & Bethel St. Ry. Co., Danbury, Conn.	78,380	81,476
Concord & Manchester Elec. Branch B. & M. R. R., Concord, N. H.	77,929	80,322
Dayton & Western Traction Co., Dayton, O.	76,871	80,251
Woronoco Street Ry. Co., Westfield, Mass.	64,489	77,220
Milford, Attleboro & Woonsocket Ry. Co., Milford, Mass.	75,461	76,849
Peekskill Lighting & R. R. Co., Peekskill, N.Y.	56,352	76,052
Fox River Elec. Ry. & Power Co. Green Bay, Wis.	58,493	75,682
Hamburg Ry. Co., Hamburg, N. Y.	29,563	75,090
Syracuse & Suburban R.R.Co., Syracuse, N.Y.	70,106	75,032
Bangor Street Ry. Co., Bangor, Me.	65,888	74,876
Olean Street Ry. Co., Olean, N. Y.	56,040	74,866
Burlington Traction Co., Burlington, Vt.	63,875	74,034
Pennsylvania & Ohio Ry. Co., Ashtabula, O.	37,464	73,063
Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co., Geneva, N. Y.	66,955	73,017
Tarrytown, White Plains & Mamaroneck Ry. Co., White Plains, N. Y.	65,737	72,933
New London St. Ry. Co., New London, Conn.	72,471	72,504
Hartford & Springfield Street Ry. Co., Thompsonville, Conn.	44,709	72,293
South Middlesex St. Ry. Co., Natick, Mass.	70,405	72,217
Washington & Canonsburg Ry. Co., Washington, Pa.	50,402	71,991
Portsmouth Street R. R. & Light Co., Portsmouth, O.	50,798	69,277
Worcester & Blackstone Valley Street Ry. Co., Worcester, Mass.	55,811	67,910
Warren, Brookfield & Spencer Street Ry.Co., Brookfield, Mass.	61,595	66,415
Black River Traction Co., Watertown, N. Y.	54,323	66,156
Jefferson Traction Co., Punxsutawney, Pa.	34,950	66,046
Chippewa Valley Electric R. R. Co., The, Eau Claire, Wis.	60,104	65,778
Erie Traction Co., Erie, Pa.	62,033	65,669
Portsmouth Electric Ry., Portsmouth, N. H.	59,204	65 266
Media, Middletown, Aston & Chester Elec. Ry. Co., Chester, Pa.	54,397	64,716
Olean, Rock City & Bradford R.R. Co., Bradford, Pa.	55,044	64,602
Oneonta, Cooperstown & Richfield Springs Ry. Co., Oneonta, N. Y.	41,180	64,188
Sharon & Wheatland Street Ry.Co., Sharon, Pa.	56,713	63,995
Waterville & Fairfield Ry. & Light Co., Waterville, Me.	55,783	62,911
Greenfield & Turner's Falls St. Ry. Co., Greenfield, Mass.	51,617	62,785
Shamokin & Mt. Carmel Electric Ry. Co., Shamokin, Pa.	71,478	62,726
Athens Electric Ry. Co., Athens, Ga.	48,050	62,638
Kokomo Street Ry., Light & Power Co., Kokomo, Ind.	48,700	62,238
Toledo, Fostoria & Findlay Electric Ry. Co., Findlay, O.	59,412	61,845
Citizens' Elec. St.Ry.Co., Newburyport, Mass.	54,831	61,309
Bangor, Orono & Oldtown Ry.Co., Bangor, Me.	57,680	60,850
People's Tramway Co., The, Putnam, Conn.	56,180	60,560
Meriden, Southington & Compounce Tramway Co., Meriden, Conn.	51,208	59,706
Branford Street Ry. Co., Branford, Conn.	54,962	59,645
Gardner, Westminster & Fitchburg Street Ry. Co., Gardner, Mass.	56,106	59,237
Concord, Maynard & Hudson Street Ry. Co., Maynard, Mass.	47,008	58,877
Raritan Traction Co., Perth Amboy, N. J.	53,023	58,251
Lewistown & Reedsville Electric Ry. Co., Lewistown, Pa.	44,473	58,185
Bristol County Street Ry. Co., Boston, Mass.	53,114	57,639
Tamaqua & Lansford St. Ry. Co., Lansford, Pa.	53,153	57,090
Biddeford & Saco R. R. Co., Biddeford Me.	48,870	56,992
Middleboro Wareham & Buzzard's Bay St. Ry. Co., Middleboro, Mass.	45,170	56,881
Waverly, Sayre & Athens Traction Co., Waverly, N. Y.	49,953	56,821
Northampton & Amherst Street Ry. Co., Northampton, Mass.	51,891	56,746
Southern Boulevard R. R. Co., New York.	60,505	56,718
Rochester & Suburban Ry. Co., Rochester, N. Y.	48,521	56,316
Dunkirk & Fredonia R. R. Co., Fredonia, N.Y.	43,302	55,801
Newtown Electric St. Ry. Co., Newtown, Pa.	64,587	54,559
Wilkesbarre, Dallas & Harvey's Lake Ry. Co., Wilkesbarre Pa.	45,028	53,850
Wellesley & Boston St. Ry. Co., Newton, Mass.	62,825	53,812
Van Brunt St.& Erie Basin R.R.Co., Brooklyn.	50,055	53,609
Southwestern St. Ry. Co., Philadelphia, Pa.,	49,222	52,369
Bradford Electric St. Ry., Co., Bradford, Pa.	50,099	52,240
Citizens' R. R., Light & Power Co., Fishkill, N. Y.	37,866	51,444
Tarentum Traction Passenger Ry. Co., Tarentum, Pa.	31,525	51,411
Bristol & Plainville T'way Co., Bristol, Conn.	52,728	51,305
Torrington & Winchester Street Ry. Co., Torrington, Conn	47,251	50,967
Blue Hill Street Ry. Co., Boston, Mass.	37,232	50,388
Chillicothe Elec. R. R., Light & Power Co., Chillicothe, O.	45,900	50,347
Total 91 companies,	$5,873,042	$6,428,53

COMPANIES HAVING GROSS RECEIPTS FOR 1903 BETWEEN $50,000 AND $25,000.

NAME OF COMPANY.	1902.	1903.
Ohio River Electric Ry. & Power Co., Pomeroy, O	$42,528	$49,558
Norton & Taunton Street Ry. Co., Norton, Mass.	46,512	48,180
Templeton Street Ry. Co., Templeton, Mass.	40,578	47,532
Tiffin, Fostoria & Eastern Electric Ry. Co.	45,574	47,386
Sea View R. R. Co., Wakefield, R. I.	36,56)	47,330
Middletown-Goshen Electric Ry. Co., Middletown, N. Y.	48,113	47,093
Butler Passenger Ry. Co., Butler, Pa.	19,302	47,001
Greenwich Tramway Co., Greenwich, Conn.	23,363	46,607
Monmouth County Electric Co., Red Bank, N. J.	36,334	46,352
Providence & Fall River Street Ry. Co., Swansea Centre, Mass.	36,147	44,460
Southbridge & Sturbridge Street Ry. Co., Southbridge, Mass.	33,532	43,675
Hudson River Traction Co., Rutherford, N. J.	42,406	42,907
Cortland County Traction Co., Cortland, N.Y.	37,617	42,551
Valley Street Ry. Co., Sharon, Pa.	34,230	42,431
Kittanning & Ford City Street Ry. Co., Kittanning, Pa.	35,865	42,313
Middletown St. Ry. Co., Middletown, Conn.	40,112	41,905
Georgetown, Rowley & Ipswich Street Ry. Co., Georgetown, Mass.	40,514	41,221
Athol & Orange Street Ry. Co., Athol, Mass.	37,298	40,385
Phillipsburg Horse Car R. R. Co., Phillipsburg, N. J.	37,813	40,358
Oswego Traction Co., Oswego, N. Y.	41,017	38,373
Fulton St. R. R. Co., New York, N. Y.	43,694	38,289
Corning & Painted Post Street Ry. Co., Corning, N. Y.	33,899	38,156
Farmington Street Ry. Co., The, Hartford, Conn.	36,301	37,922
Elmira & Seneca Lake Ry. Co., Elmira, N.Y.	29,903	36,968
Springfield Electric Ry. Co., Springfield, Vt.	37,065	36,554
Coney Island & Gravesend Ry. Co., Brooklyn, N, Y.	35,175	36,312
Marlborough & Westborough Street Ry. Co., Westborough, Mass.	31,725	36,239
Meadville Traction Co., Meadville, Pa.	29,591	35,797
West Chester Street Ry. Co., West Chester, Pa.	15,237	35,502
East Taunton Street Ry. Co., Taunton, Mass.	35,334	35,257
Penobscot Central Ry. Co., Bangor, Me.	29,743	33,808
Columbus, New Albany & Johnstown Ry. Co., Columbus, O.	26,134	32,948
Titusville Electric Traction Co., Titusville, Pa.	31,552	31,862
Haverhill, Georgetown & Danvers Street Ry. Co., Georgetown, Mass.	28,459	31,581
Millville Traction Co., Millville, N. J	30,333	30,336
Marion Ry., Light & Power Co., Marion, O.	26,948	30,310
Citizens' Electric Co., Eureka Springs, Ark.	26,938	30,301
Mauch Chunk, Lehighton & Slatington Street Ry. Co., Mauch Chunk, Pa.	23,724	29,668
Calais Street Ry. Co., Calais, Me.	26,790	29,513
Amherst & Sunderland Street Ry. Co., The, Amherst, Mass.	21,418	29,413
Ogdensburg Street Ry. Co., Ogdensburg, N.Y.	24,063	29,200
Hampshire & Worcester Street Ry. Co., Ware, Mass.	21,552	28,654
Bangor, Hampton & Winterport Ry. Co., Bangor, Me.	26,681	28,617
Somerset Traction Co., Skowhegan, Me.	24,554	28,583
Shamokin & Edgewood Electric Ry. Co., Shamokin, Pa.	32,066	28,502
Bennington & Hoosick Valley Ry. Co., Hoosick Falls, N. Y.	38,216	28,314
Vallamont Traction Co., Williamsport, Pa.	22,125	28,063
Troy & New England R. R. Co., Troy, N.Y.	26,456	27,385
Cumberland Valley Traction Co., Harrisburg, Pa.	27,114	27,251
Port Jervis Electric Light, Power, Gas & R. R. Co., Port Jervis, N. Y.	9,629	27,176
People's Street Ry. Co., Nanticoke, Pa.	28,580	25,620
Total, 51 companies,	$1,636,423	$1,871,719

*Includes earnings during Pan-American Exposition. † Exposition period. ‡ Decrease due to strike.

LONDON LETTER.

(From Our Regular Correspondent.)

It appears now as if it were certain that the tramways which have hitherto terminated at the corner of Hampstead Road and Euston Road will soon be continued to a point near Oxford Street, through the entire length of Tottenham-Court Road. The bill including this tramway improvement has been rigorously opposed by some of the largest merchants and shop-keepers in Tottenham-Court Road, but after a very full consideration of the whole case the Select Committee appointed by the House of Commons has decided to sanction the line as far as Francis Street, making it a condition, however, that no horse cars would be used, but only electric cars. This is a step further in the scheme of connecting the tramways of the north and south of London, though we are yet a very long way from seeing any definite solution of the difficulty.

The system of electric tramways in Gloucester has been inspected by Colonel Von Donop, of the Board of Trade, who has expressed his entire satisfaction with the equipment, and the whole system has now been put into service.

It appears reasonably sure now that the city of Belfast will have an electric tramway system, the Select Committee of the House of Lords who had been appointed to deal with the case having completed their consideration, and ordered the Belfast Tramway Bill to be reported for third reading. We have already published the general scheme of the electrification of the Belfast tramways, which is one of the few remaining British cities of any magnitude in which electrification of the tramways has been held back by an unfortunate disagreement between the company owning the concession and the corporation who are desirous that the system should be electrified.

There is no doubt but that the bill will be passed, and that the day of horse traction in Belfast is now doomed. When Belfast is electrically equipped it will practically conclude the list of the comparatively large cities in the United Kingdom which have been electrified within the last few years. There are certainly now no other cities of anything like the importance of Belfast which have not electric tramways, and many efforts have been made in the past few years to pave the way for the electrification which seems at last secured.

Scarborough has now formally celebrated the opening of its tramways system, the opening ceremony being performed by the Mayoress, Mrs. W. Morgan. Twelve cars of invited guests were driven over nearly the whole of the route, the cars being tastefully decorated, and the procession being cheered all along the route by crowds of spectators.

In a recent issue of the STREET RAILWAY JOURNAL an article was published on electric tramways in the East, taking them in order as they were encountered in a trip from England eastward as far as Japan. In that article it is stated that "Madras has a short electric conduit system which was installed ten years ago by the Electric Construction Company, of London. The road is only a few miles in extent." The writer of the article, it would appear, while in possession of the facts regarding the other cities which doubtless he visited, appears to have omitted to pay a visit to Madras, as the facts of the case are that Madras has now twelve miles of track, and is a system of considerable importance, and not on the conduit system. The tramways are electrically equipped on the overhead system and comprise 2¾ miles of double track and 6½ miles of single track, amounting to 9¼ miles of route, equal to 12 miles of single track, besides turn cuts, etc., which bring the total up to about 13¼ miles. The traffic receipts in 1903 amounted to £20,953 and the net receipts £6,580, so that the system is one of more importance than the writer of the article evidently considered. Arrangements are now being also made to considerably extend the mileage, and so far as appearances go the company owning the tramways is evidently in a very good condition and well satisfied with the results of its business enterprise.

The Fife Electric Power Company, which is developing an extensive scheme for the distribution of electric power, has just let one of its contracts for a generating station at Townhill, Dunfermline, to Bruce Peebles & Co. An immediate start is to be made with its erection, and it is hoped that the company will be in a position to supply both power and light by next winter. The company have also under consideration the supplying of the town of Dunfermline with electric light, as well as electric power to one or two of the large collieries in the district, and also for a scheme of electric tramways between the new naval base, Dunfermline, and Kelty, the ground of which has already been surveyed by the engineers of the company.

Recently a meeting of the Parliamentary and By-laws and the Tramways Committees of Newcastle Corporation was held, when a deputation from the Tyneside Tramways Company attended in regard to the question of their proposed running powers over the corporation lines. The deputation explained that it was the desire of the Tyneside Tramways Company to arrive, if possible, at an amicable arrangement with the corporation. They had no wish to show an antagonistic spirit toward the corporation, and the deputation had come with the object of seeing if some arrangement could be come to whereby good feeling would be maintained. The company was prepared to accept less than it originally asked for rather than go to Parliament to obtain full running powers if an agreement could be arrived at. The company would be pleased if it could be informed of all points of difference which the corporation considered to be of vital importance. After the deputation had retired it was arranged to hold a special meeting of the committee to consider the subject.

The committee of the House of Commons presided over by Henry Hobhouse has concluded the consideration of the bill promoted by the London United Tramways Company, the principal proposal of which was the construction of an electrically worked tramway from Baber Bridge to Staines. The committee sat for the adjustment of clauses embodying their decision as to drainage, pavement, the lighting of roads and other matters imposed upon the company on the opposition of the Middlesex County Council. These clauses were brought up and passed, and the committee also modified the purchase clause by reducing the period at the end of which the local authorities should be entitled to acquire so much of the undertaking as was within their area from thirty to twenty-five years. The clauses having been gone through, the bill was ordered to be reported to the House for third reading.

The tramways committee of the Exeter City Council has approved of the specifications for the tramways, and decided to invite tenders at once.

A select committee of the House of Lords—Lord Clifford, of Cudleigh, presiding—has under consideration a bill, the principal object of which is to authorize the use of the waters of Llyn Llydaw, on the eastern slopes of Snowdon, for generating electricity. The promotors proposed to supply the electrical energy so obtained for traction on light railways and as power in the quarries and mines of the district, as well as to authorize undertakers for lighting and other purposes. The area of supply is in the counties of Carnavon, Merioneth and Anglesey and parts of Flintshire and Denbighshire. Among the petitions against the bill are the Conway Corporation, Carnarvon Corporation, Flintshire County Council, Carnarvonshire County Council, the Urban District Councils of Penmaenmawr, Llandudno and Conway and the Colwyn Bay Joint Water Supply Board.

For the promotors it was explained that they proposed to construct a dam which would raise the waters of Llyn Llydaw some 20 feet, thus giving a fall of 1150 feet within a distance of a quarter of a mile of a generating station, and a line of pipes connecting it with the dam. All round the generating station were possible customers in the quarries and mines, and there was already evidence of a large demand for the power which the promoters would supply. It was proposed to transfer to the company the electricity powers of the Portmadoc Railway Company, and the two undertakers would be equal to about 12,000 horse power. About 1000 horse power of this would be utilized to "electrify" the railway authorized in the act of 1901, and 11,000 horse power would be available for quarries and other purposes. The promoters hoped to be able to supply energy at 1½ d. per unit. The estimated cost of the works at Snowdon was £86,500, and this would be provided out of the proposed capital of £170,000, the balance being available for the construction of railways. The company would own all the shares in the Portmadoc Railway and the Narrow-gage Railway, and it was proposed to extend these lines to Carnarvon on the one side and Bettws-y-Coed on the other. The promotors would supply electricity for these railways and they would be worked by the Portmadoc Company. The cost of the acquisition of the undertaking in the Conway Valley would be £40,000.

The city of Leicester has now formally opened its system of electric tramways, a full description of which will be found in another column. The invited guests assembled at the Town Hall at 2.30 p. m., and proceeded by special horse car to the power station of the Lero. At 3 o'clock Councillor Flint, chairman of the Tramways Committee, assisted by Mrs. Flint, performed the opening ceremony, subsequent to which the car department was inspected. At about 4 o'clock the Mayor (Ald. Sawday) and Ald. Smith started the first electric car, and the guests were invited to ride to the Belgrave terminus and thence to the London road terminus, returning to Waterloo Street. Tea in the Mayor's rooms followed, after which brief speeches were given

by the Mayor, the chairman of the committee and others.

At a recent meeting of the Elland Council the clerk reported that C. T. Rhodes had seen him with respect to a proposal by a syndicate which was being formed for the purpose of running tramcars from Wyke through Halifax and Elland to Huddersfield, and thus connecting those three towns. The proposal had been favorably received by the Tramways Committees of the Huddersfield and Halifax Corporations.

In order to be able to present to the next meeting of the City Council a complete scheme for the establishment of an up-to-date system of tramways throughout the city, the Tramways Committee of the Birmingham City Counsel is now busily engaged in considering details and formulating proposals. In broad terms the scheme under consideration provides not only for the reconstruction and electrification of the existing lines upon the expiration of the present leases, but also for the provision of a series of new lines running into districts which at present are unserved by trams in any form. With regard to the projected routes, it is understood that the committee is not disposed to delay the commencement of the construction of these lines until the expiration of the present leases. To this end Parliamentary powers will require to be sought, and it is understood that the Tramway Committee intends to file a Tramway bill during the coming autumn. There is thus little time to be lost, and the Tramway Committee is desirous of completing its scheme at the earliest possible moment, so that the proposals may be considered and debated by the Council before the matter goes to London.

In an agreement between the Bristol Corporation and the British Tramways Company the latter is to make efficient provision for passengers of the working classes; the corporation may exercise the right to purchase such of the extended lines as may be within the existing boundaries of the city in May, 1915, the date at which the urban system generally may be purchased. The extensions outside the present city boundary—which will, of course, be of greater scope by that time—will be purchasable in forty-two years on payment of the fair market value as a going concern. The Westbury Road, over which a new line of tramways is to run to Henbury, is to be widened at the company's expense, and otherwise suitably prepared for the special traffic.

A. C. S.

PARIS LETTER

(From Our Regular Correspondent.)

The annual meeting of the Metropolitan Railway Company was held on April 16. The operation for 1903 resulted in a net profit of Frs. 4,510,056, against Frs. 2,943,870 in 1902, an increase of Frs. 1,566,185. From this amount the company deducted Frs. 500,000 for the assurance fund and Frs. 1,150,000 special, leaving available for dividends, Frs. 2,860,056. It is proposed to pay 3 per cent dividends.

It was stated at the meeting that the company had made arrangements to take a supply of current from a new power station erected by the Societé Franco-Russe, on the outskirts of Paris, as soon as the same was completed. This power station, it will be remembered, will have 35,000 kw output, of which 18,000 is being installed by the Swiss firm of Brown, Boveri & Co., as follows:

3 turbo-alternator groups, 5000 kw, 25 cycle, 5500 volts, three-phase.
1 turbo-alternator group, 3000 kw, 25 cycle, 5500 volts.
1 turbo-exciter group, 300 kw.
1 motor-generator exciter group.

It may be stated that the Franco-Russe Company, which is building the power station, really represents the same group as compose the Metropolitan Railway. The reason for the Metropolitan Railway Company contracting for power from an outside power station (although controlled by the same group of capitalists) is because the Metropolitan Railway Company only holds the concession for operation of the electric lines (built by the city) for a comparatively short period of years, when it may be bought up by the city at the then value. If, at that time, the operating company takes most of its current from independent power stations, it is evident that the city will practically be obliged to continue the supply or go to the expense of building separate and costly power stations.

In connection with the No. 3 line of the Metropolitan Company shortly to be opened for service, it is certain that double-truck cars will be used, each capable of seating eighty passengers and arranged with three doors on either side of the car, which will have a total length of 13m35. Two motors per car will be used, both motors mounted on the leading axles of the front truck. All the electrical apparatus, whether of the Thomson-Houston train control type or the Westinghouse turret control, will be mounted in an entirely fire-proof cab lined with sheet steel. The car body itself will not be fire-proof, but constructed of pitch pine, as now in use. The Metropolitan Company is in hopes that all chances of fire will be avoided in this manner, notwithstanding the fact that there is no protection against arcing from the third rail circuit. The motor-car equipments will include four shoe-fuses. The wiring in the cabs will be of bare copper or asbestos covered passed through metallic tubes.

A new feature of the No. 3 line will be the lighting circuit arrangement. In the first two lines this consisted of bare wire mounted on porcelain insulators about 3 m above the track along the sides of the tunnel. The stations were also included in the circuit, and the tunnel itself was lighted at regular intervals. The catastrophe of Aug. 10 last was directly attributable to this system, the stations being thrown into total darkness immediately the tunnel circuit was interrupted by the burning cars. In the No. 3 line the tunnel circuit will be independent of the station lighting, and instead of bare wiring, will consist of insulated cable laid under the track. Small wires will be drawn through Bergmann tubes and embedded in the walls of the tunnel.

The equipments for use on this line will be furnished by the French Thomson-Houston Company, to the number of ninety. The Sprague General Electric system will be used, and some interesting comparative tests are expected to be made between these and the new Westinghouse equipments. The latter company is transforming ninety-one cars to be used on the No. 1 line (Vincennes-Torte Maillot), and the trains will include three motor cars and four travillers. It is also furnishing nine double-motor, 200-hp equuipments for the No. 3 line.

It is well known that Paris is a most conservative city regarding the use of the trolley system within its streets. An important inroad, however, is about to be made by the conversion of the steam road from Paris to St. Germain, and running along the Route Nationale down the Avenue de la Grande Armée starting from the Arc de Triomphe. Visitors will remember the grotesque appearance of the existing steam locomotives and long train of trailers which slowly puffed up the long incline into Paris. The trailers were one by one left at certain points on the route, and the locomotives had great difficulty in mounting the grade into St. Germain with one trailer. The Compagnie des Tramways Mecaniques des Environs de Paris have obtained the concession to erect the trolley system and a high speed interurban service will replace the cumbrous steam plant.

The new 12-mile electric extension of the Paris-Orleans Railway Company is fast approaching completion, and the first locomotive and motor car will be delivered about the end of May. This is a case of a trunk railway making an extension of an existing electric plant to handle its increasing suburban traffic in preference to increasing its steam rolling stock. The line is laid out for a 11,000-volt transmission, but until further extension be made, will run at a tension of 5500 volts three-phase, 25-cycles, transformed to 600 volts direct-current; third rail distribution will be used with a few ærial contacts at stations and crossings.

M. V.

IMPORTANT CONSOLIDATION OF GERMAN STEEL COMPANIES

On March 1, almost all of the German steel companies formed a union at Düsseldorf, under the title of the Stahlwerks-Verband Aktien-Gesellschaft, with headquarters in Düsseldorf. The new company has taken over the inland and export trade of the associated works, its manufactures including the following: Heavy and light rails, sleepers, fish-plates, sole-plates, steel joists, channels, ingots, blooms, billets, sheet bars, etc.

The following are among the more important companies absorbed in founding the new corporation: Bochumer Verein für Bergbau und Gussstahlfabrikation, Bochum i. W.; Gesellschaft für Stahl-Industrie m. b. H., Bochum i. W.; Eisenhütten-Aktien-Verein, Düdelingen (Luxemburg); Georgs-Marien-Bergwerks-und Hütten-Verein, Aktien-Gesellschaft, Osnabruck; Hörder Bergwerks- und Hütten-Verein, Hörde i. W.; Fried. Krupp Aktiengesellschaft, Essen a. d. Ruhr; Luxemburger Bergwerks- und Saarbrücker Eisenhütten-Aktien-Gesellschaft, Burbacherhütte, Burbach bei Saarbrücken; Gebrüder Stumm, Ges. m. b. H., Neunkirchen, Bez. Trier; Union Aktien-Gesellschaft für Bergbau, Eisen- und Stahl-Industrie, Dortmund; Vereinigte Stahlwerke van der Zypen und Wissener Eisenhütten-Aktien-Gesellschaft, Köln-Deutz.

NOTES FROM GERMANY

The present state of the electrical manufacturing industry in Germany may be considered entirely satisfactory. It is now possible to judge the results of last year's consolidation of the leading German electrical companies into two groups, the first comprising the Allgemeine Elektricitäts Gesellschaft and the Union Elektricitäts Gesellschaft, and the second the Siemens-Halske and the Shuckert companies. Before these combinations, the capital of the Allgemeine Company was 60,000,000 marks ($15,000,000), and its annual dividend for several years 15 per cent, while the Union Company paid 10 per cent on its capital of 24,000,000 marks ($6,000,000). The Siemens-Halske Company was capitalized at 60,000,000 marks ($15,000,000) and had paid the equivalent of a dividend of 6 per cent for several years, but as the Shuckert Company had paid no dividends for a number of years on its capital of 54,000,000 marks ($13,500,000), it was obliged to consolidate on less favorable terms than the other companies. However, an actual fusion took place only in the case of the companies comprising the first group; the Siemens-Halske and the Shuckert companies, simply combining their manufacturing plants and becoming joint owners of the new stock of 90,000,000 marks ($22,500,000) issued in the name of the Siemens-Shuckert Works.

Outside of these combinations, there are two other important electrical manufacturing companies, Lahmeyer, of Frankfort, and Helios, of Cologne. These companies are not paying dividends as they are still suffering from the after-effects of the boom of 1896-1898, and although their combined capitalization is fairly large, they are almost negligible as competitors to the other companies. It must be noted, however, that the large companies have not used their power to raise the cost of electrical machinery to a very high figure; on the contrary, they have simply endeavored to avoid the ruinous prices formerly in vogue and to base their selling prices on a fair advance over the cost of manufacture. This temperate policy is in line with that followed by other German syndicates and properly enjoys the protection of the government.

As the electrification of city and suburban railways has been practically completed, the principal source of income from railways is due to renewals. This falling off, however, is compensated for by an increase in orders from mining and smelting works, which are rapidly adopting electrical machinery. Lately this business has received a temporary check on account of the Russo-Japanese war.

The consolidated companies are displaying great faith in the future of the steam turbine. The Allgemeine Company controls the Riedler-Stumpf-Curtis patents, and the Siemens-Shuckert Company the Zoelly system. Both groups have organized separate turbine companies, and the Siemens-Shuckert Company in addition has taken into partnership the North German Lloyd and Krupp. It is evident therefore what immense capital is backing turbine development in Germany.

The Studien-Gesellschaft für Elektrische Schnellbahnen (Research Association for Electric High-Speed Railways), which was organized four years ago, has ended its labors after both of its experimental cars attained speeds of over 200 km (120 miles) an hour traveling alone, and of 170 km (102 miles) per hour with one Pullman car attached. Both of the great 90-ton cars have left the field and high-speed experiments are now being conducted on the same line with steam locomotives.

At first glance, it might appear that the expensive experiments which the association conducted have proved a failure, but that is certainly a false conclusion. Those who contributed to the cost of these experiments did not expect that they would result in the immediate adoption of high-speed electric traction. They simply intended to show that with present facilities it is possible to run a train safely at speeds of 200 km (120 miles) an hour. At the same time, the trials made possible a thorough study of the air resistance at high speeds, the proper signal apparatus and other important points. The members of the association were right in judging that these tests would awaken a public desire for higher speeds and that finally a point would be reached where the demand would justify the installation of high-speed electric traction.

The government could not shut its eyes to the fact that high-speed experiments had been conducted successfully on its own lines, and it has therefore begun a series of tests with locomotives, using superheated steam. In one of these tests a locomotive hauled three Pullman cars at 130 km (78 miles) per hour. Assuming that it will be possible to adapt the present roads to carry trains running at 130 km (78 miles) per hour instead of the present 80 km to 100 km (48 miles to 60 miles) many changes will be required in signal and other auxiliary apparatus. It will also be necessary to make changes in car construction, increase the weight of the rails, etc. The greater portion of the orders resulting from these changes would go to the companies who were members of the Studien-Gesellschaft, so that their outlays would soon be recouped even if the steam locomotives were not displaced immediately. At present it is likely that the engineers of the electrical companies will endeavor to develop a single-phase system in place of the complicated three-phase system used during the Zossen trials.

The Union Elektricitäts Gesellschaft, following what has been done in the United States, has installed a single-phase system on a line near Berlin 4 km (2.4 miles) long, which will soon be placed in operation. It is evident, therefore, that a beginning in single-phase work has already been made.

Should the single-phase system prove as economical in practice as in theory, the manufacturing companies will no doubt receive many orders from street railways, and for the construction of mountain railways whose construction is not particularly profitable under present conditions. Only the existence of the old direct-current stations, from which many of the railway companies are obliged to purchase power, will prevent the latter from adopting alternating-current.

It is unfortunate that electrical science has not advanced so far as to displace the countless narrow gage steam freight lines (light railways). Usually these lines are built partly at the expense of the government or local municipality and partly by private parties. Most of them run through thinly populated districts, some of them operating as few as three trains per day in each direction. As they are built principally to open up the country districts and advance agricultural interests, little or no profit is expected from them. Thirty railways of this type are now being built in Bavaria alone. They comprise a total length of 1500 km (900 miles), and the government has granted a subsidy of 39,000,000 marks ($9,750,000) to assist in their construction. In four years twenty-four such lines have been built in Bavaria. When the new lines are completed this small kingdom will possess 173 light railways having a total of about 4000 km (2500 miles).

The following figures will give a fair idea of the small business that is done by these lines:

1885	1,537 marks per km	$640 per mile
1888	3,659 marks per km	1,525 per mile
1902	4,347 marks per km	1,811 per mile

Of course the operating expenses were very small, making it possible to pay dividends. These average 1.3 per cent in 1884, 4.6 per cent in 1888, 3.6 per cent in 1897 and 2.33 per cent in 1902. It is proposed to increase the freight rates from 20 per cent to make these lines more profitable.

It is to be hoped that the day is not far distant when the many waterfalls in Bavaria will be harnessed for electric traction. The present locomotives are very cumbersome and expensive, and the government is now considering the use of motor cars, but has not yet decided whether they should be of the electric, steam or gasoline type.

Storage-battery cars are little heard of in Germany since the Prussian authorities forbade their use for "reasons of safety." At present they are employed only in Dresden. Nevertheless, the largest storage-battery manufacturer, the Hagen Company, is enjoying excellent business as the use of stationary storage batteries is constantly increasing. The electric railways have long employed reserve storage batteries, and there are very few power stations that do not possess them; the other storage battery manufacturers have, however, done very little business.

In view of the success of gasoline automobiles a certain amount of development is taking place in the use of motor cars or dummies as steam railroad feeders. This is evident by the experiments which are being tried on several English railroads, and which are being watched with great interest in Germany, where similar experiments have repeatedly been made.

THE YOUNGSTOWN & SOUTHERN RAILWAY SOLD

The Youngstown & Southern Railway Company, incorporated some time ago under the laws of Ohio, and having under construction a 60-mile third-rail line from Youngstown to East Liverpool, Ohio, passing through Lisbon, has recently been sold to Eastern interests. The building of the line will be carried out as originally projected, and J. G. White & Company, of New York, have the contract for constructing, the work of which has already been begun. It will be fully a month before details can be secured as to the power plants to be utilized for operating the lines. Ex-Lieutenant-Governor Jones, of Ohio, is president of the company, and Ernest Gonzenbach is chief engineer.

ANNUAL MEETING OF PARIS METROPOLITAN COMPANY

The annual meeting of the Paris Metropolitan Railway Company was held May 16. The company reported receipts for 1903, Frs. 17,626,682; operating expenses, Frs. 7,577,060; other expenses, including taxes, Frs. 5,693,654; net earnings, Frs. 4,999,537. From this sum, Frs. 1,150,000 are deducted as a consequence of the accident of August, 1903, leaving a total of Frs. 3,296,368 available for dividends. A dividend of 3 per cent has been declared. It was also decided to establish a special insurance fund, and an amount was charged off to it amounting to Frs. 500,000. On Dec. 31, 1903, the company owned 132 motor cars and 462 trail cars, and had 24 km of line in operation. The capital of the company is Frs. 75,000,000.

THE NEW HAVEN RAILROAD BUYS MORE TROLLEY LINES —OTHER NEW ENGLAND ROADS PLAN TO COMPETE WITH TROLLEY

The policy of the New York, New Haven & Hartford Railroad Company regarding the purchase of competing electric railways, is certainly being carried out aggressively. Two weeks ago announcement was made in the Street Railway Journal of the plan of the company to consolidate under the title of the Consolidated Railway Company, the electric lines then controlled, and last week the appointment was noted of Mr. E. H. McHenry as fourth vice-president of the company, to devote himself exclusively to the management of the company's electric railway properties. Now the announcement is made that the company has concluded on private terms the purchase from the receivers of the Worcester & Southbridge Street Railway and its subsidiary companies, the Rochdale & Charlton depot and the Southbridge & Sturdridge Companies. These properties, it is stated, will be consolidated with the Consolidated Railway Company and brought under the management of Mr. McHenry. In mentioning these latest developments of the company, it is interesting to note the report emanating from Newport to the effect that the company has completed plans for the electrical equipment of its line between Newport and Fall River, also the statement that the company's line between Hartford and Springfield is to be equipped with the third-rail system to meet electric competition.

The Consolidated Railway Company, which is to be the operating company for electrical properties controlled by the New York, New Haven & Hartford Company, formally organized and elected officers Saturday, May 28, at New Haven. This company, it will be remembered, is the old Worcester & Connecticut Eastern, whose name was recently changed by request. The directors chosen were as follows:

Charles S. Mellen, George J. Brush, H. M. Kochersperger, J. S. Hemingway, Arthur D. Orborne, E. H. McHenry, John M. Hall, Percy R. Todd, of New Haven; Edward D. Robbins, of Hartford; Frank W. Cheney, of Manchester; Fayette S. Curtis, of Boston; Charles F. Brooker, of Ansonia; I. D. Warner, of Bridgeport; Edwin Milner, of Plainfield.

Officers were elected as follows:

C. S. Mellen, president; E. H. McHenry, first vice-president; M. H. Kochersperger, second vice-president; J. G. Parker, secretary; A. S. May, treasurer; T. F. Paradise, assistant treasurer.

Mr. McHenry, as previously stated in the Street Railway Journal, will have charge of all the electric railway properties of the company. Mr. Robbins has been connected with the Connecticut Eastern since its organization and Mr. Hemingway was president of the Fair Haven & Westville Railroad, operating the street railway system of New Haven.

But the New York, New Haven & Hartford Railroad is not the only New England Company now making announcements bearing on the question of electric competition, and the measures to be adopted to forestall it. Both the Boston & Maine Railroad and the Boston & Albany division of the New York Central have just made statements bearing on the same general subject, but showing that a very different plan has been worked out by them for special cases. The announcements of the roads mentioned refer to statements of reductions in fare. In the case of the Boston & Maine Railroad, which is paralleled by electric railways between Springfield and Greenfield, a distance of 40 miles, the schedule of fares which went into effect on the Connecticut River division of the company this week is in every instance as low as the trolley rates. The railroad has suffered especially heavy loss in local traffic between Springfield and Northampton. Under the new schedule the fare from Springfield to Holyoke, a distance of 9 miles, will be reduced from 15 cents to 10 cents. Between Northampton and Springfield, 18 miles, the fare will be cut from 33 cents to 20 cents. From Springfield to Greenfield the rate will be 50 cents instead of 83 cents. Reductions will be made in about twenty instances.

MORE EQUIPMENT FOR MANILA

J. G. White & Company, of New York, have placed a contract with the Peckham Manufacturing Company, of New York, for fifty-five single-trucks. The cars, as previously mentioned in the Street Railway Journal, will be of Belgian build, La Metallurgique, of Brussels, having taken the contract. Teak wood will be used in order to withstand the ravages of the white ant. The motors will be of Westinghouse manufacture. The Albert & J. M. Anderson Manufacturing Company, of Boston, Mass., has been allotted the contract for the line material. The J. A. McCardell Company, of Trenton, N. J., is to ship some Trenton tower wagons for construction and repair works. Milliken Brothers, of New York, are supplying the steel for the power house. Two large compound duplex feed pumps have been ordered from the Blake branch of the International Steam Pump Company, of New York.

CURTIS TURBINES FOR TOKIO STREET RAILWAY PLANT

The Tokio Shigai Railway Company, which is constructing 30 odd miles of double track in Tokio, Japan, has ordered, through the Japanese mercantile house of Mitsui & Company, of New York, four 1500-hp Curtis turbines for installation in the company's main generating station. The portion of the road now running is operated from the Tokio Electric Light Company's plant. The new station will be one of the largest in the Far East.

DECISION IN CHICAGO NINETY-NINE YEAR ACT CASE

Decision on the validity and scope of the ninety-nine year traction act, involving traction rights in Chicago, was handed down on Saturday, May 28, by Judges Grosscup and Jenkins, of the United States Circuit Court. It must be said that the decision is somewhat ambiguous; it upholds the legality of the act as affecting all ordinances, etc., prior to 1875, but does not apply to various ordinances and grants since 1875.

The Court held that when the municipality, by vote, accepted the cities and villages act, the ninety-nine year grant from the Legislature was null and void so far as Chicago was concerned. The cities and villages act was passed in 1872, but it was on May 3, 1875, that Chicago's new charter, under that act, became operative, and on that date, said the Court, the twenty-year franchise law became effective.

The gist of the decision is found in the closing paragraph, which is as follows:

"To sum up our conclusions in one paragraph, we hold that as to such ordinances as were passed by the City Council prior to the counting of the vote at the charter election in 1875, and accepted and acted upon by the railway companies, there exists, between the companies and the city, a contract relation, terminable by neither party without the consent of the other, until the period named in the legislative act expires; but that as to the streets occupied under ordinances passed after that date, the contract relation is to be looked for solely in the ordinances themselves."

Of the various expressions of opinion regarding the decision, those of Receiver John C. Fetzer, of the Union Traction Company, and of Mayor Carter H. Harrison are of especial interest, for in them one has the opinion of the accredited representatives of the company and of the people. Mr. Fetzer says that now is the time for a settlement, and that the interests involved ought to get together at once in business-like way and adjust such differences as exist. The tone of Mayor Harrison's statement, however, is very different from that of Mr. Fetzer. He seems to think that the company is left in a position where "it must do business with the city," and that the company "might as well be sensible and come in on a deal on lines the city believes right."

In order better to understand the situation it is deemed advisable to state that the decision just rendered relates to an act passed by the Legislature of Illinois in 1857, to make franchises of street car and lighting companies in that State good for ninety-nine years. In 1858 franchises were obtained from the city of Chicago covering sections of some of the lines now in the Union Traction Company. These franchises were granted for twenty-five years, and on the expiration of that period in 1883 the companies acquired a continuation for twenty years, but without in any way prejudicing their rights under the ninety-nine year act. This extension of the terms with the city expired last year, but the companies have contended that they still possess the rights under the act of the Legislature. As extensions of original lines became necessary, permits were obtained from the city for the construction of such, and these permits were granted for the same

number of years as in the original franchise. Thus while franchises of original lines under the grant of 1858 have expired, those of the extensions of the same lines have still, in several cases, many years to run.

A MOST IMPORTANT ORDER BY A RAILROAD COMMISSION

The Railroad Commissioners of Massachusetts have handed down a decision on the petition of the Newtown & Boston Street Railway Company, which allows it to discontinue the giving of free transfers on its cars. The board does this, however, for a limited period, as an experimental measure, with the understanding that no dividend shall be paid and net earnings, if there are any, shall be devoted to the reduction of the floating indebtedness of the company. The period named by the board expired on Sept. 30, 1905, when the board will review the questions now presented in the light of the experience thus gained. Such action as may be compatible with the successful operation of the company and the interests of the traveling public will then be taken.

VICTORY FOR COMPANY IN CLEVELAND LOW-FARE FIGHT

The United States Supreme Court, on Tuesday, May 31, affirmed the decision of the United States Circuit Court for the Northern District of Ohio, in the Cleveland Street Railway fare cases. The cases involved the validity of the ordinance passed by the City Council of Cleveland fixing the rate of fare on the street railways at 4 cents cash, or seven tickets for 25 cents. The ordinance was attacked on the ground that it constituted a violation of contract, and the Court, in an opinion by Justice White, held that the consolidation ordinance of 1885, fixing fares at 5 cents, constituted a contract binding on the city and the railway companies.

THE CAMDEN & TRENTON LINE OPENED—LINK IN THE NEW YORK-PHILADELPHIA LINE

The first through car over the Camden & Suburban (Public Service Corporation) and Camden & Trenton Railways, from the Philadelphia ferries at Camden, N. J., to State and Warren Streets, Trenton, made the trip on May 24, in two hours and twenty-five minutes for the 36 miles. The car left Camden at 3:45 p. m., and arrived at Trenton at 6:10, and the trip was made without a hitch of any kind. From Camden city line the new route runs through private right of way, alongside the highway and crosses the Amboy division of the Pennsylvania Railroad near Delair, on a trestle. The 10 miles to West Palmyra were covered in forty minutes, and between West Palmyra and Riverside several miles were made at rates of speed from 20 to 25 miles per hour. Through the careful planning of Superintendent James S. Gilbert, of the Camden & Trenton Railway, there was no waiting at the switches. Upon the arrival of the car in Trenton the party was escorted to the Trenton House, where an elaborate repast was served through the courtesy of the Camden & Trenton Company. Among those who made up the party were: Henry V. Massey, president of the Camden & Trenton Railway; ex-Senator M. B. Perkins, treasurer of the Camden & Trenton Railway; Dr. James S. Gilbert, superintendent of the Camden & Trenton Railway; William E. Scull, president of the Camden & Suburban Railway; W. E. Harrington, general manager of the Camden & Suburban Railway; F. A. Hewitt, chief despatcher of the Camden & Suburban; S. G. Browning, Camden & Suburban; J. B. Hutchinson, former general manager of the Pennsylvania Railroad; A. S. Chandler and A. N. Chandler, Philadelphia bankers and financiers of the Camden & Trenton and Trenton & New Brunswick Railroads; Samuel T. Corliss, secretary of the Camden & Suburban; John. J. Burleigh, fourth vice-president of the Public Service Corporation; Joseph R. Gilkyson, general agent of the Public Service Corporation; T. G. Kitchin, of the STREET RAILWAY JOURNAL, and others. Regular service was established on May 25, with cars between Trenton and Camden every forty-two minutes from 6:10 a. m. until 9:36 p m. The running time is three hours and eight minutes, and the fare is 50 cents.

With the opening of the Camden & Trenton Railway between Trenton and the Camden ferries, through service from New York to Philadelphia, with but a single change of cars, is now a reality. The time consumed is nine hours. A person leaving the Cortlandt or Desbrosses Street Ferries in New York at 8:20 in the morning, will be in Camden at 4:59 p. m., and in Philadelphia five or six minutes later, by changing cars at Liberty and Adeline Streets, Trenton. Leaving New York at 11:20 a. m., one would arrive in Camden at 7:47 p. m.; leaving New York at 2:20 p. m., arrive in Camden 11:17 p. m. The car leaving the Camden ferries (Philadelphia ten minutes earlier) at 7:53 a. m., arrives in New York at 4:45 p. m. Leaving Camden 11:24 a. m., arrive in New York at 7:45 p. m.; leave Camden 2:12 p. m., arrive in New York at 10:45 p. m. Other trips can be made by changing at Trenton, New Brunswick, Bound Brook, Dunellen and Newark, but the ones mentioned above only provide for a change at Trenton. The single fare is $1.30, and the distance 104 miles.

PERSONAL MENTION

MR. F. J. CUTTING has been appointed general manager and superintendent of the Erie Rapid Transit Street Railway Company, of Erie, Pa., to succeed Mr. Frank S. Given, who resigned recently.

MR. C. V. MILLS has resigned as superintendent of the West Chester Street Railway, of West Chester, Pa., to become superintendent of the lines of the Chester Traction Company, operating lines from Darby to Wilmington, and numerous other points in Delaware County.

MR. SAMUEL HUNT, of Cincinnati, who has had a large experience in the management of railroads, being at present president of the Detroit Southern Railway, has been elected vice-president of the New York, Westchester & Boston Railway, which plans to build an electric railway from New York to Port Chester, N. Y., a distance of 25 miles.

MR. H. A. BELDEN, general manager of theManila Electric Railway & Light Company, will arrive very shortly on a two months' visit to this country. Mr. Charles M. Swift, of Detroit, Mich., president of the company, has already returned from a trip to the Philippines. He is expected to be in New York next week, and will make his headquarters at the office of J. G. White & Company, who are installing the Manila system.

GENERAL BANCROFT and Vice-President Sargent, of the Boston Elevated Railway, recently returned from a tour of inspection of the street railway systems of Chicago, Minneapolis, St. Paul and several other Western cities. Both were particularly well impressed with the system of the Twin City Rapid Transit Company, operating in Minneapolis and St. Paul, and also said they found some interesting features in the suburban system of the Illinois Central Company.

MR. H. S. KEMP, electrical engineer of the Standard Electric Company, of Norfolk, Va., and Charlotte, N. C., has been appointed by the Tazewell Electric Light & Tazewell Street Railway Company, of Tazewell, Va., as consulting engineer to prepare plans and specifications for the extension and reconstruction of its light and railway plant. Mr. Kemp has had a long experience in the electric light and railway management and construction, and for the past five years has been with the Standard Electric Company as engineer. The company does a general engineering and contracting business for electric light, railway and water power plants.

MR. MASON D. PRATT, M. Am. Soc. C. E., and formerly of the Pennsylvania Steel Company, has opened an office as consulting engineer at 18 North Third Street, Harrisburg, Pa., and is prepared to make surveys, plans and specifications, and to supervise the construction of electric railways, power plants, water works or industrial plants. Mr. Pratt is a graduate of Lehigh University, class of 1887, and was for a time a draftsman with the Phœnix Bridge Company. Afterwards he became associated with the Johnson Company, at Johnstown, Pa., now the Lorain Steel Company, first as designing engineer on the new mill buildings at Moxham, later as engineer in charge of construction of electric railways at Lancaster, Pa., and Washington, D. C. In this connection he traveled extensively for this company making surveys, plans and contracts. In 1889 he was associated with M. Tschirgi, Dubuque, Ia., where, as assistant engineer, he had supervision of much municipal work, including the construction of a complete system of sewers. For the past thirteen years he has been connected with the Pennsylvania Steel Company, first as street railway engineer, and for the past two years and a half as engineer in charge of construction of new shops for the frog and switch department of this company. The buildings in this plant include a 1000-hp boiler plant, electric sub-station, iron foundry and other shops of modern steel and concrete construction, having altogether about 9 acres of floor space. For several years Mr. Pratt has been a member of the water board of Steelton, designing and carrying out many improvements to the plant, including the relining of the reservoir with asphalt. He has also been engaged to design and supervise the construction of a filtration plant for Steelton.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Apr. '04	63,064	37,504	25,560	22,467	3,094
	1 " " '03	61,656	35,208	26,449	23,063	3,385
	4 " " '04	241,665	145,373	96,292	90,068	6,225
	4 " " '03	236,753	137,826	98,928	87,338	11,589
ALBANY, N. Y. United Traction Co	3 m., Mar. '04	392,776	284,478	108,298	76,147	32,151
	3 " " '03	379,503	252,870	126,633	72,651	53,982
BINGHAMTON, N. Y. Binghamton Ry. Co.	1 m., Apr. '04	18,062	11,721	6,341	------	------
	1 " " '03	17,336	10,179	7,156	------	------
	10 " " '04	195,908	108,316	87,592	------	------
	10 " " '03	182,717	105,512	77,204	------	------
CHICAGO, ILL. Chicago & Milwaukee Elec. Ry. Co.	1 m., Apr. '04	28,063	12,188	15,875	------	------
	1 " " '03	15,161	6,242	8,918	------	------
	4 " " '04	87,936	43,678	44,258	------	------
	4 " " '03	51,196	24,948	26,248	------	------
Metropolitan West Side Elevated R. R. Co	1 m., Apr. '04	182,886	------	------	------	------
	1 " " '03	176,395	------	------	------	------
	4 " " '04	719,668	------	------	------	------
	4 " " '03	700,932	------	------	------	------
Northwestern Elevated R. R. Co	1 m., Apr. '04	111,326	------	------	------	------
	1 " " '03	107,010	------	------	------	------
	4 " " '04	441,505	------	------	------	------
	4 " " '03	422,764	------	------	------	------
South Side Elevated R. R. Co.	1 m., Apr. '04	137,250	------	------	------	------
	1 " " '03	131,329	------	------	------	------
	4 " " '04	547,457	------	------	------	------
	4 " " '03	530,347	------	------	------	------
CINCINNATI, O. Cincinnati, Newport & Covington Light & Traction Co	1 m., Mar. '04	100,204	*60,631	39,573	20,917	18,656
	1 " " '03	94,830	*56,296	38,534	21,433	17,101
	3 " " '04	294,002	*176,892	117,110	63,283	53,827
	3 " " '03	275,305	*165,476	109,828	63,415	46,414
CLEVELAND, O. Cleveland, Painesville & Eastern R. R. Co	1 m. Apr. '04	14,962	9,499	5,463	------	------
	1 " " '03	14,900	9,100	5,800	------	------
	4 " " '04	53,344	36,823	16,522	------	------
	4 " " '03	52,939	33,904	19,035	------	------
DETROIT, MICH. Detroit United Ry	1 m., Apr. '04	348,502	217,813	130,689	88,303	42,386
	1 " " '03	336,047	205,018	131,029	82,009	49,020
	4 " " '04	1,282,496	874,241	408,255	355,973	52,282
	4 " " '03	1,273,544	773,388	500,156	326,748	173,408
DULUTH, MINN. Duluth Street Ry. Co.	1 m., Apr. '04	51,647	26,880	24,767	16,524	8,243
	1 " " '03	51,665	30,973	20,692	15,225	5,467
	4 " " '04	187,109	114,810	72,299	65,848	6,451
	4 " " '03	182,989	115,425	67,564	60,769	6,795
EAST ST. LOUIS, ILL. East St. Louis & Suburban	1 m., Apr. '04	98,425	50,960	47,465	------	------
	1 " " '03	83,172	40,754	42,418	------	------
	2 " " '04	195,458	97,862	97,596	------	------
	2 " " '03	161,187	81,800	79,387	------	------
FORT WORTH, TEX. Northern Texas Traction Co	1 m., Apr. '04	43,770	23,253	20,517	9,749	10,768
	1 " " '03	37,381	22,222	15,159	9,018	6,140
	4 " " '04	160,985	96,829	64,157	38,325	25,832
	4 " " '03	127,772	70,154	57,618	35,988	21,629
FINDLAY, O. Toledo, Bowling Green & Southern Traction Co	1 m., Apr. '04	19,375	12,386	6,989	------	------
	1 " " '03	22,075	13,439	8,636	------	------
	4 " " '04	77,684	58,652	19,032	------	------
	4 " " '03	83,294	53,898	29,396	------	------
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., Mar. '04	14,022	12,394	1,627	3,403	†1,776
	1 " " '03	15,768	9,914	5,854	2,929	2,925
	12 " " '04	186,867	127,206	59,661	35,815	23,846
	12 " " '03	177,777	118,131	59,646	32,225	27,421
HARRISBURG, PA. Central Pennsylvania Traction Co	1 m., Apr. '04	40,139	38,985	1,154	------	------
	1 " " '03	38,089	25,531	12,558	------	------
	4 " " '04	152,425	149,369	3,056	------	------
	4 " " '03	145,991	102,951	43,040	------	------
HAZLETON, PA. Lehigh Traction Co	1 m., Apr. '04	10,488	7,027	3,461	------	------
	4 " " 04	40,649	30,724	9,925	------	------
HOUSTON, TEX. Houston Electric Co	1 m., Mar. '04	30,106	19,469	10,636	7,933	2,703
	1 " " '03	33,150	21,795	11,355	6,984	4,370
	12 " " 04	407,598	272,792	134,805	88,009	46,795
	12 " " 03	379,565	226,406	153,159	75,734	77,424
LONG ISLAND CITY, N. Y.—New York & Queens County Ry. Co	3 m., Mar. '04	121,382	93,156	28,226	49,099	†20,873
	3 " " '03	116,371	90,763	25,608	48,233	†22,625
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Apr. '04	254,046	127,219	126,827	73,300	53,527
	1 " " '03	239,967	121,005	118,962	70,711	48,251
	4 " " '04	1,010,774	544,619	466,155	293,804	172,351
	4 " " '03	940,706	491,373	449,334	280,611	168,723
MINNEAPOLIS, MINN Twin City Rapid Transit Co	1 m., Apr. '04	337,403	160,803	176,599	72,177	103,822
	1 " " '03	317,178	151,970	165,208	60,900	104,308
	4 " " '04	1,325,475	641,464	684,011	287,770	396,241
	4 " " '03	1,231,173	594,299	636,875	243,600	393,274
MONTREAL, QUE. Montreal St. Ry. Co	1 m., Apr. '04	186,473	125,372	61,100	20,837	40,264
	1 " " '03	172,086	107,876	64,210	19,717	44,493
	7 " " '04	1,309,152	891,706	417,446	126,435	291,012
	7 " " '03	1,189,577	759,931	429,646	119,856	309,790
OLEAN, N. Y. Olean St. Ry. Co	1 m., Apr. '04	7,877	4,246	3,630	2,439	1,191
	1 " " '03	6,270	3,204	3,066	1,942	1,124
	10 " " '04	83,907	41,357	42,551	24,414	18,137
	10 " " '03	59,896	31,785	28,111	16,581	11,530
PHILADELPHIA, PA. American Railways	1 m., Apr. '04	105,190	------	------	------	------
	1 " " '03	98,831	------	------	------	------
	10 " " '04	1,152,797	------	------	------	------
	10 " " '03	1,008,189	------	------	------	------
ROCHESTER, N. Y. Rochester Ry. Co	1 m., Apr. '04	116,586	64,951	51,635	26,467	25,168
	1 " " '03	97,872	49,179	48,693	25,448	23,245
	4 " " '04	457,431	271,368	186,063	105,052	81,011
	4 " " '03	397,040	207,081	189,959	101,855	88,104
SAN FRANCISCO, CAL. United Railroads of San Francisco	1 m., Apr. '04	569,609	------	------	------	------
	1 " " '03	518,467	------	------	------	------
ST. JOSEPH, MO. St. Joseph Ry., Light, Heat & Power Co	1 m., Apr. '04	45,956	28,154	17,802	------	------
	1 " " '03	38,889	22,083	16,806	------	------
ST. LOUIS, MO. St. Louis Transit Co	1 m., Apr. '04	710,338	------	------	------	------
	1 " " '03	607,031	------	------	------	------
	4 " " '04	2,484,176	------	------	------	------
	4 " " '03	2,180,294	------	------	------	------
SAO PAULO, BRAZIL. Sao Paulo Tramway, Light & Power Co., Ltd	1 m., Apr. '04	119,000	38,000	81,000	------	------
	1 " " '03	109,926	34,143	75,783	------	------
	4 " " '04	487,354	160,512	326,842	------	------
	4 " " '03	422,650	129,179	293,471	------	------
SAVANNAH, GA. Savannah Electric Co.	1 m., Mar. '04	39,371	24,811	14,559	10,034	4,525
	1 " " '03	37,675	26,803	10,871	9,583	1,288
	12 " " '04	525,992	305,287	220,704	121,360	99,343
	12 " " '03	493,158	281,425	211,732	115,149	96,582
SEATTLE, WASH. Seattle Electric Co	1 m., Mar. '04	183,836	130,070	53,766	23,541	30,224
	1 " " '03	142,085	110,865	31,219	25,354	5,864
	12 " " '04	2,170,804	1,525,361	645,443	278,122	367,321
	12 " " '03	1,944,863	1,385,863	558,999	271,206	287,793
SYRACUSE, N. Y. Syracuse Rapid Transit Co	1 m., Apr. '04	70,539	42,428	28,111	20,376	7,734
	1 " " '03	62,612	35,646	26,966	19,238	7,729
TERRE HAUTE, IND. Terre Haute Elec. Co.	1 m., Mar. '04	42,024	31,391	10,633	9,246	1,386
	1 " " '03	33,876	24,299	9,577	6,585	2,993
	12 " " '04	498,739	329,409	169,330	95,965	73,365
	12 " " '03	367,538	270,610	96,928	77,069	19,859
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Apr. '04	134,420	*77,391	57,029	41,969	15,060
	1 " " '03	127,562	*69,709	57,853	40,360	17,493
	4 " " '04	534,641	*301,158	233,483	166,843	66,640
	4 " " '03	495,217	*258,673	236,544	160,098	76,446
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Light Co.	1 m., Apr. '04	37,602	*22,856	14,746	------	------
	4 " " '04	148,233	*92,242	55,990	------	------

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, JUNE 11, 1904. No. 24.

Published Every Saturday by the
McGRAW PUBLISHING COMPANY

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues).............................. $3.00 per annum
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Through Car Arrangements

One of the subjects discussed at the last meeting of the Ohio Interurban Railway Association, that regarding through car arrangements, is likely to be of increasing importance among interurban companies as time goes on. The question arose in Columbus as to what arrangements should be made between interurban companies and between an interurban company and a city company, in case the cars of one company operate over the tracks of another.

So far, while interurban cars use city tracks, in many instances the operation of special interurban cars over the tracks of another interurban company has been largely in the nature of a complimentary privilege without compensation. When traffic arrangements are made between different interurban companies, as we have frequently urged, some provision must be made for a just division of the expenses and profits between the companies. Steam railroads have worked out this problem and electric roads can do it also, although the conditions are decidedly different.

In the case of a steam railroad it is usually merely a matter of passing along a coach from one road to another. The motive power equipment of one road rarely passes very far from the tracks of the owning company. Where every car is a motor car, however, conditions are somewhat the same as if the locomotive of one company were to be operated over the tracks of another company for long, continuous runs. The electric motor car is capable of much longer runs without repairs than is the steam locomotive, but it can hardly be classed with steam coaches and electric trailers, which have comparatively few parts to require attention. There are some managers who are strenuously opposed to allowing their motor cars to be handled by foreign crews, and have equally strong objections to allowing foreign crews, especially motormen, to operate over their own tracks.

It is self-evident that whatever arrangement is made, some man familiar with the road must be in responsible charge of a car while he is on that road. When regular arrangements are made for the operation of cars over several interurban systems, one way to solve the problem without the expenses of adding an extra man as pilot would be to teach the crews which were to operate these through cars the whole route over which they were to operate, and allow them to take the car through from one end of the road to the other, with the understanding that they would be under the rules and regulations of whatever company's line they were operating over at any moment. The plan of running a car with its own crew and providing a third man for a pilot whenever that crew left its own road, is too expensive a combination to be thought of for anything but occasional special cars.

Cutting Rates to Compete with the Trolley

The reduction of fares in the Connecticut Valley by the Boston & Maine Railroad, which went into effect June 1, furnishes a good illustration of the length to which steam lines will go in these days in the effort to recapture traffic long since diverted to parallel trolley systems. It is stated that fares will be cut down by more than a third in order to equal the tariff in force between various points in the valley, via the electric lines, but that the reduced rates will not be operative after Sept. 1.

We do not believe that the trolley lines operating in this picturesque part of New England will be seriously disturbed by the steam railway's lowered fares, if they will but seize the opportunity to call the attention of the public to the preponderance of advantages in favor of the electric routes. The only point of consequence which can be made by the steam railroad people is that of greater speed in through travel, and even this advantage can be considerably reduced by paying close attention to the maintenance of convenient trolley schedules and the

elimination of delays at meeting points. The steam train fails to score in the matter of frequent service; it is handicapped by its inability to pick up and discharge passengers at any point along the route, and to transfer them upon arrival to connecting city lines; and, lastly, the comfort and enjoyment of a trolley ride in the open air through attractive country is simply beyond comparison with the stuffy, dirty and smoky atmosphere inseparable from steam railway transportation. The fare reduction is likely to have little effect with that class of patrons who would be obliged to travel by the steam road even if the present tariff were increased, and it lies with the managers of the electric lines to bring home to the public at large the points above mentioned, and to leave no stone unturned to secure general appreciation of facts which every street railway man realizes to be true. A few crisply worded cards in the advertising racks of the cars will do a great deal of good, supplemented by a little missionary work on the part of those in charge of the traffic.

The St. Louis Cable Trouble

Elsewhere in this issue are given the bare facts of one of the most disastrous cable conduit troubles ever experienced. This accident, which resulted temporarily in depriving the St. Louis Transit Company of about two-thirds of its power in a very abrupt and uncermonious manner, is certainly worthy of study. It is only by the consideration of such accidents that the most valuable knowledge can be gained for guidance in future construction. Electrical engineers have been taking unusual precautions with high-tension, alternating-current underground feed lines, to prevent the spread of trouble from a short circuit in one cable. To make the possibility of break-down more remote the supply of high-tension alternating current from large power stations is usually so divided between different conduit lines that the shutting down of all the feeders in one conduit will not affect the service. The catastrophe which overtook the St. Louis Transit Company last week, however, was entirely on a direct-current line of underground feed cables. Stated briefly the case is this: An unusual amount of rain had fallen. The company's largest power house has underground cables leading from it in several directions. Practically without warning an enormous short circuit came on the power station, flame burst from manholes along the conduit line and from the iron conduits leading up the poles at the underground cables' terminal boxes. The manholes were so hot for 12 hours afterward that workmen could not enter them. In some cases cables were melted off.

At first appearance this would seem like another case of the "one-horse shay," since the trouble occurred at so many places at once. A closer study of the conditions, however, shows that there was nothing in the event other than might have been predicted, as the result of a short circuit on one cable. It appears that many of the feeders had been solidly connected together by jumpers at various points. This being the case, a short circuit on one cable would have current fed into it from several feeders. The underground cables, being all worked well up to their capacity, heated rapidly under this unusual load and other defects developed. The original short circuit, probably, melted the lead covering of other cables near it, and even if it did not the current flowing was enough to char the insulation of many cables, as was shown by the immense heat generated at so many points simultaneously. The first and most important lesson to be drawn from the occurrence is to avoid solid connections for jumpers between feeders. If feeders are to be tied together at all, as they frequently are, to get full benefit of all the copper installed, they should be so tied or connected through the medium of fuses or circuit breakers. Then a short circuit cannot be fed from several directions at once, longer than the time it takes to open a fuse or circuit breaker, and a wholesale destruction of 500-volt underground cables will be as little known in the future as it has been in the past. True, there is a strong temptation to put solid jumpers around section insulators and between feeders, but if such solid jumpers are used it should be with the full recognition on the part of the management that there is a risk in so doing, that a wholesale burn-out like that at St. Louis will be the price paid for the advantage of not having to bother with circuit breakers and fuses on the line.

Mr. Richard McCulloch has suggested one lesson to be drawn from this accident is that the wearing through, or rather the gradual pressing through, of the lead covering where the cables are hung on hooks in a conduit, should receive more consideration. There is danger of a gradual flowing away of the load covering if much weight comes on a narrow hook. Broader bearing surface is, of course, the remedy for this.

Taken altogether, the accident teaches that even a direct-current, 500-volt underground conduit line can get into wholesale trouble, and when such wholesale trouble comes the effects on the service are as bad as on a high-tension system. To be sure, this was an unusually large direct-current power station, capable of giving 30,000 amps., and a large percentage of this went out over one conduit.

The Electric Railway and the Town Authorities

The advent of the warm season and resulting impetus given to new construction work brings the electric railway face to face once more with the varying requirements of local authorities. Each year produces a crop of new demands from Selectmen, Aldermen and influential citizens along the existing or projective route, and it is a wise manager whose experience has taught him how to meet these representatives of the public in a manner which "disarmeth suspicion" and is fair to all parties concerned.

It certainly is time that local authorities realized more fully that the street railway traversing several towns and the interurban railway connecting larger centers of population have responsibilities to the total number of communities which they serve. In some cases the transportation welfare of half a State may be seriously injured by the imposition of petty restrictions at local points—a policy that is provincial in the extreme, and utterly unsuited to twentieth century methods. Thus, the speed limits enforced on interurban lines may be so low as to annul the good of the fast schedule outside the village. In such a case money invested in high powered motors, ample feeders and liberal power or sub-station capacity, cannot hope to earn legitimate returns. Again, the question of maintaining the highway may be carried to such extremes that the railway company bears a burden of expense all out of proportion to what is right and fair. The town authorities who demand almost unlimited privileges for workingmen, school children, ministers and politicians, run the risk of so hampering the rural earning power of a company that it may take several years for it to reach a point where the best service can be given to the community.

Doubtless, many electric roads, operating in large cities where the traffic is heavy, have earned pretty substantial dividends by virtue of their strategic position in the transportation world. It is quite another story, however, with the average suburban and rural system. The Selectman has thus far, in

many instances, failed to realize that such roads are not the multi-millionaire bonanzas which they have often been denominated.

The street railway is a public servant, just as is the steam road, the electric light and telephone company. None of these corporations can do business, in the long run, successfully, without fair and equitable returns on the investment involved. On the other hand, exorbitant charges for the service rendered are a species of slow business suicide on the part of any corporation which maintains them. Sooner or later the crash is bound to come if the limit of reasonable charge is passed in either direction. The question of fares is not one to be properly settled by any local board of town authorities. It involves an expert knowledge of transportation which cannct possibly be possessed by those of no experience in the work. It is always a matter of difficulty to lay down a tariff of rates in a system newly built through communities that are but sparsely settled—that is, a tariff which shall be entirely just to both the community and the railway. It stands to reason that rural rates must be higher than city rates when we take into consideration the lighter traffic encountered, the distance from steam railways, cost of labor, transportation, haulage of material, removal of snow and ice and heavy maintenance expenses. If a dispute arises in connection with rates, the State Railroad Commission is the proper tribunal to adjudicate the question, or some impartial board of experts in States which do not enjoy the advantages of such a commission.

Given, however, a community with a few fair-minded representative men and a railway management which meets the public with frank, face-to-face treatment, and which is constantly striving to perfect the service rendered for a given return, there will be less and less expensive litigation between the town authorities and the companies, a better understanding of mutual positions and the probability of common prosperity, as far as the influence of electric transportation can affect it.

Fire Prevention for Cars

We have recently called attention to the increasing necessity for fire prevention for car houses and yards, and the article on construction and hazards for car houses and cars by Ralph Swetland, in our issue of May 21, calls attention to some of the precautions which should be taken from the insurance man's standpoint. In this connection the recently inaugurated policy of the Metropolitan West Side Elevated Railway Company, of Chicago, is of interest. As elsewhere described, this company has just put into commission a chemical fire-extinguishing car, for use in extinguishing fires which may start among its cars when standing in its yards at terminals. This car is intended for rapid use at the beginning of a fire, before there is time to put other systems with a more liberal water supply into operation. That this company is awake to the importance of reducing fire hazards is shown not only by the building of this fire car, but by the fact that it is earnestly working in the direction of fireproof construction for its cars. A recent order for cars which it placed specifies a complete steel floor below the regular floor, the main object of which is to prevent the spread of fires originating from electrical causes underneath the car. This, it is believed, will prevent the spread of the majority of fires, since the experience of that company indicates that most fires in which electric cars are destroyed, originate under the floors of the cars themselves.

The company is not, however, stopping at this, and is building, as a sample, an all-steel car, with the idea of gaining information which will enable it to fix on a design for an all-steel car for all future orders. We have recently described the steel car which the Interborough Rapid Transit Company has had constructed, and the partial steel construction of the Illinois Central suburban cars in Chicago. It is evident, therefore, that as far as the heavier rapid transit car is concerned there is a decided tendency toward steel construction, which should materially reduce the fire risk.

The Ninety-Nine Year Decision in Chicago

The result of the first clash at arms between the city of Chicago and the Chicago Union Traction Company as regards the rights of the latter under the ninety-nine year act, passed by the Illinois Legislature in 1865, and which was briefly reported in our last issue, has resulted in a decision which corresponds very closely with opinions given by the legal advisers of the Chicago Union Traction Company some years ago. Although this decision of the court has been heralded by the Chicago newspapers as a victory for the city, it is hard to see wherein the great victory lies. The main contention of the company that the earlier franchises granted were extended ninety-nine years by the Legislative act of 1865 was fully sustained by the court. The theory upon which the court based its decision was that at the time the street railways of Chicago were first granted franchises, the granting of such rights was commonly considered as lying with the State Legislature and not with the City Council. Later, the right to grant franchises was given by the State to the City Council, but in the early days, not only in Chicago, but elsewhere, the granting of rights to street railway companies was, by common custom, considered to be with the State Legislature, which had supervision over other railroads. The judges, therefore, argue that unless an express statement was made to the contrary in the act of the Illinois Legislature of 1865, which extended the rights of the Chicago street railway companies ninety-nine years, this act must be taken as extending not only charters but franchises, since there was at that time no reason for assuming that the City Council rather than the State Legislature had jurisdiction over the length of franchises. The judges considered that the whole question hinged on what the Legislature intended to do when it framed the ninety-nine-year act of 1865. Considering this act from the standpoint of the Legislature of 1865, the judges consider that the intention plainly evident was to extend the existing franchise rights of the street railway companies of Chicago. Only one contention made by the attorneys for the Chicago Union Traction Company was not upheld, namely, that the act of 1865 carried with it extensions of franchises for branch lines subsequently built.

This decision is of interest only as indicating the line of logic likely to be taken by the United States Supreme Court, as the case will be immediately appealed to that body. The traction tangle in Chicago is apparently no nearer to being unraveled than before. If the present decision is upheld by the United States Supreme Court, the companies have important rights on the streets for over fifty years to come. Other important rights are lost to them. While the decision of the court shows that the city officials are a long ways from being able to carry out their threat of throwing the companies off the streets and exacting whatever terms they wish, it is evident that there can never be any satisfactory settlement until the parties to the controversy can stop fighting and talk business. Both have sufficient ammunition in the way of powers and rights, so that they can make matters very uncomfortable for each other, and as long as the war is on and the city continues to use all of its powers to harass rather than to come to a business-like compromise, there is no use looking for a settlement.

AN IMPROVED TERMINAL FOR HANDLING THE HEAVY CONEY ISLAND CROWDS—BROOKLYN RAPID TRANSIT COMPANY

One of the most difficult problems in the handling of heavy pleasure traffic that is to be found in this country is that involved in moving the enormous crowds that frequent the famous seaside resort of New York and Brooklyn, known as "Coney Island." The enormous volume of this traffic has long been a difficult problem for the Brooklyn Rapid Transit Company, as the unprecedented and increasing growth of popularity of this resort from year to year has caused the increased terminal facilities, that they have installed each succeeding year, to be rapidly outgrown. Owing to the large and costly attractions, such as "Luna Park," "Dreamland," etc., that have recently been added to those already there, the demands upon the passenger-carrying facilities grew last year to such proportions that the company found immediate provisions upon a large scale, for the safe and rapid handling of this traffic, to be necessary.

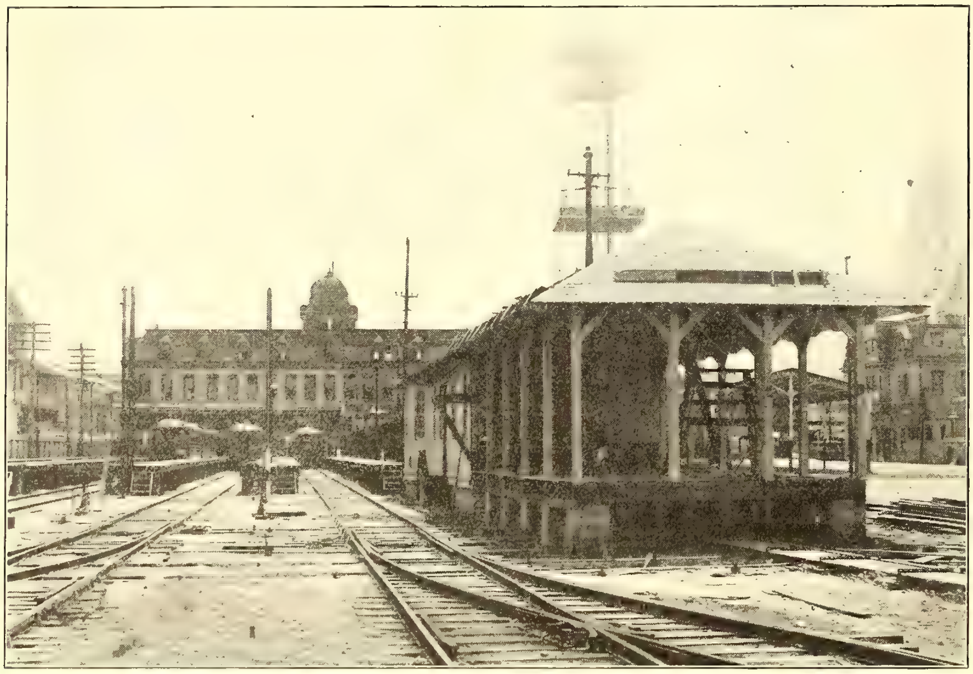


FIG. 1.—VIEW OF THE ELEVATED TERMINAL TRACKS, SHOWING PLATFORMS. TRAINMEN'S PAVILION AND OFFICE BUILDING AT THE RIGHT

A careful study of a suitable provision for this enormous traffic has long been under consideration, and the results in the form of an entirely new terminal plan are shown in this article. The old terminal at Coney Island, known as the "Culver" terminal, which had been considerably increased in size last year, has this spring been almost entirely rebuilt, to a plan which it is thought will provide more carefully than ever before for the safe and rapid handling of the large crowds that frequent this resort. It is true that the determination of this plan was influenced by many governing local conditions, but the general features involved in this new terminal are applicable to a great many other summer resort terminal problems. It is probably the largest and most important pleasure resort terminal in existence, and its interesting features are worthy of careful study.

The traffic to the "Culver" terminal at Coney Island includes not only the heavy surface-car service upon six of the street car lines from Brooklyn, but also that of the elevated railroad lines which are now operated to this district; elevated trains now run direct from the Brooklyn Bridge terminal in New York City of the lines of the Brooklyn Rapid Transit Company, over the two important elevated railroad divisions in Brooklyn, the Fifth Avenue and the Fulton Street elevated lines, to the suburbs, and thence upon private rights of way on the surface to this terminal. This permits high-speed operation and rapid transit in the true sense of the word. Formerly, however, the elevated trains were brought into the terminal and unloaded upon the level, under conditions met in surface-car operation, with all the attendant inconveniences of loading and unloading.

The new arrangement of tracks, which was worked out in rebuilding the "Culver" terminal, is shown in the accompanying yard plan. The elevated train service will be taken care of separately from the surface lines, as shown, the principal feature of the new terminal being this provision for the rapid handling of the crowds by the elevated trains. Four terminal tracks are installed for this purpose, the two upon the east side being intended for the "Brighton Beach Route" elevated trains, and the other two, to the west, for the express and local trains operating over the Fifth Avenue elevated division. As may be noted, convenient track connections are provided for easily handling trains under very close headway; train movements will be greatly facilitated by the very complete system of interlocking switches and signals which has been installed to cover all elevated train movements throughout the yard.

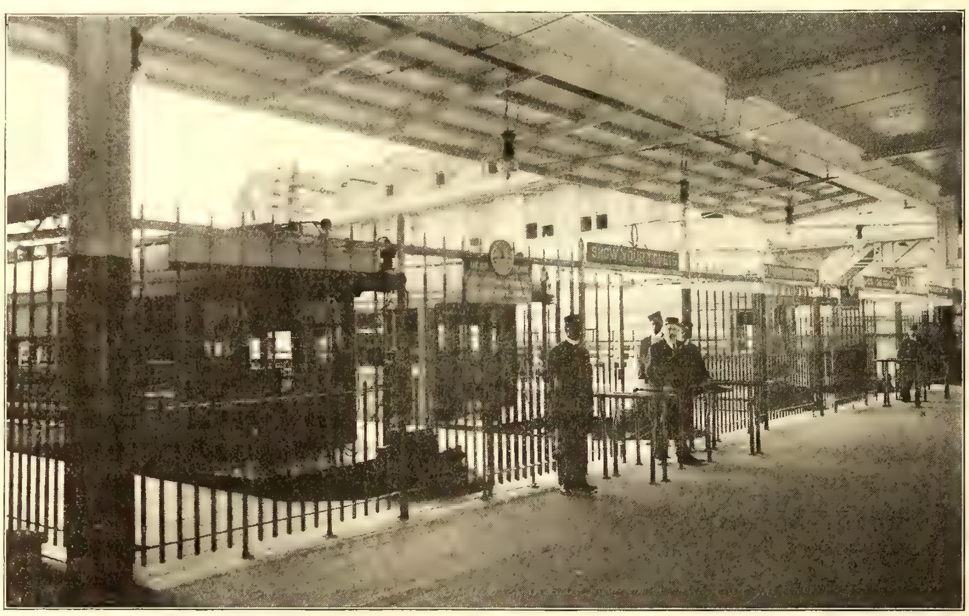


FIG. 2.—THE ELEVATED TRAIN LOADING AND EXIT GATES AT THE CULVER DEPOT AT CONEY ISLAND

The arrangement of the elevated train terminal is shown in an accompanying photograph, Fig. 1. Elevated platforms, of a height of 42 ins. above rail level, are provided on both sides

of every terminal track, five in all, two of which are used for passengers entering outgoing trains, while the other three provide exits for incoming trains. In this way incoming passengers, leaving the trains, are thus kept entirely separated from the outbound passengers, and the disagreeable scrambling and fighting to gain entrance before the cars are emptied is eliminated. As a train arrives at the terminal station the gates upon the unloading, or exit platform side, are opened first, and the train emptied, after which the unloading gates are closed and the opposite gates, on the loading side, are opened for outgoing passengers to board the train. The elimination of the confusion by the separating of the two classes of traffic permits trains to be unloaded, loaded and sent out again with the least possible delay. It is, indeed, thought that this arrangement will permit trains to be operated out of the terminal on a 2-minute headway easily, and, under the pressure of very heavy service, even less, thus bringing the possible capacity of the elevated terminal up as high as 20,000 passengers to 25,000 passengers per hour.

FIG. 3.—THE ELEVATED TERMINAL DEPOT, SHOWING USE OF AN UNUSUAL FORM OF TICKET BOOTH, RESEMBLING THE END OF AN ELEVATED CAR

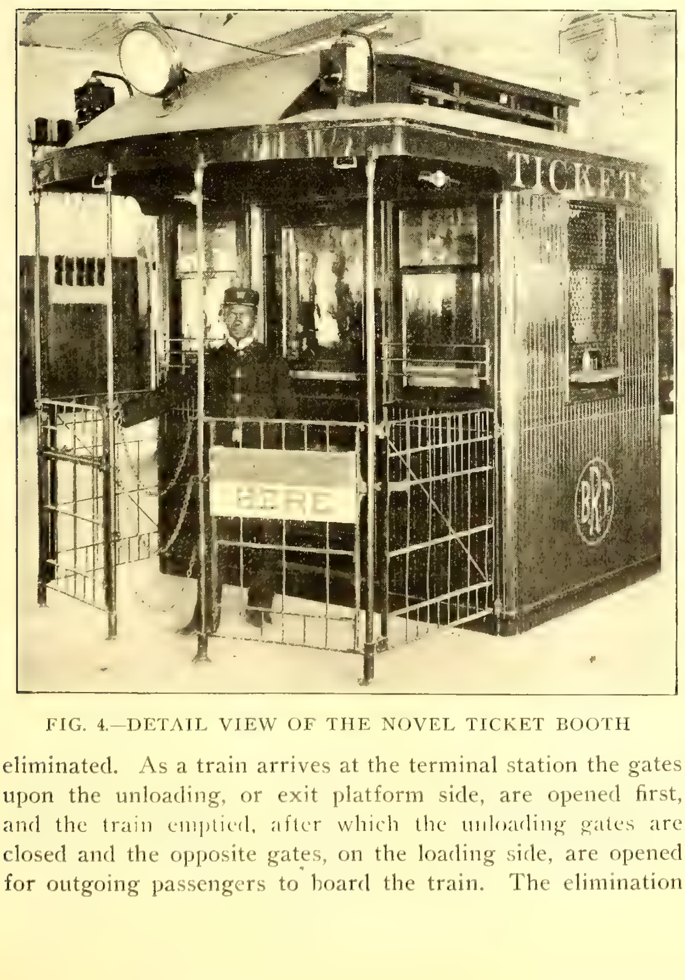


FIG. 4.—DETAIL VIEW OF THE NOVEL TICKET BOOTH

A feature of importance in the loading of the trains has been introduced in that all passengers for elevated trains are required to purchase tickets before boarding, instead of paying their fare upon the train after starting, as was formerly done at this point. For all the various suburban surface stations of the Brighton Beach and Fifth Avenue elevated lines, the fares are collected upon the trains, as is done in steam railroad passenger practice, and formerly great difficulty was experienced by the conductors in doing so upon trains leaving the beach with the heavy crowds; change-making was a severe burden upon the conductor, and as a result considerable dissatisfaction was caused and many fares were overlooked. Under the new arrangement tickets must be purchased and shown at the entrance gates to the loading platforms, so that all passengers leaving the terminal have tickets, and the duties of the conductors in collecting fares are thus minimized. An entire train can be covered in a very much less time than was the case when fares were collected in cash upon the trains. This arrangement also serves to assist in keeping objectionable characters off trains.

In Fig. 2 is shown the arrangement of the entrance and exit gates at the elevated train terminal. The three unloading platforms have rolling gates, above which are signs, "No Passengers Admitted Here;" the two loading platforms have similar rolling gates with signs above, which read, "Show Your Tickets." The loading platform gates are provided with the best arrangement for guides for facilitating the examining of tickets by directing the entering passengers in two lines. Clock-type indicators are also used to show the times of departure of trains upon the two routes.

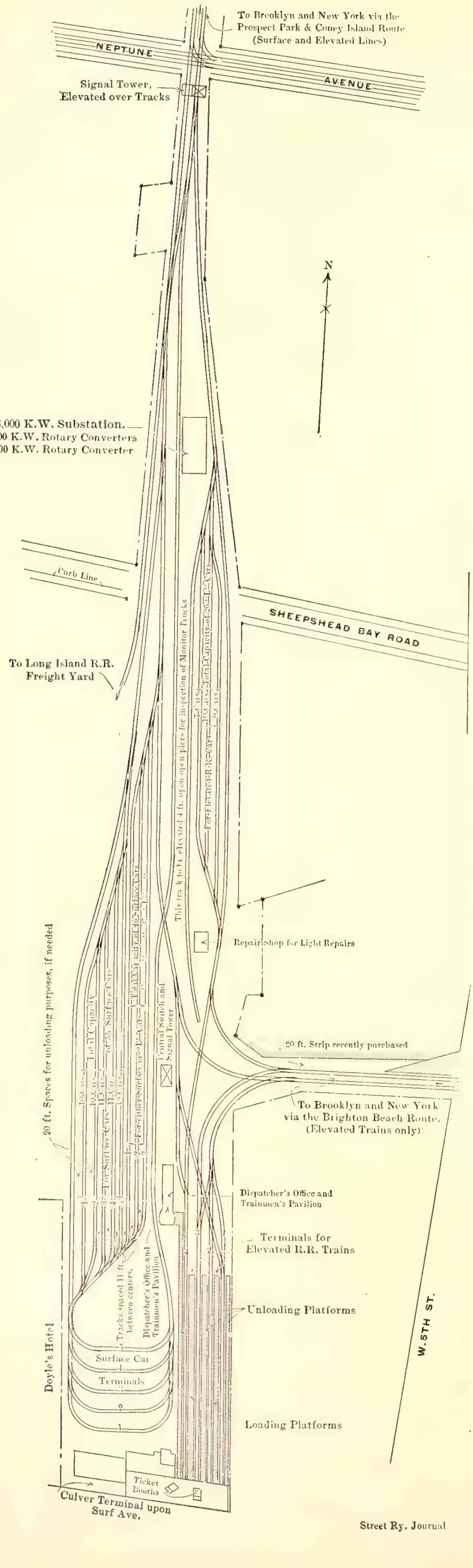


FIG. 5.—PLAN OF THE NEW TERMINAL YARD ARRANGEMENT FOR THE CULVER TERMINAL AT CONEY ISLAND—BROOKLYN RAPID TRANSIT COMPANY

Figs. 3 and 4 illustrate the novel type of ticket booth that has been constructed for use at this new terminal. In harmony with the many other suggestive features of the surroundings at Coney Island, these booths, from their likeness to the front end of an elevated train, suggest that all elevated passengers must purchase tickets before boarding the train. These booths were built to exactly resemble the end of the standard elevated car of the Brooklyn Rapid Transit Company, and are of a very striking appearance, not only as to the platform gates, but even to the headlight and side color lamps upon the hood, are they an exact imitation of the original. Each booth has a ticket window upon either side, under the glass shelf of each of which windows is worded the laconic query to the purchaser of tickets, "How Many?" for facilitating the movement of the crowds.

The switching and signaling system has been installed with unusual care, and provision has been made for handling the most severe combinations of traffic. There are three slip switches in the ladder-track lead to the elevated terminals, so that an entering train may be directed to any one of the terminals; similarly any combination desired is possible for outgoing trains. These switches and their governing signals, as well as those for the adjoining storage tracks, are all controlled from the central signal tower. This tower, which contains sixty-four levers, is conveniently located for the observation of train movements upon all tracks of the yard.

Fig. 5 illustrates this central signal tower and also shows the substantial character of the pipe connections for operating the switches and signals. All pipe carrier gangs for the pipe leads, as well as supports for the "lazy jacks," are mounted upon heavy concrete foundations. The interior of this tower is shown in Fig. 6. At the upper end of the yard an interesting arrangement of elevated signal tower has been installed for the control of all switches and signals at that end, and down as far as the sub-station. These switching and signaling systems were installed complete by the Union Switch & Signal Company, Swissvale, Pa.

The substantial character of construction of this tower, as well as of other features of this installation, is unusual for a temporary summer service of this nature, but it indicates clearly the growing importance of such summer pleasure traffic and of catering to it by providing ample train service.

An interesting feature of this yard is shown in Fig. 1, in the form of a combined train despatchers' office and trainmen's pavilion. It has conveniently arranged offices for the despatchers and other local officials, and at the north end has an open pavilion for the convenience of the trainmen. It is the custom of the Brooklyn Rapid Transit Company to provide lunches for the trainmen on Sundays and holidays, which will hereafter be arranged for in this pleasant open structure, affording the men a pleasant resting and recreation place.

Light running repairs will be provided for by an elevated track and small repair shop just above the signal tower. The track will be raised upon substantial concrete piers, located about 12 ft. between centers, which will bring the rail level 4 ft. above the ground. This provides the same repair facilities that would be obtained by the use of pits, and the trucks are, moreover, rendered much more accessible. The repair shop will contain only such tools as are necessary for light repair work.

THE SURFACE CAR TERMINAL

Elaborate provision has also been made for the handling of the heavy surface car traffic. The former track arrangement at the Culver terminal, involving loops around which the surface cars were turned in discharging and taking on passengers, has been retained, as may be seen by reference to the track diagram (Fig. 5), but an important improvement has been

FIG. 6.—LOOKING NORTH FROM THE ELEVATED TRAIN TERMINAL TRACKS, SHOWING CENTRAL SWITCH AND SIGNAL TOWER AND THE OPERATING PIPE LINES

added to this department of the service by the addition of a number of storage tracks in the yard above. The surface cars enter the yard from the upper end, passing down at the extreme right upon an open lead track, directing them to any one of the five loops; access is given, also, at a point midway down the yard, to any one of the five storage tracks on the west side, which may be used to receive cars in case of blockades, or whenever it is desired to store them there temporarily.

FIG. 7.—INTERIOR OF OPERATING ROOM OF CENTRAL SWITCH AND SIGNAL TOWER

It will be noticed that the outside lead track and also the first two of the storage tracks are spaced at 20 ft. between centers, which permits of the unloading of passengers at these points in cases of delays upon the unloading loops below, due to heavy crowds and congestion of traffic. This arrangement is the result of past experience with the heavy crowds at this terminal. It has been found that with the heavy incoming crowds in the early evening and at other times of heavy traffic, it is impossible to move cars as rapidly as desired upon the unloading loops below. For this reason the three tracks above mentioned in the storage yard were spaced at convenient distances between centers for unloading, and are surfaced up evenly with gravel nearly to the top of the rail, for convenience to passengers. This arrangement provides convenient facilities for unloading cars in such cases before they reach the departure tracks.

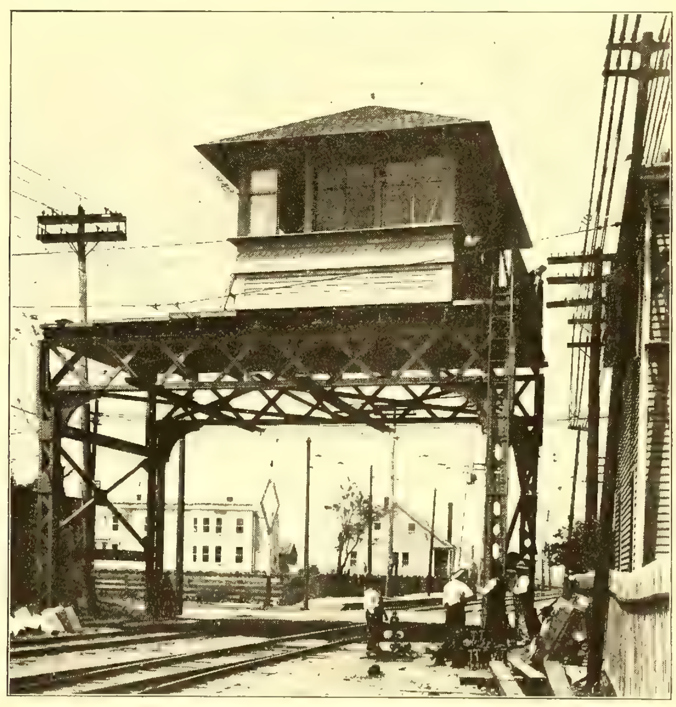


FIG. 8.—THE ELEVATED SIGNAL TOWER AT THE NORTH ENTRANCE TO THE TERMINAL YARD

It will be noticed that in addition to the five storage tracks for surface cars, above mentioned, there are also three further storage tracks adjacent which may be used for the storage of either surface or elevated cars. These tracks, together with the other storage tracks which have been installed, provide large storage facilities in reserve for almost any combination of traffic that may be met. The five surface car storage tracks have a capacity for fifty-five surface cars, the three elevated train storage tracks on the east side have a combined capacity of twenty-six cars, and the three tracks adjacent to the surface car storage have a capacity of forty-six surface cars, or thirty-seven elevated cars.

The signaling for departures of surface cars from the loop tracks is handled by the usual method of gong signals of numbered rings for each of the five tracks, which are given by a starter located in an elevated booth near track No. 5. These loop tracks are covered by a substantial shelter, so that passengers may board cars under cover in case of storm. It might also be added that the elevated trains are despatched from the elevated train terminals also by a similar gong-signal system, the number of rings corresponding to the track for which the signal is intended.

ELEVATED CAR FOR FIRE FIGHTING

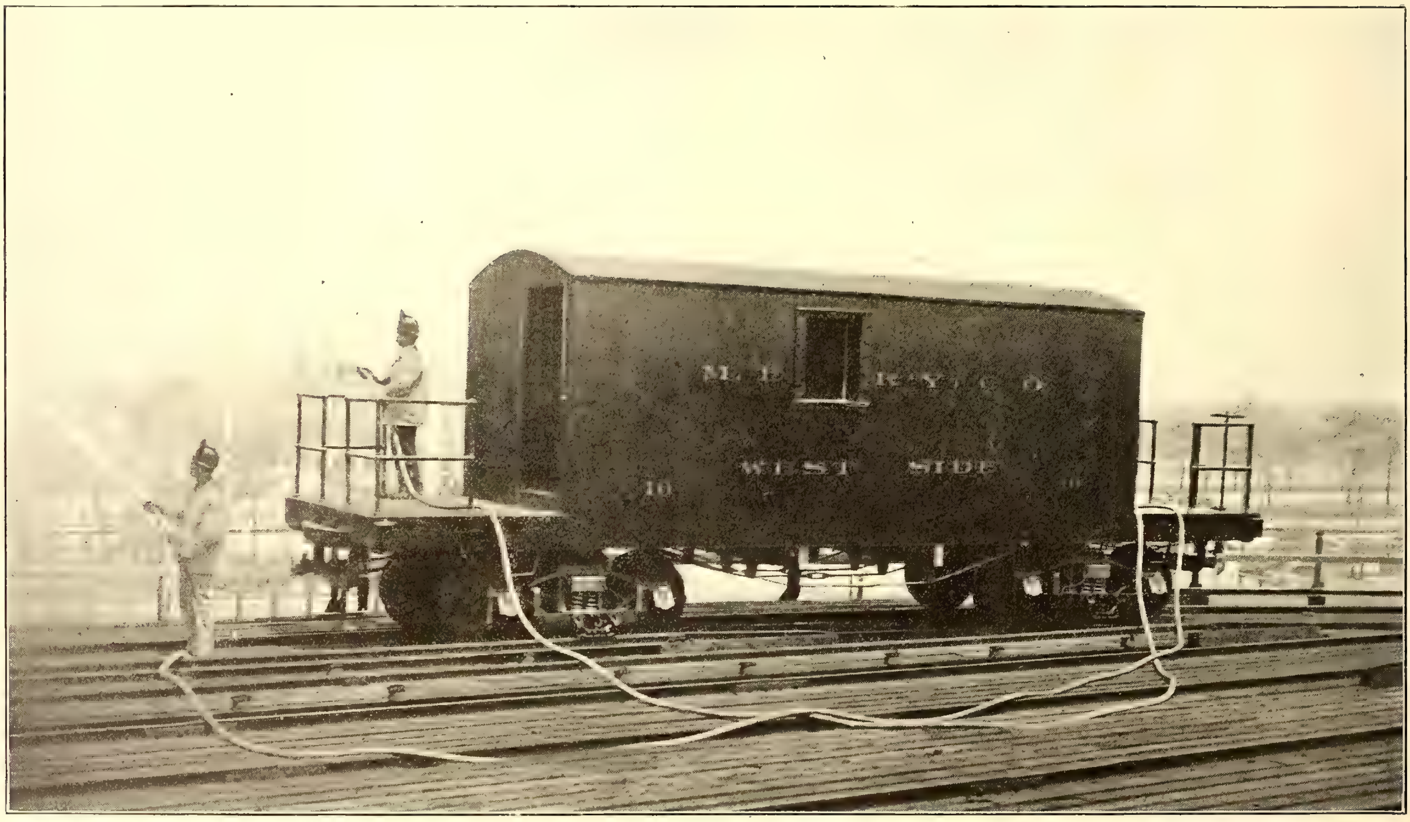
A novel car equipment for fire protection at terminals and yards has recently been installed and tested by the Metropolitan West Side Elevated Railway Company, of Chicago.

It consists essentially of an outfit of chemical extinguishers of large capacity housed in a fireproof car body. The illustration, Fig. 1, conveys the general appearance of the car, which was formerly a coal car, the hopper having been razed down to the deck, and the house built on it as shown, using the original body frame and trucks.

The car is 30 ft. long and 8 ft. wide outside. The house is 20 ft. long, extends clear across the car, with an inside width of 7 ft. 6 ins., and has two doors and two windows, all symmetrically located. The house is covered completely with corrugated iron, and the floor of the 5-ft. platform at each end is of ¼-in. steel plate. The entire structure is very strong and intended to withstand the impact of falling bodies. The system of fire extinguisher used is that of the Nott Fire Engine Company, of Minneapolis, which built and installed the apparatus.

In the car, at one side near the end, the two duplicate horizontal pressure tanks are mounted side by side on the floor, and occupy a space 6 ft. long by 4 ft. 6 ins. wide, thus leaving a 3-ft. passage by them. The ends of these tanks are seen in Fig. 2. Through the center of each tank from end to end runs a shaft, carrying two paddles, and terminating outside, one end in a crank, also seen in Fig. 2. In the top of each tank near the crank is a large hole closed by a cap, which is screwed down tight with the wrench seen lying on the floor in front of the tanks in Fig. 2. Immediately under this hole the inside shaft and paddles are so bent and shaped as to form a cradle, wherein the acid solder or jar is set and held firmly while the whole shaft is rotated. This rotation of the shaft and paddles spills the acid out of its jar, and at the same time agitates the whole mixture, thus keeping up the pressure during the discharge. The water and the soda are also introduced through this large hole and are well mixed with a few turns of the paddles before putting in the acid jar.

On top of each tank is permanently fastened a heavy wire hose-basket. Each basket holds 150 ft. of 1-in. chemical hose, one end of which is coupled to the piping out of the pressure tanks, and the other end has a ½-in. brass nozzle with a shut-off valve. The piping is so arranged as to play either hose or both hose together from either tank, and each hose line has a 250-lb. pressure gage mounted near its controlling valve.



FIRE EXTINGUISHER CAR ON METROPOLITAN WEST SIDE ELEVATED, CHICAGO

In the opposite corner stands an upright water supply tank, 3 ft. 6 ins. in diameter, of 250 gals. capacity, mounted high enough off the floor to give a gravity flow into the pressure tanks opposite. The space thus left under this water tank is utilized as a cupboard wherein to stow charges of soda, etc. Fig. 2 shows the edge of the water supply tank at the extreme left, and the ends of the two pressure tanks opposite.

To put the apparatus into operation one man leads out the

hose and the other gives the crank a few swings and opens the proper valves. But one tank is discharged at a time, the second tank being reserved, to be discharged when the first is exhausted and is being refilled, thus maintaining a continuous stream; a priceless advantage in checking incipient conflagrations.

RECHARGING

As one pressure tank becomes exhausted action in the other is started by turning its crank, and as the pressure rapidly rises the hose lines are cut off from the first one and thrown on it instantly by the valves. The gas is then blown off from the empty tank by a drain valve and pipe, which leads down through the floor, the cap is unscrewed and the empty acid holder lifted out of its cradle and set one side. One of the little canisters holding a charge of 50 lbs. of soda is then emptied into the cap hole, a 3-in. pipe with a gate valve fills up the pressure tank

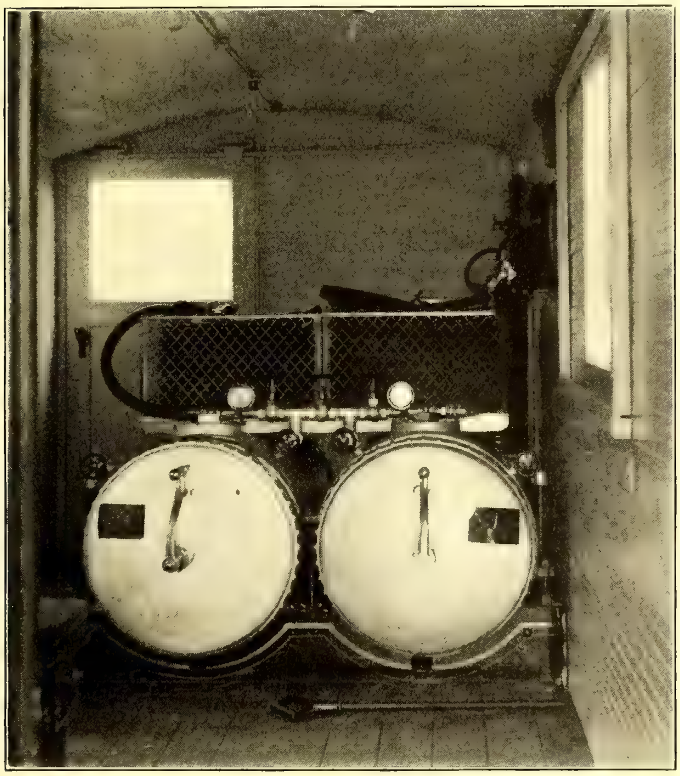


FIG. 2.—APPARATUS IN INTERIOR OF CAR

with water from the supply tank in the corner, and after a few turns of the paddle crank to stir the soda solution, the fresh acid holder is set in, the cap screwed on, and that side is ready for business again. One tank will run 7 minutes when supplying both hose lines simultaneously at 150 lbs. pressure, and the recharging of a tank only requires 4 minutes to complete. Fig. 2 shows the cranks, the two pressure tanks, with their piping, hose and baskets, and their cradles and anchor straps. At the left is shown indistinctly the edge of the water supply tank in the corner, which is fitted with a water glass and water in-take. The car is further equipped with two grappling poles, having a chain at the rear end whereby a car may be hauled out of danger. These are carried on hooks on the walls above the windows. Fig. 2 also shows the two axes, two firemen's helmets and two small Babcock hand fire extinguishers.

This car has no motor, and is intended for use at a yard or terminal, where it will be kept upon a short island in the main lead, next to the night despatcher's office, so that any motor car will be instantly available to move it. The Metropolitan Company is building four more similar cars, as this one has been demonstrated to be a great success.

A clear track will be kept through the middle of each yard, and the fire car can be run onto this track and within reach of any car in a yard as soon as it arrives at a yard.

THE USE OF SUPERHEATED STEAM AND OF REHEATERS IN COMPOUND ENGINES OF LARGE SIZE*

BY LIONEL S. MARKS, CAMBRIDGE, MASS.

The object of this paper was to collect and present the results of a number of unpublished tests made during the past five years on several high-speed, two-cylinder compound engines, all built by the same makers, and all of the same type. The engines tested differ from one another only in size, in cylinder proportions, and in their working conditions. The investigations were made to determine the performance of the engines under different loads, both with and without jacketing and reheating. A comparison of the results for the different tests throws some light upon the influence on the thermal efficiency of large sized four-valve compound engines of the following factors:

(*a*) The use of a reheater.
(*b*) The use of moderately superheated admission steam.
(*c*) The load.
(*d*) The size of the engine.
(*e*) The cylinder proportions.

The results recorded here are for tests made on nine separate engines and for twenty-eight different tests. The engines are parts of three electric lighting plants situated in or near Boston. The engine referred to as *A*, is at the L Street station, South Boston, of the Edison Electric Illuminating Company—a plant which at the time of the test was the property of the Boston Electric Light Company. The tests at this station were conducted by the writer. Engines *B*, *C*, *D*, *E* and *F* are at the Atlantic Avenue station of the Edison Electric Illuminating Company, and they were tested under the joint supervision of an employee of the company and a representative of the engine builders. Engines *G*, *H* and *K* are at the new plant of the Cambridge Electric Light Company, and were tested by the writer.

DESCRIPTION OF THE ENGINES

The engines tested vary from 750 to 2500 rated horse-power, and were all built by McIntosh, Seymour & Company, of Auburn, N. Y. They are all vertical, high-speed, two-cylinder, cross-compound, direct-connected units with overhanging crank. Each cylinder is supported on a heavy, hollow, cast-iron frame at the back and on two inclined steel standards in front. Each high-pressure cylinder is jacketed on the barrel and both heads, and the jackets are piped in series; the steam enters the jacket on the top head, passes into the barrel jacket, goes to the jacket on the lower head and then to the reheater coils. In this way a very active circulation in the jackets is ensured. As there is no separate steam supply to the reheater coils, nor any separate drain from the high-pressure jackets, it was not possible to use either the jackets of the reheater alone. The receivers are of the large cylindrical drum-type, located at the back of the engine and close to the cylinders. The reheater consists of one or more coils of pipe in the receiver. The low-pressure cylinder is unjacketed.

The valves are of the flat, gridiron type, unbalanced and of short stroke. The steam valves on both high-pressure and low-pressure cylinders consist of a main valve cutting off at about .8-stroke, and a Rider cut-off valve, the movement of which can be varied so as to give any desired cut-off. The main steam valves and the exhaust valves on each cylinder are given from an eccentric on the main shaft through a system of links and levers. The cut-off valves are driven by auxiliary eccentrics, which are controlled by a fly-wheel governor. The action of the valves is rapid; the openings for admission and exhaust of steam are large.

The fly-wheel governors are designed to control the speed within 2 per cent variation between zero load and full load.

* Abstract of paper presented at the Chicago meeting of the American Society of Mechanical Engineers, June 2, 1904

TABLE OF PRINCIPAL RESULTS OF ALL THE TESTS

1	Number of test	1	2	3	4	5	6	7	8	9	10	11	12	13	14
2	Engine	A	A	B	B	B	B	B	B	B	B	B	B	C	C
3	Nominal load	1	1	¼	½	½	¾	¾	1	1	1¼	1¼	1	1	1
4	Duration of test, hours	10	5	2	2	2	2	2	5	2	1	1	8	10	5
5	With or without jackets and reheaters	With	Without	With	With	Without	With	Without	With	Without	With	Without	With	With	Without
6	Nominal H. P. cylinder diameter, inches	28	28	23	23	23	23	23	23	23	23	23	23	29	29
7	Nominal L. P. cylinder diameter, inches	58	58	48	58	48	48	48	48	48	48	48	48	60	60
8	Stroke, inches	48	48	48	48	48	48	48	48	48	48	48	48	56	56
9	Revolutions per minute	118.46	118.46	103 6	103.4	103.1	162.5	102.5	101.9	101.9	101.2	101.2	101.9	97.48	97.64
10	Steam pressure at throttle, pounds per square inch	159	161	152.6	151.5	155.3	150	155.1	149.5	155.9	152.6	155.2	161.8	168.6	167
11	Superheat at throttle, degrees, Fahr.	Wet	Wet	.8	4.8	21.8	10.7	17.5	9.2	14.6	8	13 8	18.6	80.2	78.5
12	Initial steam pressure in H. P. cyl., by cards	156	155	97.8	130	133.8	131.6	133.7	130	134.8	131.2	135.9	140	158	155.5
13	Steam pressure in receiver, gage	21	20	1.33	8.8	7.	13 8	11.	16.5	13.8	----	19.7	20.	13.7	11.1
14	Superheat entering L. P. cylinder, degrees, Fahr.	35.5	Wet	99.8	75.4	Wet	60.5	Wet	46.6	Wet	26.5	Wet	49.4	60.3	Wet
15	Effective vacuum in L. P. cylinder, ins., by cards	24.05	23 05	26.7	26.	25.8	26 5	25.5	25.8	25.9	24.6	23.6	25.6	23.3	23
16	Vacuum in exhaust pipe, inches	25	24.5	28.2	28.0	27.25	28.3	27.1	27.7	28.0	25.2	26 8	27.0	24.9	24.7
17	I. H. P., total	1,994	1,984	309	552	548	845	831	1,047	1,105	1,498	1,516	1,104	2,267	2,240
18	I. H. P., H. P. cylinders	859	962	121	203	247	316	388	413	507	608	702	415	1,098	1,218
19	I. H. P., L. P. cylinders	1,135	1,022	188	349	301	529	443	634	598	890	814	689	1,169	1,022
20	Percentage of power developed in H. P. cylinder	43	48.5	39.4	36.8	45.1	37.4	46.7	39.5	45.9	40.6	46.3	37.6	48.5	54.3
21	Total steam per I. H. P. per hour, lbs.	13.59	13.68	14.04	13.71	15.11	13.63	13.72	13.59	14.41	14.57	15.16	13.58	12.72	12.98
22	Per cent of total steam used in jackets and reheater	6.8	----	10.2	8.95	----	7.91	----	7.49	----	8 9	----	6.9	6.5	----
23	Wet steam in jackets and reheater per I. H. P. hour, lbs.	.92	0	1.43	1.23	----	1.08	----	.95	----	.91	----	.94	.83	----
24	Per cent of cylinder steam drained from receiver	1.6	6 0	----	----	3.7	----	6.7	----	5.97	----	4.97	----	----	2.3
25	Quality of steam at cut-off H. P. cylinder	81.6	75.5	61	58	60	68	72	68	60	79	74	65	86	86
26	Quality of steam at release H. P. cylinder	85.6	79.6	85	85	88	80	74	78	75	83	78	81	83	88
27	Quality of steam at cut-off L. P. cylinder	92.4	87	95	90	65	88	78	90	76	94	88	90	99	84
28	Quality of steam at release L. P. cylinder	95 5	93	95	95	91	88	90	91	83	98	89	93	96	91
29	B. T. U. per I. H. P. per minute	245	248	248	252	277	251	270	248	267	255	265	241	236	244
30	Thermodynamic efficiency, per cent	17.3	17.1	16.5	16.9	15.4	17.0	15.8	17.2	15.9	16.7	16.1	17.6	18.0	17.4
31	Thermodynamic efficiency compared with ideal cycle	65.4	65	58	60	58	60.5	59	62 5	58	66.1	61.5	64.5	68.3	65.6
32	Per cent saving by jacketing and reheating	1.3	----	----	9.0	----	8.0	----	7.0	----	4.0	----	----	3.0	----
33	Engine friction at no load, I. H. P.	118	----	----	----	----	----	----	70.5	----	----	----	----	159	---
34	Mechanical efficiency at rated load, per cent	94.1	----	----	----	----	----	----	94	----	----	----	----	93.2	----

1	Number of test	15	16	17	18	19	20	21	22	23	24	25	26	27	28
2	Engine	C	C	D	D	E	E	F	G	G	H	K	K	K	K
3	Nominal load	¾	½	1	1	1	½	1	1	1	1¼	1	½	¼	½
4	Duration of test, hours	4	4	8	8	8	6	8	10	10	9	10	8	8	8
5	With or without jackets and reheaters	With	With	With	Without	With	With	With	Without	With	Without	With	With	With	Without
6	Nominal H. P. cylinder diameter, inches	29	29	29	29	29	29	29	18	18	18	31	31	31	31
7	Nominal L. P. cylinder diameter, inches	60	60	60	60	60	66	60	38	38	38	64	64	64	64
8	Stroke, inches	56	56	56	56	56	56	56	42	42	42	48	48	48	48
9	Revolutions per minute	98.77	99.6	98.2	98.6	99.7	100.7	98.53	118.4	119.1	119.15	116.9	119.1	119.3	118.37
10	Steam pressure at throttle, pounds per square inch	167	169.4	162.8	163.1	159.2	160.4	158.7	186	137	131	136	132	136	135
11	Superheat at throttle, degrees, Fahr.	64.5	48.3	98.4	98.4	72.4	70.4	92.7	72.2	75	55.5	64.2	70.3	55.3	73.5
12	Initial steam pressure in H. P. cyl., by cards	155.4	150.5	157	157.3	156	153.3	150	130.9	136.9	130	132.9	122.4	95	126.1
13	Steam pressure in receiver, gage	10.1	5.5	13.5	12.3	14	7.5	14.5	8 9	11.1	13.1	10.6	5.1	1.5	3.6
14	Superheat entering L. P. cylinder, degrees, Fahr.	67	84.8	60.5	Wet	60.9	86.0	61.7	Wet	49.1	Wet	40.3	59	79.1	Wet
15	Effective vacuum in L. P. cylinder, ins., by cards	23.9	24.3	24.3	24.4	24.8	24.4	24.8	11.8	12.2	11.8	11.9	12.1	12.5	12.22
16	Vacuum in exhaust pipe, inches	25.6	26.1	25.6	25.7	25.3	25.4	26.1	26.2	26.3	26.1	25.4	26.4	26.4	25.8
17	I. H. P., total	1,831	1,239	2,202	2,215	2,230	1,259	2,171	715	716	858	2,184	1,196	716	1,198
18	I. H. P., H. P. cylinders	874	573	1,083	1,189	1,119	633	1,008	384	347	464	1,064	605	331	647
19	I. H. P., L. P. cylinders	957	666	1,119	1 026	1,111	626	1,163	331	369	394	1,120	591	385	551
20	Percentage of power developed in H. P. cylinder	47.8	46.2	49.1	53.8	50.2	50.3	46.5	53.7	48.6	54	48.8	51	46.2	54.5
21	Total steam per I. H. P. per hour, lbs.	12.71	12.38	11.57	11.88	11.67	11.78	11.67	14.13	13.21	13.13	12.50	12.22	12.95	12.90
22	Per cent of total steam used in jackets and reheater	7 2	9.3	7.4	----	7.1	9.3	5.6	----	6.45	----	4.89	7.28	9.05	----
23	Wet steam in jackets and reheater per I. H. P. hour, lbs.	91	1.15	.85	----	.83	1.09	.65	----	.85	----	.61	.89	1.17	----
24	Per cent of cylinder steam drained from receiver	----	----	----	----	----	----	----	3.35	.69	6.12	.93	.67	----	2.75
25	Quality of steam at cut-off H. P. cylinder	77	65	99	93	93	82	89	76	85	86	92	83	81	80.5
26	Quality of steam at release H. P. cylinder	82	80	94	87	94	92	84	75	88.5	83	93	82.5	88	92
27	Quality of steam at cut-off L. P. cylinder	93	99	100	86	93	85	100	84	89	84	93	92	97.4	80.5
28	Quality of steam at release L. P. cylinder	98.5	99	96	84	93	92	100	87	93.2	82	97	96	100	94
29	B. T. U. per I. H. P. per minute	235	227	217	226.5	217	217	221	264.9	245.5	243.3	227.3	226.6	241.5	244
30	Thermodynamic efficiency, per cent	18.1	18.7	19.6	18.7	19.6	19.6	19.2	16.0	17.3	17.4	18.7	18.7	17.6	17.4
31	Thermodynamic efficiency compared with ideal cycle	67.3	67.7	75.4	72.3	72.6	73	70.7	62.8	67.4	68.5	74.2	73.3	66.8	67.5
32	Per cent saving by jacketing and reheating	----	----	4.5	----	----	----	----	----	7.5	----	----	7.2	----	----
33	Engine friction at no load, I. H. P.	----	----	169	----	164	----	197	----	50	50	----	----	----	----
34	Mechanical efficiency at rated load, per cent	----	----	92.7	----	93	----	91 4	----	93.4	93.4	----	----	----	----

At the Cambridge electric light station the position of the governor weights can be regulated when the engine is running by means of a small electric motor fastened to the fly-wheel and controlled from the switchboard. This device is valuable for synchronizing in parallel running.

THE TESTS

(The author here described the arrangements made for testing the engines, which was carried out with the greatest possible care with reference to preventing leakage from boilers, feed mains, steam pipes and connections; as all but one of the engines are fitted with jet condensers, their steam consumptions could be determined only by measuring the boiler feed. The diameters of all cylinders were gaged when hot, the weighing scales for coal were carefully tested, and all gages, thermometers and indicators were carefully recalibrated. The results of the tests are summed up in an interesting form in the accompanying table).

RESULTS:

THE VALUE OF HIGH-PRESSURE JACKETS AND OF REHEATING

There are certain facts which the writer believes may be postulated with reference to the effectiveness of jacketing and reheating, and which are supported by the results of these tests. The saving by jacketing varies with the following factors:

(*a*) It increases as the cut-off becomes earlier.

(*b*) It decreases as the superheat of the entering steam increases.

(*c*) It decreases with increase in size of the engine.

There is no saving by reheating when the reheater does no more than to dry the steam. If there is any advantage in using dry and saturated steam in the low-pressure cylinder over the use of wet steam, it can be obtained by the use of a separator between the cylinders. In tests 2, 7, 9 and 24, when the reheater was not in use, the receiver acted as an almost perfect separator, taking away all the condensation which calculations showed to have occurred in the high-pressure cylinder. If the reheater merely vaporizes the condensed steam at the expense of a practically equal quantity of high-pressure steam it is not only non-effective but is also, probably, a source of actual loss, since more work could have been obtained from the total steam used if it had all gone into the high-pressure cylinder.

The reheater then should be regarded merely as a superheating device for the steam entering the low-pressure cylinder, and it may be expected to be more effective the greater the amount of superheat it gives the receiver steam. It is probable that the reheater would be more effective if the only work were superheating, as it might be if the wet steam exhausting from the high-pressure cylinder passed through a good separator before reaching the reheater. As the reheater will have less to do when the engine is running at low loads it may be expected to give a higher superheat at low loads, and, consequently, to be more effective. With the above in mind, an examination of the tests, the principal results of which are presented in the accompanying table, throws some light on the conditions under which the jacketing of the high-pressure cylinder and the practice of reheating are desirable, and shows the saving to be expected from them in large size engines.

In engine *A*, when saturated steam is used, the jackets, at full load, keep the steam about 6 per cent dryer in the high-pressure cylinder and the reheater superheats 35 degs. As the greater part of the 6.8 per cent of the total steam which is condensed in the jackets and reheater must have been condensed in the latter place, it is obvious that the reheater cannot have contributed anything to the small saving of 1.3 per cent.

The conditions in engine *B* are much more satisfactory for effective action of jackets on reheater, especially at the lower loads. The engine is smaller, and its reheater more effective. At half-load, with 75 degs. superheat of the receiver steam,

the saving was 9 per cent; at three-fourths load, with 60 degs. superheat, there was 7 per cent saving; at full load, with 46 degs. superheat, there was still 7 per cent saving, and even at one-quarter overload, with 26 degs. superheat, there was 4 per cent saving. The larger engines, *C* and *D*, with 80 degs. and 98 degs. initial superheat and 60 degs. superheat by the reheater, show but 3 per cent and 4.5 per cent saving respectively.

The engine *G* is only one-third the power of engines *C* and *D*, consequently the jackets are much more effective (raising the steam quality 10 per cent in the high-pressure cylinder), so that with 49 degs. superheat going to the low-pressure cylinder, the saving is 7.5 per cent. The tests on engine *K* at half-load, with 59 degs. superheat by the reheater, show 7.2 per cent saving. The engines *C*, *D* and *K* have sufficient initial superheat and are of such size as to make the high-pressure jackets of but little value, so that the savings shown are due principally to the action of the reheater.

A study of the above results appears to indicate that the reheater will not justify its use (except as a separator) unless it superheats the low-pressure admission steam at least 30 degs. An examination of the qualities at release in the low-pressure cylinders indicates that 100 degs. superheat of the receiver steam will probably be enough to make the steam dry and saturated at release. As it is not desirable to have superheated steam at release, this suggests the probable desirable limit to the amount of superheat to be given by the reheater.

THE VALUE OF MODERATE SUPERHEATING

The engines *C*, *D*, *E*, *F*, *G*, *H* and *K* were all supplied with steam from Babcock & Wilcox boilers, fitted with superheaters giving from 100 degs. to 125 degs. superheat at the boiler when running at the rated power. The amount of superheat at the engine depends on the load at which the engine is running; (*a*) because the superheat at the boiler decreases as its load is decreased, and (*b*) because the fall of temperature in the steam pipe increases as the weight of steam passing through it diminishes. For these two reasons the superheat was less at low loads than at higher loads, except in some cases where the number of boilers used could be decreased as the load decreased. As the superheat going to the low-pressure cylinder when the reheaters were in use varied in the opposite way, that is, incrased with decrease of load, these two variations tended to offset one another in their influence on the engine efficiency. The tests without the reheaters in use will then be the most valuable for showing the influence of the superheat of the high-pressure steam. The tests at full load show that engine *A* uses 248 B. T. U. per indicated horse-power per minute with no superheat; engine *C*, of about the same size, with 78 degs. superheat, uses 239 B. T. U., and engine *D*, with 98 degs. superheat, uses 226 B. T. U., a saving of about 9 per cent; some of which, however, is also due to a better vacuum and better cylinder proportions. Engine *B*, a smaller engine, uses 267 B. T. U. with 15 degs. superheat—which is practically the same result as that obtained from engine *G*, a still smaller engine, with a poorer vacuum but with 72 degs. superheat. In the test of engine *D*, with 98 degs. superheat, the quality of the steam at release is 87 per cent, so that it is evident that when the jackets are not used a much greater superheat is desirable in order to prevent condensation in the high-pressure cylinder—probably at least 150 degs. will be necessary. An even greater superheat will be necessary to keep the steam dry in both cylinders. With the jackets in use and with 98 degs. superheat the quality in the high-pressure cylinder at cut-off is 99 per cent., and at release is 94 per cent. The advantage gained by superheating is, of course, greater in the smaller engines.

THE VARIATION OF ECONOMY WITH ENGINE LOAD

The engines *B*, *C*, *E* and *K* were all tested at several loads so as to determine the effect of variation of engine load on the efficiency of the engine. In all the cases (engines *C*, *E* and *K*) where moderately superheated steam was admitted to both cylinders, the important fact was brought out that the heat consumption per indicated horse-power is practically constant through a range of load varying from one-half load to a full load, and probably even to a considerable overload. The apparent exception in the better performance of engine *C* at half-load is probably due to a better vacuum at that load. The general result was to be expected, because the effect of superheat is to reduce the amount of heat disappearing during admission, and, consequently, to permit the increased expansion at low loads to occur without excessive cylinder condensation. In engine *B*, with very small superheat of the admission steam, there is a slight decrease in economy as the load decreases from full load, and in the tests without reheater, and, consequently, with no superheat going to the low-pressure cylinder, this decrease in economy is very marked.

It is, perhaps, hardly necessary to emphasize the fact that the constancy of heat consumption referred to above is in terms of the indicated horse-power. In all these engines the friction horse-power is low, and the mechanical efficiencies at the rated loads are high, varying (see table, line 34) from 91.4 per cent to 94 per cent, and averaging 93.2 per cent. The friction horse-powers were determined by taking cards with no load on the engine, but they really represent more than the friction of the engine proper, since they include some losses properly chargeable to the generator—such as the brush friction, the armature windage, the bearing friction of the armature and, in some cases, a low excitation of the field. Consequently, the real mechanical efficiencies of the engines are somewhat higher than the quantities given in the table.

The low friction of the engine causes the heat consumption per electrical horse-power to change a comparatively small amount as the load decreases; the heat consumption per kilowatt per hour will be some 6 per cent or 7 per cent greater at half load than at full load.

THE RADIATION AND CONDUCTION HEAT LOSSES

In these tests where the reheater was in use, the knowledge of the exact condition of the steam entering the low-pressure cylinder permitted the determination of the heat lost by radiation and conduction from the high-pressure cylinder and the receiver. The total heat of the steam coming to the engine is the sum of the four following quantities:

(1) The heat going to the low-pressure cylinder.

(2) The heat equivalent of the work done in the high-pressure cylinder.

(3) The heat escaping with the reheater and receiver drainage.

(4) The heat lost by radiation and conduction from the high-pressure cylinder and the receiver.

The first three quantities can be calculated from the observations made on the test, and, consequently, the last quantity can be determined by the heat balance stated above. The radiation and conduction loss was calculated for most of the tests, and was found to vary from ½ per cent to 1 per cent of the total heat supply to the engine at full load. As the low-pressure cylinder is as carefully lagged as the high-pressure, it appears that from 1 per cent to 1½ per cent of the total heat supply to the engine at full load will be lost by external radiation and conduction. The larger percentage applies to the smaller engines.

PISTON LEAKAGE

The steam qualities at cut-off and release, given in lines 25 to 28 of the table, show considerable variation in different engines running under practically the same conditions. The reason for this variation is apparently not far to seek, and depends on a phenomenon to which but small consideration is generally given in the discussion of steam engine performances. This phenomenon is piston leakage.

Most of the engines were tested when at rest for piston

leakage, before the runs were made, and in no case was there any but slight leakage. It is probable, however, that a piston which is quite tight when at rest will leak when running. The static leakage tests were made for a small number of piston positions, and did not insure static steam tightness in every position. There is evidence, moreover, to show that even if the piston is tight in every position when at rest, it may leak when in motion owing to the breaking up of the oil film on the cylinder walls. If to the results of the leakage test of the piston is added the knowledge that an intelligent engineer has of the condition of the cylinders of which he has had charge, it is probable that a more accurate statement can be made as to the tightness of the pistons. From such data the following statements may be made as to the condition of the engines tested.

Engine *B*, neither piston perfectly tight, but both in good condition.

Engine *C*, no appreciable leakage.

Engine *D*, both cylinders in very good condition.

Engine *E*, high-pressure cylinder very good; low-pressure piston had not worn down to maximum tightness.

Engine *F*, high-pressure cylinder had been scored a few weeks before test, and had not worn quite tight; low-pressure cylinder unusually good.

Engine *H*, high-pressure cylinder very good; both cylinders better than engine *G*.

The above conditions, as known before the tests, will be found to explain most of the variations in steam quality to which reference has been made. For example, of the two similar engines, *E* and *F*, the latter shows lower quality at cut-off in the high-pressure cylinder, notwithstanding a greater initial superheat—and this quality is seen to decrease throughout expansion. Leakage past the high-pressure piston readily accounts for this. In the low-pressure cylinders of these two engines the phenomenon is reversed, and the remarkably high quality of the steam in engine *F* is presumably due to the unusually good condition of the cylinder.

Similarly comparing tests 22 and 24 on the exactly similar engines, *G* and *H*, under practically similar conditions, a marked advantage is seen in the quality of the steam during expansion in the high-pressure cylinder during the latter test—a result to be expected from the known better conditions of that cylinder.

These examples could be multiplied were it desirable. The effect of the piston leakages, when moderate, on the engine economy is not very great, since steam leaking by the high-pressure piston will be available for doing work in the low-pressure cylinder.

CONCLUSIONS

In summing up the general results of the tests the following conclusions appear to the writer to be justified when applied to large size, high-speed, compound, four-valve engines of common proportions.

The jacketing of the high-pressure cylinder is of but little value when moderately superheated steam (100 degs. F.) is used.

Reheating is probably a source of loss unless it superheats the receiver steam at least 30 degs. F., and is not fully effective unless it superheats about 100 degs. F. In the latter case it may be expected to effect a saving of 6 per cent to 8 per cent of the total heat used per indicated horse-power.

Jacketing the low-pressure cylinder is shown by the steam qualities during expansion in the low-pressure cylinder to be unnecessary and, therefore, undesirable when the reheating is effective. The effect of admitting moderately superheated steam to both the high-pressure and low-pressure cylinders is to keep the heat consumption per indicated horse-power practically constant throughout a considerable range of loads—from half load to about one-quarter overload.

The variation within the ordinary limits of the ratio of stroke to diameter in large size engines of the same power when using moderately superheated steam does not have any marked effect upon the economy of the engine. The size of the engine is an important factor in determining its efficiency. The engine *G* has about 10 per cent greater heat consumption per indicated horse-power than *K*, which is three times larger.

A NEW HIGH-SPEED INTERURBAN LINE BETWEEN BOSTON AND PROVIDENCE

Another high-speed double-track electric railway system is being projected, to operate out of Boston and connect that city and its suburbs to the west, with Providence, R. I. The organization papers have been completed and the necessary locations will be secured. The organization of this road is being carried out by James F. Shaw, president of the Boston & Worcester Electric Companies and allied interests, the new company to be closely related to the present high-speed interurban line between Boston and Worcester, Mass.

It is proposed to utilize the tracks of the Boston & Worcester Electric Railway as far out from Boston as the suburb of Newton, 8 miles distant, from whence the new line will start directly south, running through Needham, Dover, Walpole, Wrentham, North Attleboro, Attleboro and Pawtucket, into Providence. The road will be double-tracked throughout, and will be heavily ballasted for high-speed operation. The plans call for the building of a total of 34 miles of double track, a large proportion of which will be upon private right of way. Where highways are used it is proposed to make use of the boulevard system of arrangement of tracks, with center-pole construction. Large cars of the most recent construction will be provided, and they will be heavily powered for high-speed operation. It is expected that the total distance between the two cities, 43 miles, will be covered in a little over 2 hours. The line is to be equipped with a system of signaling for the safe operation of trains, and a despatching system similar to that used upon the Boston & Worcester line will be installed. It is thought that power for the line will be furnished by the present power plant of the Boston & Worcester line at South Framingham.

The cost of this new line and its equipment is estimated at $2,500,000, which will be provided for by a capitalization of $1,250,000 and a bond issue of like amount. The promoters are sanguine of complete success, and expect that an even greater development of traffic will result from the opening up of this territory than was the case upon the Boston & Worcester line. No trouble is anticipated in securing the rights through the connecting towns, as it will mean an important development of many inaccessible locations and will tend to increase property valuations. Moreover, the section to be traversed is at present inadequately provided with transportation facilities, and the new system will come as a relief. The fare which will be charged between Providence and Boston will probably be 50 cents one way, as compared with the regular fare of $1 which prevails upon the lines of the New York, New Haven & Hartford Railway between these points.

The Montreal Street Railway proposed to erect waiting rooms at several of the terminal points for the accommodation of the public. One has just been completed on Wellington Street; another, formerly the Park & Island station on Victoria Avenue, Westmount, has been improved and refitted, and a third is being constructed at the Harbour Street yard, corner of Notre Dame and Harbour Street, Hochelaga. A two-story stone and brick station is to be erected at the corner of Mount Royal and Park Avenue, to have waiting room and ticket office, and living rooms for the agent and his family.

ELECTRIC RAILWAY BLOCK SIGNALING BY USE OF ALTERNATING-CURRENT TRACK CIRCUITS

In a paper upon the above subject recently read before the Railway Signal Association, J. B. Struble, signal engineer of the Union Switch & Signal Company, referred in an interesting manner to the important pioneer work of installing the first system of automatic block signaling, using alternating current for the track circuits, which was carried out under his direction upon the North Shore Railroad, a suburban system operating out of San Francisco, Cal. This system, which formerly used steam motive power, was recently equipped for electric traction, as described in the January 2d and 9th issues of the STREET RAILWAY JOURNAL, and this special system of track-circuit block signaling for use in connection with the propulsion system, utilizing the rails for the return conductor, where direct-current track circuits would not ordinarily operate satisfactorily, owing to interfering currents, was installed. It is of particular interest to electric railway interests, as it opens up the possibility of operating automatic block signals thus with the certainty and reliability of former systems upon our steam railroad systems. The system upon the North Shore Railroad is referred to in detail upon pages 66 and 67 of the above mentioned articles.

In referring to the system upon the North Shore Railroad Mr. Struble stated as follows:

"Alternating current for signaling purposes opens up a field which is in some respects revolutionary. The point of chief interest, aside from that of immunity from the effects of direct current, whether that of electric roads or that of steam roads, annoyed with foreign current on their track circuit, is that of transmission. Its advantages and possibilities in this respect are very great.

"It was my good fortune to be sent to California about one year ago to install the first alternating-current system of signaling. This was on the North Shore Railroad running north from San Francisco. The part signaled comprised about 10 miles of double track, and included the rather novel arrangement of an old narrow-gage railroad having added to its old steam service the new standard gage electric service. This was done by applying standard ties and the addition of one running rail. The rail which was common to both gages was divided into block sections. Thus trains of either gage or propelled by steam or electricity would operate the signals.

"Current for operating the electric trains, as well as the signal system, was generated at the famous Colgate power house, distant about 180 miles, in the Sierras, and with a water head equal to several Niagaras. The current was transmitted at about 40,000 volts at 60 cycles to their local power house near the tracks, and there transformed to 4500 volts. For signal purposes we here connected to the neutral and one side of the three-phase system, giving about 2300 volts single-phase. At this voltage the electrical size of the wire required for the signal mains was less than that necessary for mechanical strength. In addition to supplying the track circuits, these mains served to supply current for lighting the signals and way stations. The 6-cp signal lights, in that clear atmosphere, gave, with properly focused lenses, an illumination which was very satisfactory.

"A novel feature, and one which appeals to the imagination, was that when making tests of the track circuits we soon learned to tell when a storm was raging in the Sierras, on account of certain peculiar electrical disturbances, and forthwith to postpone further tests until better weather prevailed in the mountains. Another feature, odd to an Easterner, was the fact that they can guarantee weather conditions in advance, so that, during construction, cement and other material can be distributed and left entirely unprotected from harm by the elements.

"Some of the track circuits were about 1 mile in length, and, as it rains with much copiousness during the wet season, conditions were favorable for a test of the system. Ballast was of gravel and well removed from contact with the rails. We were happily surprised to find that under the worst conditions the relays operated with a margin of about 30 per cent to 40 per cent or more above the failing point. We had no failures due to the alternating-current feature, and since it was put into service, about eight months ago, we have not heard from the railroad company, so the signals are presumably working in a satisfactory manner.

"An interesting feature was that of the effect upon animals of the alternating current in the tracks. Although the voltage on the rails was about 8 to 14, horses soon refused to pass over the tracks at road crossings, and things came to such a pass that something had to be done. The simple remedy was that of insulating the block rail at crossings and connecting with a wire run through the road in grooved lumber.

"The signals used were of the Union style "B" electric semaphore type, operated by 8-volt storage batteries, two sets of which were located in the base of the signals. Where two signals were opposite, one set served for both. They were charged at one-fifth ampere rate through resistance from the 500-volt contact-rail. Thus no primary batteries were necessary, and the chances of failure and cost of maintenance were reduced to a minimum. During certain hours of the night the electric train service was shut down, while the steam service continued. Storage batteries then kept the signals operative while the contact-rail was dead."

Mr. Struble stated further, in reference to the use of the alternating-current track-circuit system:

"The scheme of alternating-current signaling was devised to meet the demands of high-speed electric trains. Ordinary direct-current track circuits, as applied to steam roads, would not be satisfactory for this service, because the running rails are here used as return conductors for the motor current. This current would wrongly affect the operation of the track relay, and, of course, the signal. To overcome this difficulty it was necessary to employ a current for the track circuit which would have such characteristic difference from that of direct current as would operate selectively upon the track relay. Alternating current accomplishes this because of its ability to induce a current in another circuit brought within its magnetic field—a property not possessed by direct current.

"The track relay is, therefore, of the induction type, and responds to alternating current and not to direct current. An excess of direct current cannot cause it to go to danger, for if a fuse or other protective device fails to open the circuit the relay coils will be destroyed. With this relay there is no such thing as residual magnetism, and the points of pick up and release are identical, except as effected by twice the mechanical friction of the moving parts.

"Two main feed wires bearing alternating current at, say, 60 cycles and 2000 volts, extend the length of the system, and across these are connected the primaries of the track transformers, the secondary leads of which are connected across the rails at the exit end of each track circuit. Across the rails at the entering end are connected the terminals of the induction relay. We now have a circuit consisting of the secondary of the transformer, the rails and the coils of the track relay. Through this circuit passes simultaneously two kinds of current, alternating, induced by the primary of the transformer, and direct, the return from the car motors.

"Since the direct current tends to make ineffective the alternating current, an impedance coil is connected across the relay terminals, or track rails; this has low ohmic resistance, but high inductive resistance to the alternating current, and serves the purpose of shunting the direct current from the relay, while compelling the alternating current to pass through it."

STREET RAILWAY EXHIBITS AT THE WORLD'S FAIR.

In the Street Railway Journal of May 7, a short description was given of a number of the principal exhibits of street railway interest at the Louisiana Purchase Exposition, in St. Louis. At the time that that synopsis was published the work of placing the exhibits had not progressed sufficiently to allow the publication of any views of individual exhibits. While all parts of the World's Fair are not entirely complete, the railway and electrical exhibits are in very good condition, and a number of the exhibits mentioned in the May 7 issue have been selected in this issue for illustrative purposes. Other views of prominent exhibits will be published in early issues of this paper.

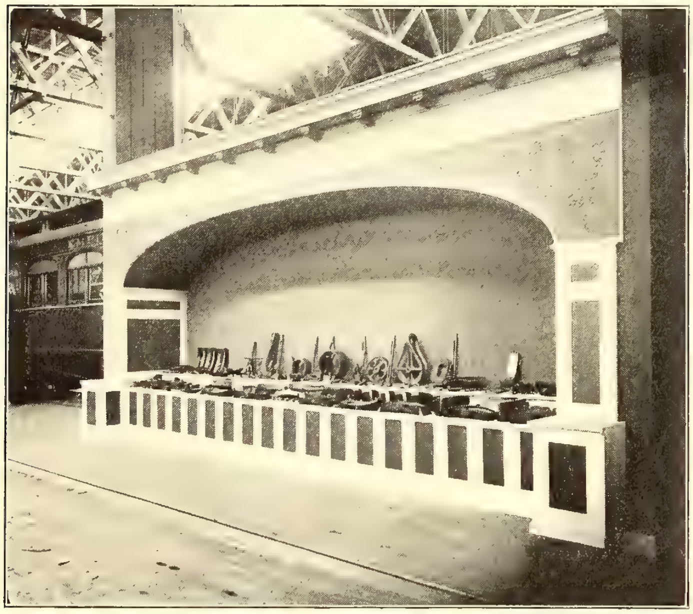


EXHIBIT OF AMERICAN BRAKE-SHOE & FOUNDRY COMPANY

AMERICAN BRAKE-SHOE & FOUNDRY COMPANY

The American Brake-Shoe & Foundry Company, of Mahwah, N. J., has exceptional facilities for presenting an exhibition showing the development of railway brake-shoes and the different successful schemes which have been adopted to secure high-wearing and frictional qualities. This it has done, beginning with the plain cast-iron shoe and finishing with the modern patented brake-shoes containing various forms of inserts or reinforcements, which enable the brake-shoe to be kept in service after the body metal cracks. An interesting variety of reinforcements are shown, most notable of which are the shoes containing expanded metal around which cast-iron is poured, and those containing soft irregular shaped centers embedded in cast-iron. The exhibition, although not large, is of great educational value to the student of brake-shoe development. The company also shows small steel castings, which it makes by the Tropenas process. This company has the American rights to manufacture under these patents, and has a large steel foundry at Chicago Heights, Ill., devoted to this work. Steel castings by this process are made for motor and gear casings, oil cups and tools. Both large and small work is successfully done by this process.

EXHIBIT OF AMERICAN CAR & FOUNDRY COMPANY, EXTERIOR OF CAR

AMERICAN CAR & FOUNDRY COMPANY

The American Car & Foundry Company has two exhibits in the Transportation Building. The one of most interest to electric railway men is the vestibuled interurban car built by the Wilmington plant for the Scioto Traction Company, of which W. E. Baker & Company, of New York, are the constructing engineers. This car is equipped with four General Electric 150-hp motors, being intended for speeds as high as 75 m. p. h. The car is, therefore, very substantially built; it has composite steel and wood longitudinal sills. The dimensions are: Length over buffers, 60 ft.; length over vestibules, 58 ft.; length of car body, 49 ft. It is divided into two compartments, the ladies' compartment being 37 ft. 6 ins., and the smoking compartment, 10 ft. 10 ins. long. The width over sheathing is 8 ft. 4 ins.; distance between truck centers, 37 ft. 4 ins. The seating capacity of the ladies' compartment is fifty-four, and of the smoking compartment sixteen, which is, as will be seen, high for this length of car. The trucks, which are also built by the American Car & Foundry Company, are of the so-called M. C. B. type, with all contact parts machined to secure good fit. The wheel base of these trucks is 6 ft. 6 ins. The trucks are equipped with the Westinghouse Traction Brake Company's electric brake. The car body follows in general steam railroad construction. There are eighteen windows on each side, arranged in pairs, with upper and lower sash. Both compartments are finished in mahogany. The ceiling is three-ply veneer poplar, decorated in gold. The car weighs, complete, in running order, 86,900 lbs. The wheels are 36 ins. in diameter, with the M. C. B. wheel tread and flange. It was accordingly sent from the factory to St. Louis on its wheels. The couplers are Van Dorn No. 3. It is equipped with Consolidated Car Heating Company's electric heaters and Hale & Kilburn Manufacturing Company's special high-back walkover seats. This car

EXHIBIT OF AMERICAN CAR & FOUNDRY COMPANY, INTERIOR OF CAR

will probably be one of those submitted to the Electric Railway Test Commission for test of the electric equipment, which is intended for high-speed work.

WILLIAM WHARTON, JR., & COMPANY, INC.

Interesting proofs of the fact that manganese steel-hardened centers, when set in special track work, such as frogs and crossings, will outlast the special work in which it is placed, is offered in several places in the extensive special track work exhibit of William Wharton, Jr., & Company, Incorporated, of Philadelphia, in the Transportation Building. Several samples of worn special work are shown where the frogs and points have lasted as well as the surrounding track. One frog is shown over which 2,570,000 electric cars have passed, and another frog over which 1,600,000 electric cars have passed, but these frogs are worn down in about the same proportion as the rail, and were taken out of the track because the rail was practically worn out. Another prominent feature of the exhibit is the protected heel switch. This is a street railway switch in which the pivot of the switch is not exposed to the hammering of the car wheel, as it is concealed in hardened steel. Another feature is the Wharton unbroken main line switch for steam and interurban railroads, which makes it unnecessary to have frogs in the main line at the switch. Street railway special work with manganese steel centers is, of course, shown. Manganese steel frogs are also being made for steam and interurban railroads, with guard rails having manganese steel reinforcements. Arthur S. Partridge, the well-known supply man of St. Louis, has charge of this exhibit.

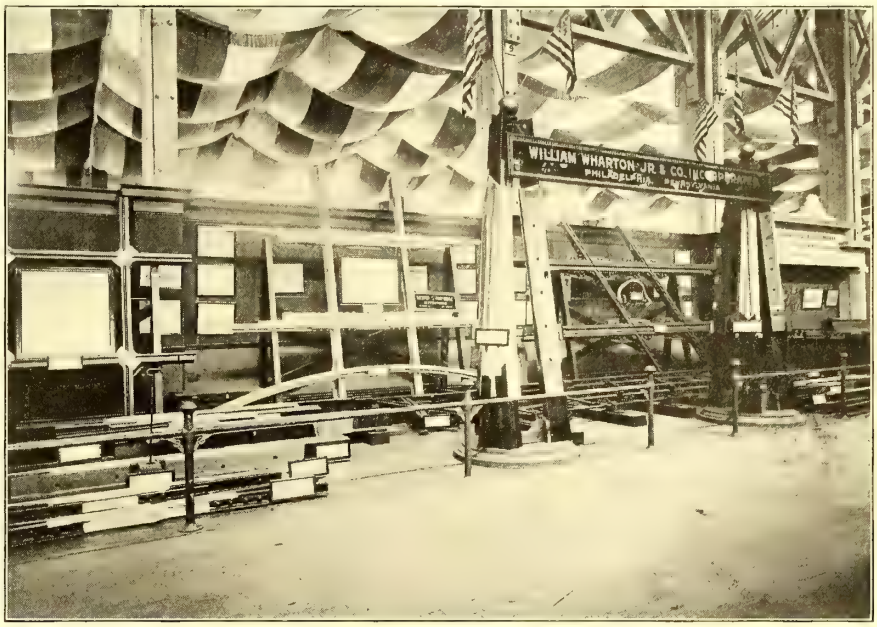
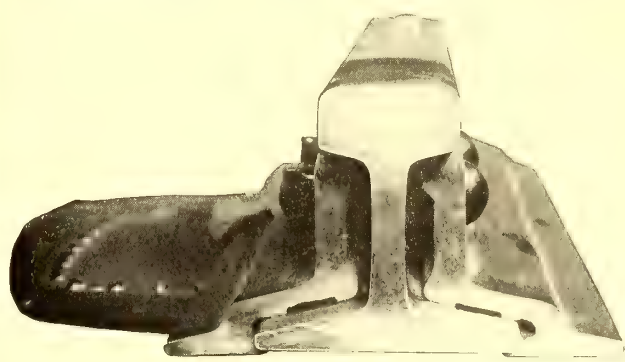


EXHIBIT OF WILLIAM WHARTON, JR., & COMPANY

THE CONTINUOUS RAIL-JOINT COMPANY OF AMERICA

Sample joints for a great variety of sections of T and girder rail are to be seen at the space of the Continuous Rail-Joint Company of America in the Transportation Building. Joints, with a number of the more common types of electric bonds, are displayed, and a new bond this company is preparing to supply is shown for the first time. This bond consists simply of a flat strip of copper forced into a groove in the angle-bar of the joint at the point where the angle-bar bears on the rail base. The copper, therefore, forms part of the bearing surface between angle-bar and rail. A new insulated joint for block signal work shown, employs insulating strips under half of the angle-bar on one side and half on the other side.


EXHIBIT OF BRISTOL COMPANY


NEW BOND OF CONTINUOUS RAIL-JOINT COMPANY

THE BRISTOL COMPANY

Although the majority of street railway men are doubtless fairly well acquainted with the Bristol recording instruments in one form or another, it is doubtful whether they appreciate the large number of uses to which the Bristol instruments have been adapted, as shown in the exhibit of the Bristol Company in the Electricity Building. These instruments are successfully applied to the continuous recording of current, voltage, wattage, steam pressure, water pressure, height of water level and temperatures even up to stack temperatures of 800 degs. F. One improvement that users of Bristol instruments will appreciate and which is shown here, is what is called a stationary dial instrument. On this instrument, instead of removing the circular steel plate when charts are to be changed, the chart only is removed. The chart is slipped under guides in the vicinity of the recording pointer, so that there is no necessity of moving the pointer or danger of bending the pointer and throwing the instrument out of adjustment when renewing a charge. The company makes a very ingenious instrument for recording slight variations in pressure, and which can be cali-

brated for use in indicating the level of water in a tank or the height of the tide. This consists of a recording pressure gage, connected to a long, very small covered tube about the size of a No. 12 wire, outside diameter. Upon the end of this tube is a sealed metal cylinder. The cylinder tube and recording pressure gage are filled with a liquid. The tube is anchored to the bottom of the tank in which the rise and fall of level is to be measured. The variations in the depth of water cause variations in pressure, which are recorded on the chart of the recording pressure gage. The company makes an electric alarm attachment which can be used on any of its recording instruments, so as to give an alarm either high or low, or both. An alternating-current recording wattmeter is one of the new instruments shown. A 5000-amp. recording ammeter, for use on station bus-bars, is exhibited. All the different types of instruments shown are arranged so that their operation can be demonstrated.

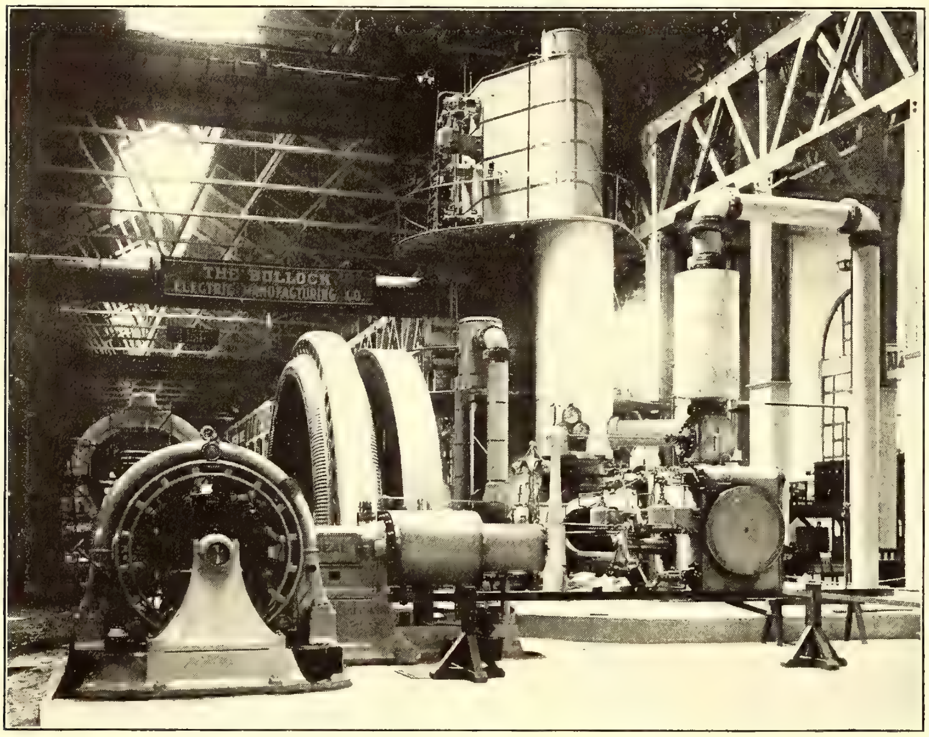


EXHIBIT OF BULLOCK ELECTRIC MANUFACTURING COMPANY

PAIGE IRON WORKS AND BUDA FOUNDRY

The special work and track work specialties of the Buda Foundry & Manufacturing Company and the Paige Iron Works, of Chicago, are shown in Transportation Building. Among the track work shown is a Buda derailing device, which is designed to derail engines or cars passing from a side to a main track except when the switch is properly set. The derail is set about 125 ft. from the main track-switch stand, and connected by a pipe line to the switch stand. The Buda oscillating cattle guard is an ingenious device, resembling in appearance an ordinary cattle guard with V-shaped wood slats. The whole guard, however, is suspended from hangers, so that it swings or oscillates a short distance whenever an animal puts its foot on the guard. This is likely to make an animal wary of crossing the guard. The guard is hung from iron plates bridging from one tie to the next. A switch stand with high semaphore attachment is shown, as well as the Ramapo automatic switch stand. A number of styles of rail benders, both Jim Crow and roller, are shown, and also the Paulus, Buda and Wilson track drills. The Buda standard hand car, with pressed steel wheels with reinforced flanges and straight webs, and specimens of special track work, of course, form part of the exhibit.

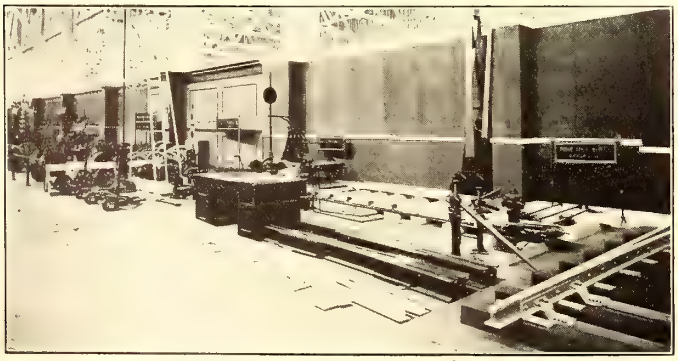


EXHIBIT OF PAIGE IRON WORKS AND BUDA FOUNDRY & MANUFACTURING COMPANY

THE BULLOCK ELECTRIC MANUFACTURING COMPANY

The Bullock Electric Manufacturing Company, of Cincinnati, exhibits for the first time its new street railway motors. It has at its space in the Electricity Building five 50-hp railway motors, one of which is shown open; the others are to be mounted on trucks and shown in operation in connection with a railway controller. These motors are arranged for lubrication by means of pads mounted on springs and bearing against the journals. They are built to open from below. Ventilation is provided through the field cores, and these cores are of laminated iron. In the pole tips every other sheet of steel has been omitted, thus reducing by one-half the amount of iron in the pole tip. Extra precautions have been taken to prevent grease working into the armature windings from the bearings. A prominent feature of this company's exhibit is a 500-kw, 25-cycle rotary converter, intended for railway use. This supplies current for the operation of street railway motors in the exhibit. In connection with this converter there are three 150-kw transformers, reducing the supply voltage from 6600 volts, for use in the rotary converter. A motor generator

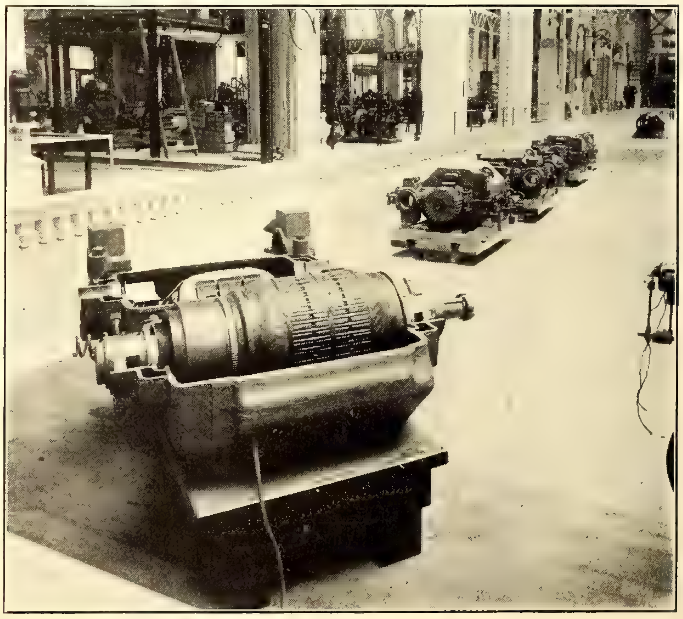


EXHIBIT OF BULLOCK ELECTRIC COMPANY

set, with a synchronous 60-cycle, three-phase motor, and a direct-current generator, with a capacity of 409 amps. at 550 volts, may also be included in the railway portion of this company's large exhibit. A large three-phase alternator, partly assembled, is shown to illustrate the

EXHIBIT OF ST. LOUIS CAR WHEEL COMPANY

method of coil construction and insulation as well as the arrangements of coils. A 250-kw transformer, water and oil-cooled, for a high-tension voltage of 20,000, and a low-tension voltage of 2300, is shown. The company has equipped its space with a testing table and instruments necessary to make tests to show to interested visitors the performance of the working apparatus in its exhibit. Besides the strictly railway part of the exhibit, a large amount of space is given to showing the application of Bullock motors to the driving of machine tools, which should be of interest to the master mechanics of large railway shops. The company occupies a 104-ft. x 54-ft. space in the Electricity Building, and has provision for the entertainment of visitors. In the Machinery Building one of the most prominent features in the building is the 3500-kw, three-phase, 25-cycle, 6600-volt Bullock generator, driven by an Allis-Chalmers combined vertical and horizontal compound engine. This is the largest generating unit at the Exposition. While available for any kind of service, it has frequently been used to carry the decorative lighting load, and the gradual bringing up of the decorative lighting from darkness to full brilliancy has been accomplished by the gradual bringing up of the field excitation.

EXHIBIT OF WESTERN ELECTRIC COMPANY

STANDARD STEEL WORKS

In view of the increasing use of steel-tired wheels in interurban service, which has been forced upon the electric railway man by the increase in weight and speed of cars, the exhibit of steel wheels made by the Standard Steel Works, of Philadelphia, should be especially valuable to interurban managers at this time. This exhibit includes steel-tired wheels and solid rolled steel wheels. Two pairs of very heavy wheels, mounted

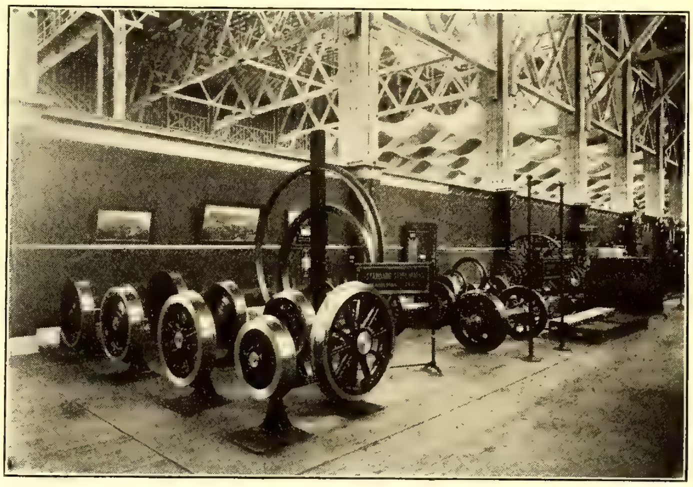


EXHIBIT OF STANDARD STEEL WORKS

on axles, with gears for electric railway service, are included in the exhibit. These are such as are used on the heaviest interurban and elevated cars.

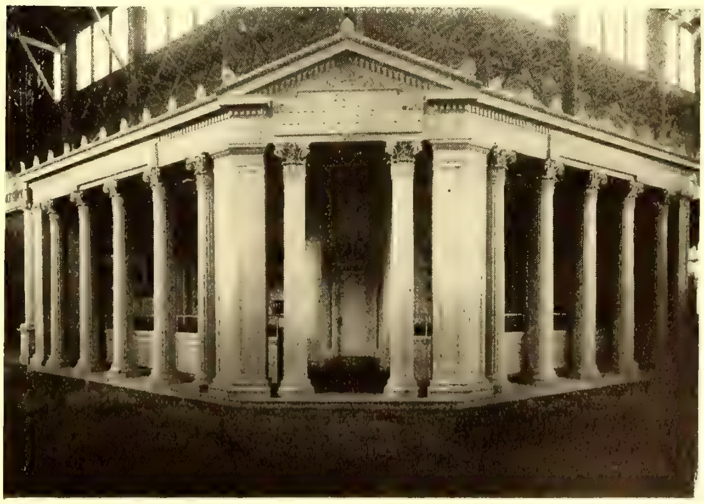


EXHIBIT OF WESTON ELECTRICAL INSTRUMENT COMPANY

THE WESTERN ELECTRIC COMPANY

The Western Electric Company has a very large exhibit, in which it shows a large amount of lighting apparatus and also a machine shop, which will be of interest to master mechanics, which shows in actual operation some of the Western Electric motors connected to modern machine tools with variable speed derived from a three-wire multi-voltage system. A new line of emery grinding machines, manufactured by this company, is a feature of this part of the exhibit. Direct-connected and belt-driven generators are shown, and also a number of Cornish cycle gas engines, direct connected to Western Electric generators. This company includes in this exhibit many goods for which it is agent, which will be of interest to the street railway men.

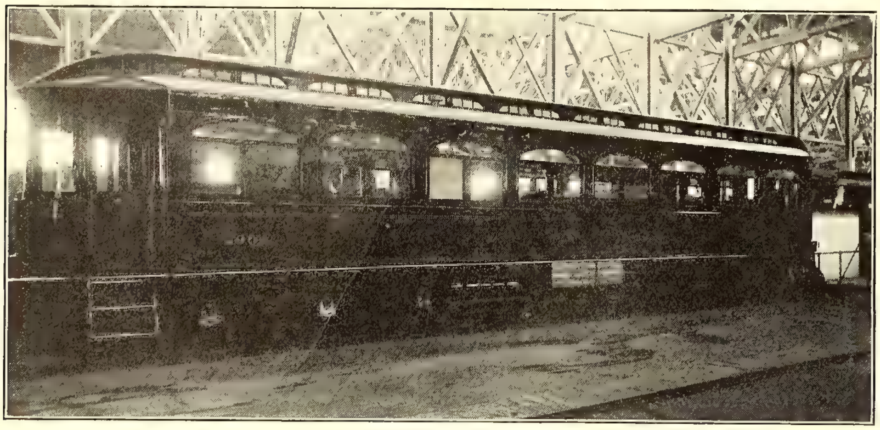


EXHIBIT OF JOHN STEPHENSON COMPANY

ST. LOUIS CAR WHEEL COMPANY

A large exhibit of cast-iron wheels, of interest both to steam and electric railway men, is shown by the St. Louis Car Wheel Company, of St. Louis. The wheels are all shown unpainted, to give the electric railway man an idea of the way the product actually leaves the foundry. A design of street car wheel having a new spoke, and known as the "Twentieth Century," is one of the types of wheel shown. Among wheels for interurban roads are such as were designed for the interurban service of the Milwaukee Electric Railway & Light Company, weighing 550 lbs. each. There are lighter wheels also, as furnished for city service. Double-plate wheels with sections cut and broken out, show the depth and quality of the chill. The wheels are mounted in such a way as to be easily inspected for their entire circumference. This exhibit includes the St. Louis Car Wheel Company, the Decatur Car Wheel & Manufacturing Company, of Birmingham, Ala., and the Atlanta Car Wheel & Manufacturing Company, of Atlanta, Ga.

EXHIBIT OF NATIONAL CARBON COMPANY

JOHN STEPHENSON COMPANY

The high-speed car exhibited by the John Stephenson Company in the Transportation Building is notable not only on account of the unusual strength and elegance of the car body, but because it is mounted on six-wheel trucks. The object of the six-wheel truck is, of course, to make the car run smoothly at the highest speeds attainable. This truck has 36-in. steel-tired wheels. The middle pair of wheels have no flanges, so that the car can take curves as low as 60-ft. radius. The wheel base is 10 ft. 4 ins. The truck is designed to have the motors placed on the two outside axles. In order to give room to do this the springs under the bolsters have been placed at an angle. The car body is 46 ft. long. A detailed description of this car can be found in the issue of the STREET RAILWAY JOURNAL of April 30, 1904. The bottom frame is very heavy, weighing 20,000 lbs., the vestibules are made somewhat tapering to reduce wind resistance. Everything about the car has been designed especially for high speed, and it is believed that this car will run safely at 120 m. p. h.

THE WESTON ELECTRICAL INSTRUMENT COMPANY

The Weston Electrical Instrument Company has an elegantly fitted up booth with offices in the rear and with show cases containing nearly all the company's different types of portable instruments, both for alternating and direct current. Around the walls are shown switchboard instruments. This company's instruments are so well known in all their different forms that further comment is unnecessary.

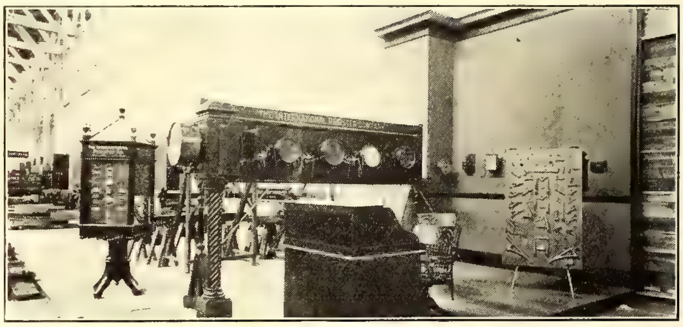
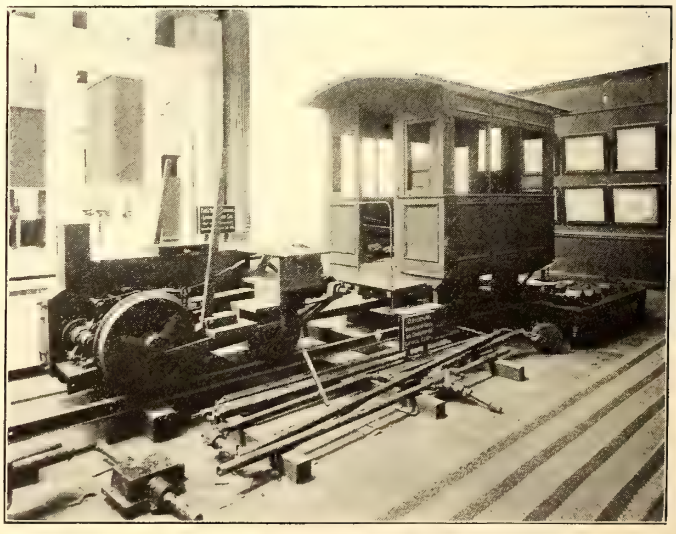


EXHIBIT OF INTERNATIONAL REGISTER COMPANY

INTERNATIONAL REGISTER COMPANY

The only exhibit of fare registers made at the exposition is that of the International Register Company, of Chicago, which



EDISON FIRST LOCOMOTIVE CAR

has a large display, both of International registers and of the New Haven registers, the manufacturing plant of the latter having been purchased by the International Register Company some time ago. Sixteen different types of registers are shown, beginning with a small counter and going up to the most elaborate forms for registering different classes of fare. The mechanism of different forms of registers is shown open, so that their operation may be studied. Besides registers this company makes punches, brackets, Heeren badges, register and bell cord and smaller supplies, all of which are displayed. A. N. Loper, formerly of the New Haven Car Register Company, will be in attendance at this exhibit during the season.

GOLD CAR HEATING & LIGHTING COMPANY

The Gold Car Heating Company, of New York, has an extensive space, equipped with steam, electric and hot-water heating systems, the two latter being of interest to electric railway men. Among the electric heaters the exhibit includes simply the well-known styles of Gold electric heaters, which have been manufactured for some time past. Some of these heaters are made to be placed flush with the heel board and others are intended to be mounted for circulation of air from all sides. A comparatively new hot-water system is shown, which has been in use on a number of the cars of the North Jersey Traction Company. The novelty of this hot-water heating system is that the heater is not placed in the car, but is suspended below the car body, extending about 26 ins. below the sills of the car at some point near the middle. The heater proper consists of a cast-iron water jacket, in which the fire is placed. This jacket and all is enclosed in a steel casing, which leaves an air space between the casing and the heater proper. The top of the heater is flush with the car floor. The hot water pipes and the smoke pipe pass up through the car floor. The heater is suspended from the car floor by a large steel plate which rests on the edges of the hole in the car floor. Coal can be poured in the fire from above, so that it is not necessary to go out of the car. To remove ashes or shake down the fire, however, it is necessary to go outside the car. Hot water rises from the heater, and after being cooled by flowing through the radiating pipes returns by gravity to the heater. An expansion tank is provided in order that the system may always be kept full of water. The hot water, however, does not

EXHIBIT OF THE CONTINUOUS RAIL-JOINT COMPANY

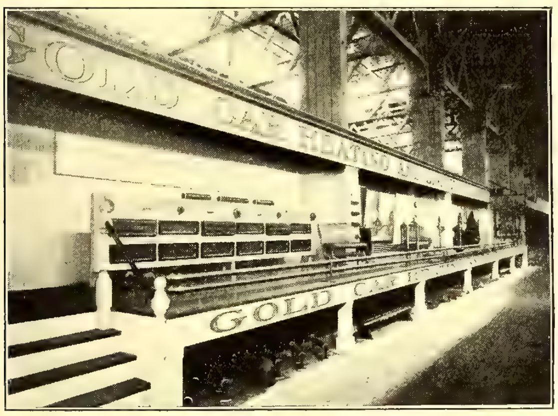
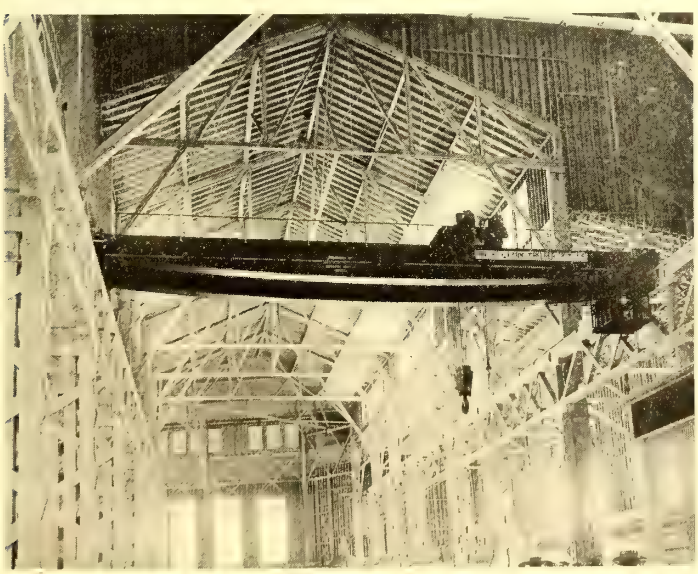


EXHIBIT OF THE GOLD CAR HEATING & LIGHTING COMPANY

EXHIBIT OF N. MATTHEWS & BROTHER

EXHIBIT OF THE WHEEL TRUING BRAKE SHOE COMPANY



CRANE OF PAWLING & HARNISHFEGER

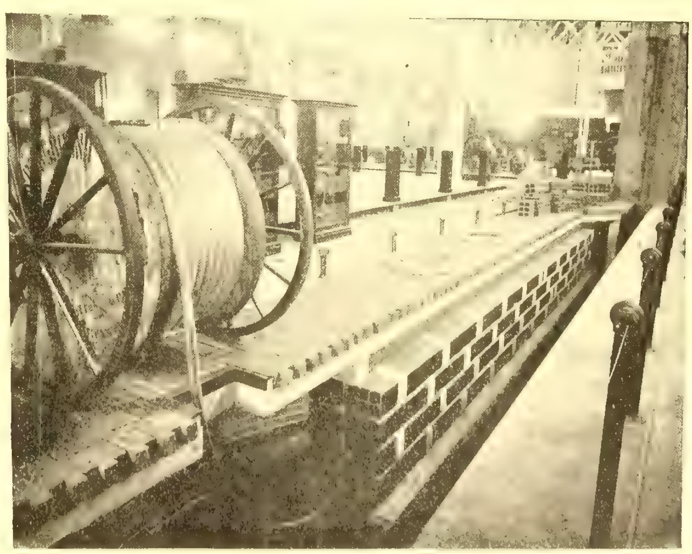


EXHIBIT OF STANDARD UNDERGROUND CABLE COMPANY AND McROY CLAY WORKS

pass directly from the heater to the expansion tank, as in some systems. By means of a jet arrangement the hot water is confined mainly to the circulation pipes, leaving the expansion tank without circulation.

STOMBAUGH GUY ANCHORS

W. N. Matthews & Brother, of St. Louis, make an exhibit of Stombaugh guy anchors in the space of the Wesco Supply Company in the Electricity Building. This guy anchor acts on the principle of an auger and requires no excavation, as it is secured into the ground a sufficient distance to give it a firm hold. This anchor, as shown, is made in sizes small enough to guy fence posts, and in the larger sizes sufficient for anchoring guy wires of the heaviest pole line or stack construction.

PAWLING & HARNISHFEGER

The traveling crane which was used to install the heavy electric apparatus in the west side of the Electricity Building was built by Pawling & Harnishfeger, of Milwaukee. This crane has a capacity of 30 tons and a span of 57 ft. 5½ ins. It is equipped with four electric motors. The movement of the crane is effected with a 20-hp, 220-volt motor, giving a speed of 250 ft. per minute. The movement of the hoist from one end of the crane to the other is effected with an 8-hp motor. The crane hoist has a 30-hp motor, giving a hoisting speed of 25 ft. per minute, and the auxiliary hoist has a 15-hp motor, which will hoist at from 30 ft. to 90 ft. per minute. This crane has, of course, proved of immense convenience in handling the heavy exhibits, which were installed with a celerity never equaled in

BRILL OPEN CAR

any exposition building where such hoisting facilities were not present. This company has also installed a much larger crane for use in the exhibit power plant in the Machinery Building.

WHEEL TRUING BRAKE-SHOE COMPANY

The Wheel Truing Brake-Shoe Company shows in the exhibit of the Wesco Supply Company, in the Electricity Building, brake-shoes of various designs adapted to grinding down cast-iron and steel-tired wheels. These brake-shoes consist of an iron frame containing blocks of an abrasive material, which acts to grind down a car wheel each time the brakes are applied, thus dressing down flat wheels so that they need not be removed or ground down with an emery-wheel grinder. Some of the shoes exhibited are especially designed for grinding down dirt-worn or grooved tires of locomotive drive wheels.

THE STANDARD UNDERGROUND CABLE COMPANY AND McROY CLAY WORKS

A unique joint exhibit is made in the Electricity Building by the Standard Underground Cable Company and the McRoy Clay Works. The idea of this exhibit is to show on a small scale the operation of laying underground conduit and drawing lead-covered cable into the ducts. The conduit is laid under the floor at about the depth it would usually be laid beneath the street surface. An opening in the floor permits the visitor to descend by stairways and examine the conduit, which is shown in various stages of construction. There are two manholes, and cable is being drawn from one manhole to the next. The conduit consists of seventy-two ducts, some of which are completely laid and some of which are partly finished, so as to show the method of wrapping the joints between lengths of tile and placing concrete at the bottom and top of the ducts. A reel of the Standard Underground Cable Company's cable, such as is actually used in construction work, is placed on the main

BRILL CONVERTIBLE CAR

floor of the building above one of the manholes, and in the manhole at the other end is a capstan rigged up for drawing in cables. From the manholes the cables go to distributing poles to illustrate the method of supplying overhead distribution from underground lines.

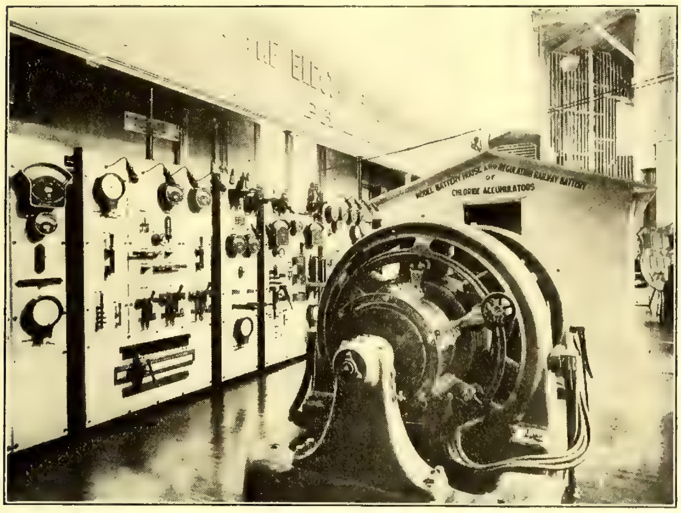
THE J. G. BRILL COMPANY AND AMERICAN CAR COMPANY

The exhibit of the J. G. Brill Company and the American Car Company in the Transportation Building is characterized by the choice selection that these companies have made of a few cars which are representative of the Brill methods of construction. There has been no attempt to show a great variety, but rather to embody in the few cars shown all the principal features of excellence in car building that this company has introduced in recent years. The same idea has been carried out in the truck exhibit. The Brill car exhibit consists simply of three cars, of the three types of construction most actively pushed by this company the past few years. All of these cars are mounted on double trucks. One is a Brill convertible car, one a Brill semi-convertible, the third an open Narragansett-type car. All these types are now so well known among electric railway men that a description hardly seems necessary. The Brill semi-convertible car, which is probably the most popular

SEMI-CONVERTIBLE CAR—AMERICAN CAR COMPANY

type these days, has window pockets in the roof. When the windows are raised, both upper and lower sashes go up into the roof pockets, leaving the window opening equivalent to that of an open car. The inside width of the car with a given outside width, is greater with this construction than where the windows are stored beneath the sills. At the same time a very low sill is possible, because room need not be provided for storing the windows below the sill. As a result the car with windows open approaches nearer to an entirely open car than any other semi-convertible car that carries its windows with it. The window sills are so low on this car that an arm rest above the

sill has been provided. The convertible car has the same principles in its construction that have just been mentioned in connection with the semi-convertible, with the addition that the



PART OF EXHIBIT OF ELECTRIC STORAGE BATTERY COMPANY

panels, as well as the sashes, slide into the roof. The convertible, like the semi-convertible, is entirely self-contained, carrying all sashes and panels on the car at all times, so that they can be raised or lowered any time, either by conductors or passengers. To avoid sticking, all sliding parts are made metal to metal.

On the semi-convertible car a new and desirable feature is an arrangement for holding the motorman's window at any height. The side vestibule window on this car is very wide, and is so built, under a new patented method, that both sashes are raised at once, and automatically assume their proper places as soon as the full height is reached. The Narragansett regular open car has, as its distinguishing Brill feature, the angle-bar side sill, which gives a maximum amount of room underneath the car for the swiveling of the truck.

In the truck exhibit are shown long and short whole-base swivel trucks of the No. 27 type in several sizes clear up to a very heavy truck for the heaviest passenger cars. A single truck (No. 21-E) with solid forged side frames is shown, and also an Eureka maximum traction truck. On top of the largest and heaviest No. 27 truck is an unpainted forging of a side frame for such a truck, for the benefit of those who are skeptical

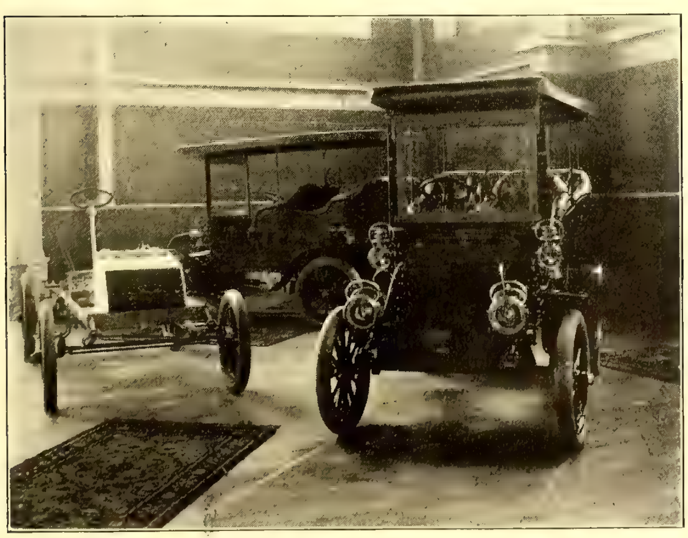


EXHIBIT OF WINTON AUTOMOBILES

enough to question the statement that the side frames of these trucks are forgings. This forging never fails to excite the admiration of experienced blacksmiths who examine it.

The American Car Company part of this exhibit has a semi-convertible interurban car, made under the Brill patents. This car is the most distinctly interurban car of the exhibit, the Brill cars being intended for city and suburban service. This car is 39-ft. body and 52-ft. over the vestibules. It is finished inside in mahogany, Corinthian style, with marquetry panels. The ceiling is semi-Empire, with recessed dome. All floor corners are filled with brass corner pieces to prevent dust catching. The seats are leather covered. The lighting of this car is one feature of special excellence from the standpoint of the illumination secured. The ceiling is dotted with eighty-six frosted-bulb, 8-cp incandescent lamps. The frosted bulbs soften and diffuse the light, while the great number of small units of light give an even distribution of light that is excellent. An M. C. B. type of truck is shown, as recently constructed by the American Car Company, to meet the wishes of customers who may prefer that to the regular Brill trucks. A vestibule door shown on a car in this exhibit is a pleasant surprise to the man who attempts to operate it. This is a folding door, and there is a railing across the middle of the platform parallel with the end of the car, that the doors would be sure to hit in closing were it not that a guide is provided at the top of the doors. The doors close themselves as soon as released.

W. W. LINDSAY & COMPANY

The model electric battery house in the exhibit of the Elec-

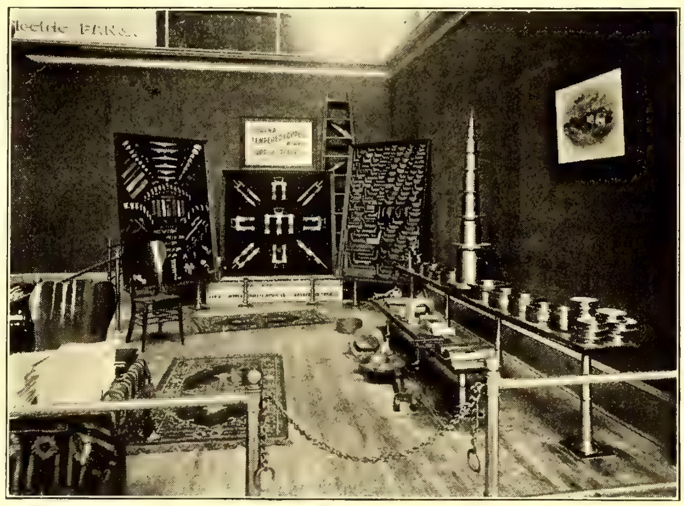


EXHIBIT OF EUREKA TEMPERED COPPER WORKS

tric Storage Battery Company, Electricity Building, represents the construction of W. W. Lindsay & Company, engineers and contractors, of Philadelphia. This model battery house is worth considerable study by those contemplating the use of storage battery sub-stations. The building is of steel and concrete construction, the columns and trusses being of structural steel. All the steel in the building is covered. The roof and walls are of a new building material called ferro-inclave, made by the Brown Hoisting Machinery Company, of Cleveland, and for which W. W. Lindsay & Company are agents. This ferro-inclave is covered both inside and out of the building with cement plaster. This forms a smooth finish and completely encases all the structural steel, protecting it from the battery fumes. The ferro-inclave is fireproof, waterproof and practically indestructible, as well as light in weight. The model battery house is 20 ft. long, 12 ft. 9 ins. wide and 12 ft. 6 ins. high. The batteries in this house are placed on white enameled brick foundations, extending slightly above the floor of the battery room. They are arranged along the walls and along the center line of the building.

THE ELECTRIC STORAGE BATTERY COMPANY

A most extensive and comprehensive exhibit of storage batteries and the auxiliary apparatus pertaining thereto, is made by the Electric Storage Battery Company, of Philadelphia, in

the Electricity Building. The model battery house forming part of this exhibit is described under the head of W. W. Lindsay & Company, who are the contractors for this type of con-

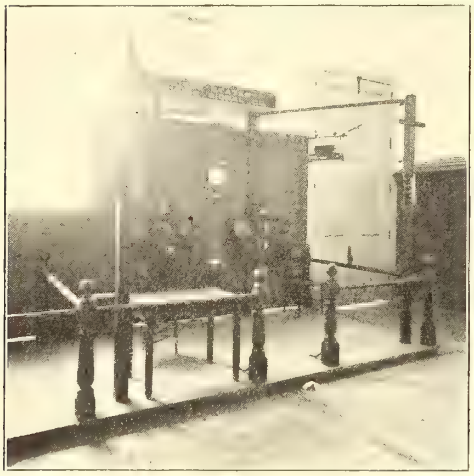


EXHIBIT OF UNITED STATES ELECTRIC SIGNAL COMPANY

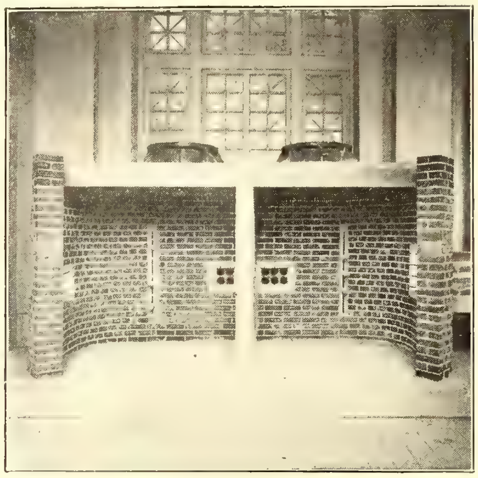


EXHIBIT OF GUY M. GEST

struction. Of course, all the types of "Chloride" and "Exide" battery plates now in use are shown as well as many different types of cells. In connection with the battery in the battery house a small booster is operated, together with a complete switchboard with recording instruments showing the performance of the battery on a fluctuating load. Provisions are made for providing for such a fluctuating load in order to demonstrate the action of the battery. Railway men will be interested in the railway booster of 100-kw capacity, intended for use in making a storage battery take the fluctuations of a sub-station or power station. A 2000-amp. end-cell switch shows the end-cell method of voltage regulation. Altogether, there are five types of storage battery switchboards, which give the visitor an excellent opportunity to study the practice of this company. Back of the space is an immense map of the United States, 30 ft. x 45 ft., indicating the location of each of the 1700 Electric Storage Battery Company's installations, the location of each being illuminated by incandescent lamps mounted behind the map, red lamps indicating railway plants, blue lamps central station lighting plants, green lamps isolated lighting plants.

THE EUREKA TEMPERED COPPER WORKS

A handsome display of commutators, commutator bars, trolley wheels and copper, bronze and brass castings are shown by

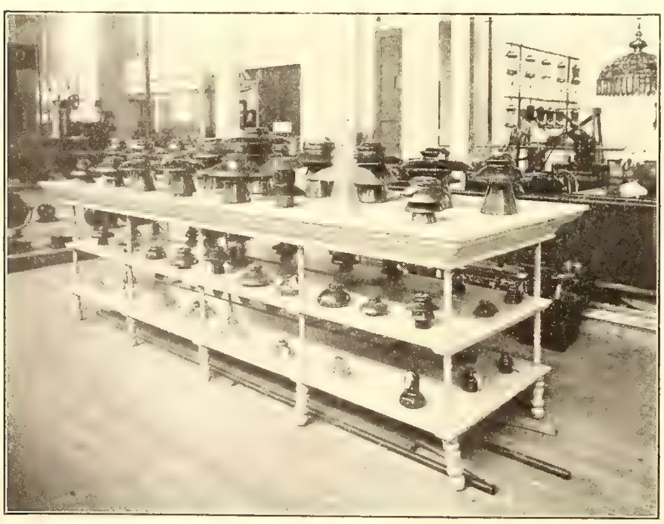


EXHIBIT OF LOCKE INSULATORS

the Eureka Tempered Copper Works, of Philadelphia, in the northeast end of the Electricity Building. The company shows a new swivel trolley harp.

WINTON MOTOR CARRIAGE COMPANY

Street railway officers, looking up automobiles for the use of officers and inspectors, will find that the Winton Motor Carriage Company, of Cleveland, Ohio, which is catering to this class of business, has two touring cars and one chassis ready for inspection in the Transportation Building.

UNITED STATES ELECTRIC SIGNAL COMPANY

Block signals for electric roads are exhibited in the Electricity Building by the United States Electric Signal Company, of West Newton, Mass. This signal system, which is the result of a number of years' careful development and experience in practical use, is one of the few block signal systems for trolley roads that has survived after being on the market several years. With this system, as those who are familiar with it know, an electric car upon entering a block operates with its trolley wheel a trolley-wire instrument which throws signals to danger at the opposite end of the block

EXHIBIT OF WESTERN WHEELED SCRAPER COMPANY

and to caution at the near end. The signals consist of red and green lights, which are thrown into or out of circuit by the operation of the trolley-wire instruments. The exhibit offers a good opportunity to study the details in the working of this block signal system, as all parts are placed so as to be easily investigated.

GUY M. GEST

Guy M. Gest, the contractor, of Cincinnati and New York, has a handsome sample of underground conduit construction work in the court of the Electricity Building. This consists of one-half of a manhole with the tile cable ducts leading from it. The manhole is equipped with a cable hanger, which is placed in a metal slot imbedded in the brick work. The hanger can be put at any height, and only the hooks actually in use need to be put in place.

LOCKE INSULATOR MANUFACTURING COMPANY

A splendid display of high-tension insulators, made by the Locke Insulator Manufacturing Company, of Victor, N. Y., can be found in the exhibit of the Wesco Supply Company in the Electricity Building. These insulators are in all sizes, from the smallest telephone insulators to an insulator 17 ins. in diameter and 15 ins. high. The latter mammoth insulator is designed for working voltages of 80,000 volts, and will stand a break-down test, of course, much in excess of this. It consists

of an umbrella-shaped porcelain top surmounting three porcelain petticoats, which prevent discharges to the pin.

THE WESTERN WHEELED SCRAPER COMPANY

Light dump cars for street railway use are seen in fourteen different varieties at the space of the Western Wheeled Scraper Company, in Transportation Building. Most of the cars are arranged for side dump, with the load so balanced with reference to the pivot that dumping is easy. Four of the cars have rotary boxes, which permit of either side or end dump. The capacities of the smaller cars of this company are from 1¼ yds. to 10 yds. for the side dump, and from 1¼ yds. to 3 yds. for the rotary dump.

ELLIOTT FROG & SWITCH COMPANY

A number of interesting new designs of frogs for steam and interurban rails are shown by the Elliott Frog & Switch Company, of East St. Louis, Ill., in the Transportation Building. These frogs are of both the closed and open type. An inspection of this exhibit is necessary to an understanding of these frogs, and such an inspection is well worth the time of the visiting interurban railway man.

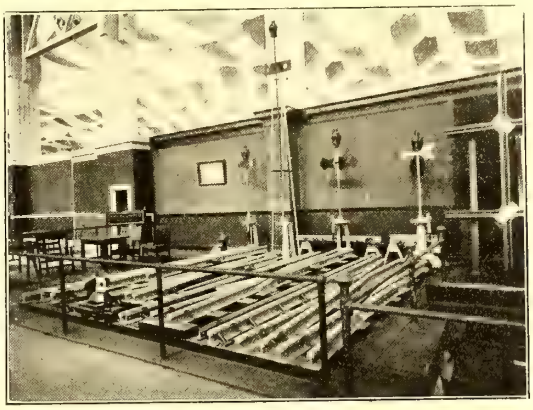


EXHIBIT OF ELLIOT FROG & SWITCH COMPANY

WYCKOFF PIPE AND CREOSOTING COMPANY

At the south side of the court of the Electricity Building the Wyckoff Pipe & Cresosoting Company, of Stamford, Conn., has an exhibit which shows some of the results attained with a process which is not very generally used as yet in this country for the preservation of timber, but which, nevertheless, is likely to come into more extensive use as the cost of timber advances.

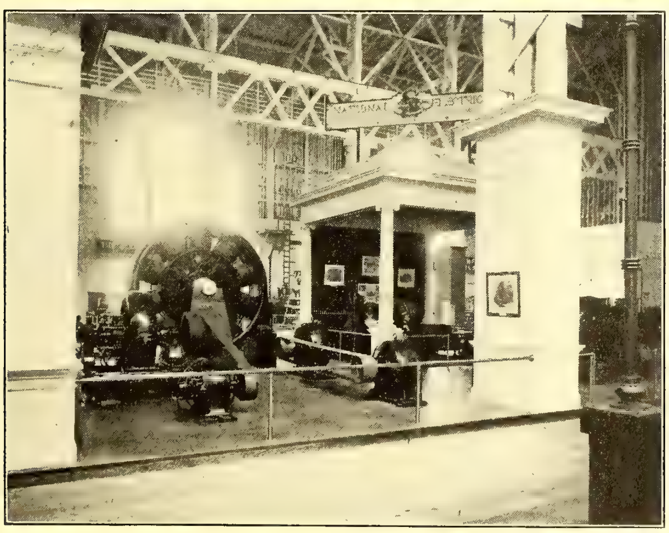


EXHIBIT OF NATIONAL ELECTRIC COMPANY

The company shows creosoted pump-log conduits for underground wires, including several pieces of this conduit laid in Philadelphia by the Bell Telephone Company fifteen years ago, and removed last fall, not on account of their deterioration but on account of the building of a subway in that city. This conduit is apparently as good as the day it was laid, as it shows no signs of deterioration. The company shows poles, cross ties, cross arms and paving blocks impregnated with creosoted oil. To show the penetration of the oil in the heart of the timber, two sections of piling, one creosoted and one uncreosoted, are shown. The uncreosoted section shows the work done by the toredo which honeycombs the piling in a very short time.

ATLAS RAILWAY SUPPLY COMPANY

Rail-joints for standard T-rails, Shanghai T-rails, guard rails and girder rails form the exhibit of the Atlas Railway Supply Company, of Chicago, located in the Transportation Building. Besides this, the work which can be done with the Atlas primer and surfacer in painting cars of street and interurban railways, is demonstrated by a board taken from an ancient car body, upon which a rectangular space has been refinished, using Atlas primer and surfacer, although the board is scarred and weather beaten, the refinished surface looks practically as good as new, and has a tough elastic finish.

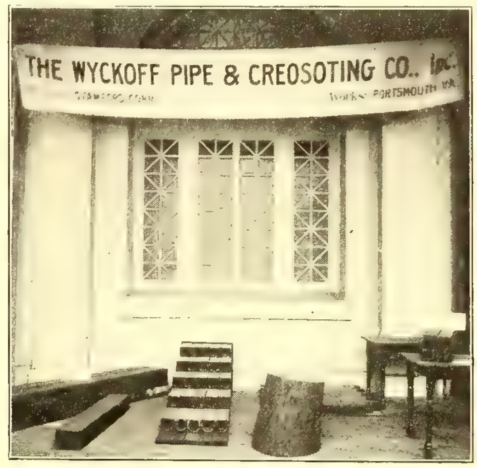


EXHIBIT OF WYCKOFF PIPE & CREOSOTING COMPANY

NATIONAL ELECTRIC COMPANY

Considerable interest naturally attaches to the exhibits made by the National Electric Company at this Exposition, because of its position as a newcomer into the field of manufacture of large electrical machinery. A 1500-kw alternating-current generator is being installed in the exhibitors' power plant in the Machinery Building. The plans for this large alternator were given in the STREET RAILWAY JOURNAL of May 7, 1904. In the company's exhibit in the Electricity Building opportunity is given to study the special features of excellence in the construction of this company's electrical machinery. A direct-current generator of 400 kw is shown, which is fairly representative of this company's direct-current construction for the larger units. This generator has pole tips of soft, laminated iron, the tips being bolted to the cast-field cores and serving to hold the field coils in place. Considerable space is allowed between the series and shunt coils of the fields, so that air can circulate between the coils and allow them to be run at a higher current density without overheating than would be possible with less ventilation. The armature coils are formed from copper strips or bars, but there is no riveted or soldered joint at the end opposite the commutator. A form of coil has been adopted which permits bars to be bent hot and afterward insulated, so that no soldered joint is necessary in the entire coil save where it connects to the commutator bars.

The Christensen straight air-brake equipment for a single car, and also the multiple-unit system, as applied to a train of three cars, is shown. The apparatus, as installed in the exhibit, is mounted on platforms, each platform representing the equipment of one car. The company puts up equipments in this shape for the instruction of employees of those companies having instruction rooms. The single-car equipment has an electric motor-driven compressor, with a capacity of 11 cu. ft. of free air per minute, driven by a 2-hp motor. The multiple-unit equipment has a 4-hp motor on each car, driving a compressor with a capacity of 20 cu. ft. of free air per minute. This multiple-unit system is the same as that which is being used on the Intramural Railway, which furnishes transportation inside the Exposition grounds. The trains on the In-

tramural can be operated with as many cars as desired, all being equipped with the multiple-unit system. Like single-car apparatus, this multiple-unit equipment is intended for straight air brakes. It requires two air pipes connected together for the full length of the train. One of these, which is called the train pipe, is used for the application and release of the brakes from the motorman's three-way valve on any platform. The other air pipe, running the length of the train, is to equalize the air pressure between the storage reservoirs on the various cars. In order to prevent the compressor on one or two cars from doing most of the work on a long train, the automatic electric governor on each car is provided with contacts, so that as soon as the governor on one car cuts in its air compressor-motor, those on the other cars are also started. Another air brake equipment shown is intended for use on large electric locomotives. It has a compressor capable of taking care of 75 cu. ft. of free air per minute, driven by a 14-hp motor. Another piece of compressed air apparatus of considerable use to electric railway companies is a portable compressor outfit, consisting of two tanks and a motor-driven compressor, with a 2.4-hp motor. This can either be used in the shop for cleaning motors and car seats, as well as car interiors, or it can be taken into the yards or out on the road for use in driving track drills, or for other purposes to which compressed air can be put.

EXHIBITS OF THE WESTINGHOUSE COMPANIES AT THE ST. LOUIS FAIR

The main service plant at the Louisiana Purchase Exposition, for which the Westinghouse Electric & Manufacturing Company received the general contract, is naturally a notable feature of the Westinghouse exhibits, and one which appeals, because of the commanding size of the four big electric generating units, each of 2000-kw capacity, and their location in the central aisle of Machinery Hall, to practically all visitors to the Fair. At Chicago, in 1893, the great central station plant, which also was installed by the Westinghouse Electric & Manufacturing Company, was a complete exhibit of the most modern type of electrical machinery at that time, and the twelve 750-kw generators, each at 2200 volts, were the largest alternating-current polyphase machines ever constructed, and constituted the largest polyphase plant then in service. The 2000-kw, three-phase alternating-current generators of the St. Louis Fair plant, which operate at a speed of 83½ r. p. m., and deliver a 25-cycle current at 6600 volts, although of almost three times the individual capacity of those seen at Chicago, are, of course, not at this day remarkable on account of their size, and, indeed, entrance to the service plant exhibit is through a large 35-ft. plaster ring moulded in close representation and in exact duplicate size of the stationary armature of the 5000-kw alternating-current Westinghouse generators constructed for the elevated and subway train service in New York City. The 10,000-kw generators for the Ontario Power Company are now being constructed in the East Pittsburg works of the Westinghouse Electric & Manufacturing Company.

The total space devoted to the service electric plant in Machinery Hall, with the exciter units, condensers, cooling towers and the thirty-five-panel switchboard, is 26,260 sq. ft. The entire steam and electric station was designed and equipped by Westinghouse, Church, Kerr & Company, and all the motive power apparatus in connection with the generators, and in the steam generating plant in the nearby boiler house, was furnished by the Westinghouse Machine Company. In addition, the various organizations associated with the Westinghouse name, which have adjoining exhibit space in Machinery Hall of 26,260 sq. ft., space in the Palace of Electricity of 10,100 sq. ft., where Baldwin-Westinghouse electric trucks and locomotives also are shown, and space in the Palace of Transportation of 3000 sq. ft., a total of 65,620 sq. ft., or nearly ten times the space occupied by the same interests at the Pan-American Exposition at Buffalo in 1901. These companies include besides the Westinghouse Electric, Machine, Air Brake and Traction Brake Companies, Westinghouse, Church, Kerr & Company, the various foreign companies, also the Union Switch & Signal Company, American Brake Company, R. D. Nuttall Company, Bryant Electric Company, Perkins Electrical Switch Manufacturing Company, and other allied corporations.

The Westinghouse exhibits and preparations for the reception and entertainment of visitors are on a scale so complete and elaborate that they constitute a noteworthy feature of the industrial display at the Exposition. In Machinery Hall, in addition to the electric service plant and the main exhibit of Westinghouse gas engines, turbo-generators, rotaries, exciters and motors in operation, all enclosed within ornamental staff walls and columned entrances of classic design, is the Westinghouse auditorium, which seats 350 persons, in which are displayed at regular hours through the day the biograph and mutoscope pictures of scenes in and about the various Westinghouse works in the Pittsburg district, including the first interior photography of the kind ever taken by means of the Cooper-Hewitt mercury vapor lamp.

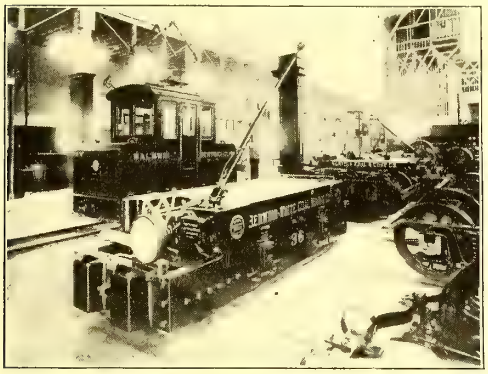
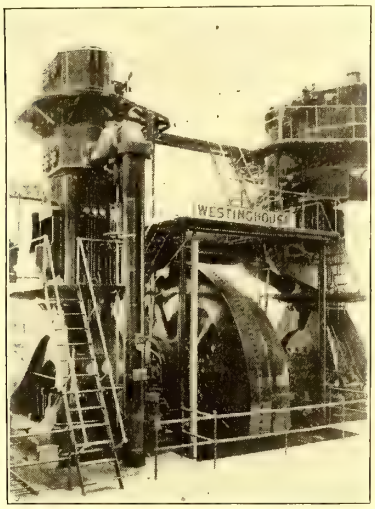
The R. D. Nuttall Company's exhibit of cut and planed gears, trolleys, trolley gears and pinions for electric railway, mine and industrial haulage motors, is in Machinery Hall, near the Westinghouse headquarters.

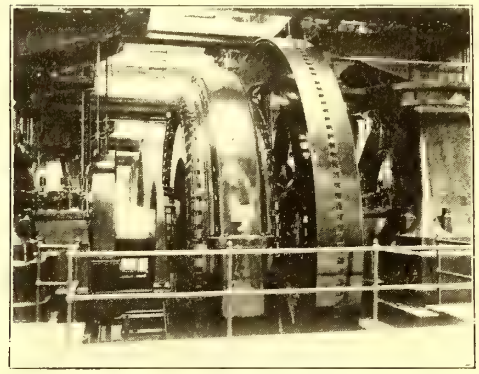
The exhibit service plant, immediately west of the company's headquarters, which is utilized to furnish power for various purposes, includes a 400-kw Westinghouse-Parsons steam turbine generating set, operating at a speed of 3600 r. p. m., and delivering a three-phase, 60-cycle current at a potential of 440 volts. The unit selected for exhibit is of a size that has met with most extended introduction by reason of its applicability to power stations of moderate size, although it is the smallest turbine unit built by the Westinghouse Machine Company. The construction of the rotating field of the generator shown in connection with the turbine on exhibit may best be studied in the Westinghouse exhibit in the Palace of Electricity, where one of similar type is set up but not in operation. The exhibit service plant contains also a 125-hp vertical and a 225-hp horizontal gas engine, the first direct connected to standard two-wire, the second to standard three-wire, double-voltage, direct-current generators. Both single-acting and double-acting types of gas engines at present manufactured by the Westinghouse Machine Company are here represented in their latest form. The horizontal engine will be of particular interest to engineers, as its development has been coincident with the introduction of gas power upon a large scale in this country.

An important part of the Westinghouse installation which is seen by few is the pumping apparatus under the beautiful cascades in front of Festival Hall. This equipment was designed to supply 90,000 gals. of water a minute for these cascades by three large centrifugal pumps, each driven by a 2000-hp Westinghouse induction motor, probably the largest motors ever constructed.

In the Palace of Electricity, the Westinghouse Electric & Manufacturing Company occupies a space of over 10,000 sq. ft., including 1600 sq. ft. devoted to the display of electric trucks and locomotives constructed in conjunction with the Baldwin Locomotive Works. Two locomotives built for mine service are shown, one weighing 20,000 lbs. and the other 30,000 lbs., each equipped with two No. 79 motors at 500 volts. Another 20,000-lb. locomotive, for switching, is equipped with two No. 75 motors, at 220 volts. In the regular electrical equipment display are a 400-kw turbine-type generator, typical generators for direct and alternating currents, for belt or direct connection, rotary converters, motor generator sets, oil insulated and

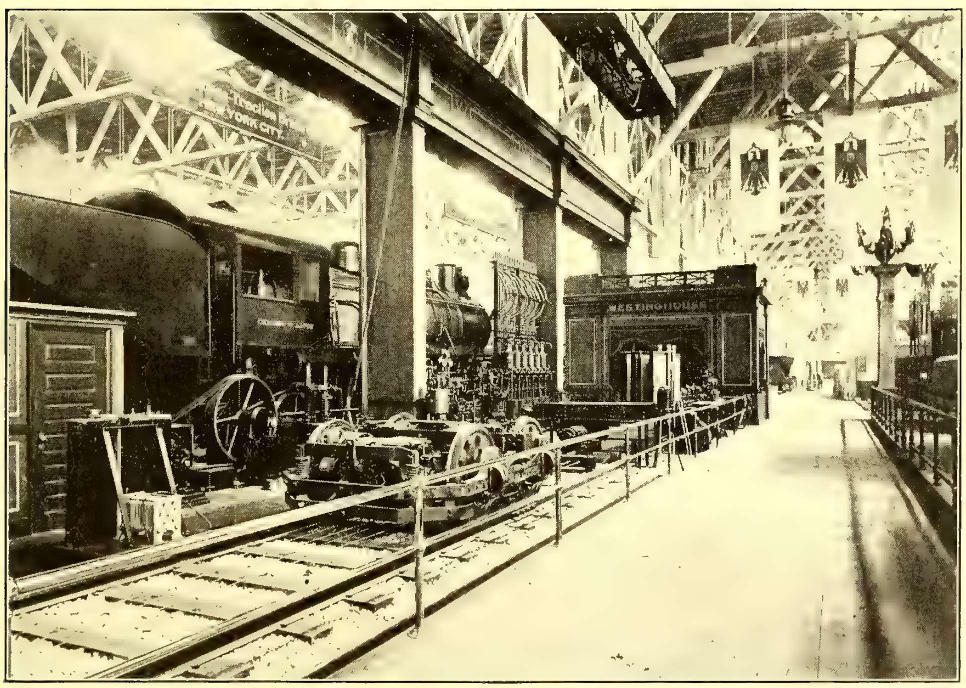
air blast transformers, direct-current and alternating-current railway motors and controllers, single and polyphase induction motors of constant and variable speeds, direct-current motors of many types, including motors for variable-speed service, from single and double voltage circuits; switchboard apparatus, ammeters, voltmeters, wattmeters, synchroscopes, power factor meters, circuit breakers and switches, many of them electrically operated; portable instruments, instruments of precision, potential regulators and innumerable other forms of



VIEWS IN THE WESTINGHOUSE EXHIBITS

auxiliary apparatus and instruments. The alternating-current, series wound, single-phase crane motors, similar in type and general construction to the single-phase railway motors exhibited in the Transportation Building, and the new "Westinghouse unit switch system of multiple control" are also to be seen in this section. The spectacular high-tension sign, using



A PORTION OF THE WESTINGHOUSE TRACTION BRAKE EXHIBIT

a potential of 50,000 volts, which spells the name "Westinghouse" in lightning-like discharges radiating from large letters over a plate-glass surface—one of the attractions at the Pan-American Exposition—is to be seen in the Westinghouse auditorium.

The combined exhibit of the various Westinghouse brake companies extends for 150 ft. down the aisle from the turn-table in the Transportation Building. At the end nearest the turn-table is a reception room for guests, and at the other end is a booth fitted up as a Russian kiosk by the Westinghouse Company, Ltd., of St. Petersburg, to be used as a rendezvous for Russian visitors to the Fair. Included in this operating exhibit is the display of the Westinghouse Electric & Manufacturing Company's alternating-current single-phase railway motors.

The Westinghouse Air Brake Company's exhibit shows a rack made up of apparatus constituting the equipment for a six-coach passenger train with engine and tender, all fitted throughout with the high-speed brake and signal equipment. All valves are placed in duplicate, one sectioned so as to show the internal working mechanism, and connected to the valve in use in such a manner that it moves as the regular valve is operated. The operation of the various valves is thus readily studied. The Westinghouse friction draft gear also is shown in section, with a machine especially designed for testing it in operation. The available power which can be exerted on the draft gear approximates 2000 lbs. A triple-valve testing rack is presented to show the manner in which this device is now being installed in many railroad shops. Sectional parts also are shown of the other apparatus of the Westinghouse Air Brake Company and the Westinghouse Traction Brake Company. The latter's exhibit consists of the magnetic brake and car heating apparatus and the straight air brake for both motor-driven and axle-driven compressors. The magnetic brake is applied to a track 45 ft. long, the truck being equipped on both ends with friction draft-gear buffers, showing the use of this device, which has become extensively adapted to this kind of service. In this connection also is shown the separate brake controller, for use with the magnetic brake when it is decided to add the latter to street railway equipment having an ordinary controller for the motor.

The straight air-brake rack shows the equipment now used in the straight air outfit on electric cars that are operated by one of the company's standard compressors. The compressors shown are of the axle and motor-driven types, in section for inspection of their internal working parts. One of the sectional compressors is fitted to move with a regular compressor in operation.

The Union Switch & Signal Company's exhibit is a group of signals, full size and in working condition, erected in the Transportation Building. The company shows also examples of electrical apparatus for the operation and control of signals, photographs of various installations and a signal designed for

use in the tunnels of the Pennsylvania Railroad under the Hudson River to New York City, shown in position in a full size model of one of the tunnel tubes. The company's most important exhibit at St. Louis, however, is in installations in actual service, including the Westinghouse electric pneumatic interlocking system at the big Union Station, which controls all of the passenger yard movements, and is much the largest interlocking apparatus ever built.

A brief guide pamphlet to the Westinghouse exhibits may be secured at the headquarters and exhibits office, in the form of a neat folder, which includes maps of St. Louis and the Exposition, and a list of typical Westinghouse installations in St. Louis. Red lines on the St. Louis map show street railways using Westinghouse apparatus.

BRAKE TESTS OF A 400-KW WESTINGHOUSE-PARSONS STEAM TURBINE

The following are the interesting results of a series of tests of one of the Westinghouse-Parsons 400-kw steam turbines at the works of the Westinghouse Machine Company, at East Pittsburg, Pa. This turbine was one of a large number of the same size that were being made, and was placed upon the testing floor of the factory for the purpose of subjecting it to a series of tests, which were conducted by Dean & Main, consulting engineers, Boston, Mass. The turbine was direct connected to an alternating generator, but for the purposes of the test it was decided to remove the generator and substitute therefor a water brake. This brake was placed in the position usually occupied by the generator, the brake shaft being coupled to the turbine shaft.

The arm of the brake rested upon a block upon a platform scale, and the pressure of the brake arm was weighed upon the scale beam in the usual manner.

The turbine was connected to a surface condenser, which was provided with a circulating pump, a dry vacuum pump, and a pump for removing the condensed steam from the bottom of the condenser, all being reciprocating pumps. The surface condenser was tested for leakage and found to be perfectly tight. The discharge of the latter pump was connected to two steel weighing tanks, each mounted upon a good platform scale, so as to be directed into either by means of a tight plug cock. In each test the water discharged was received in each tank 10 minutes.

Two corrections were applied to the water weights, one arising from the circumstance that at the end of a test the height of the water in the "hot well" at the bottom of the condenser was not the same as at the beginning, and the other from the leakage of water from water-cooled bearings into the exhaust. The possibility of the discharge from the dry vacuum pump containing water from the condensing steam, was foreseen, but observation of this, as it was discharged into an atmosphere considerably below the freezing point, revealed almost no vapor, and this source of error was neglected.

The barometer used was of the mercurial type, and stood in general at about 29 ins. The vacuum was taken by a mercury column, and read about 2 ins. less than the barometer except in two tests, during which the vacuum was intentionally reduced in order to ascertain the effect of different vacua on economy.

Since the steam was condensed in a surface condenser and the amount condensed in any length of time could be accurately weighed, the tests were sub-divided into 10-minute intervals. If the load on the turbine were perfectly steady it would be expected that the 10-minute weights would be identical, except for the effect of the height of water in the "hot well" and the bearing leakage to which reference has been made. These weights were nearly uniform, but the total duration of no test was as little as ten minutes. The durations were, for the full-load tests, with 100 degs. superheat, 2 hours, and for most of the others 1 hour. A few tests were made 30 minutes in length.

The detailed results of the tests are given in the adjoining column, to which should be added:

Length of lever arm of brake, 20.09 ins.; equivalent diameter of circle described by brake resistance, 40.18 ins.; circumference of equivalent circle, 10.519 ft.; rated electric generator capacity, 400 kw; rated brake horse-power, 580 hp; rated speed, revolutions per minute, 3600 r. p. m.

In the tests with dry, saturated steam, steam was used which had been superheated sufficiently to be just dry at the throttle. This was accomplished by observing samples flowing through a throttling calorimeter and adjusting the gas-heating supply to the superheater. In the tests with friction load only the brake was used without water. There was a slight pressure on the scale, due to the brake journal friction and the "windage" inside of the brake.

THE ECONOMY OF SUPERHEATING

While the tests did not cover a great range of superheating, the effect was determined as far as the data would allow. Curves were plotted, the vertical distances representing percentages, the amount of dry steam used being called 100 per cent, and the degrees of superheat varying with the horizontal dimensions. In the case of the 77 per cent load only two points were established, and whether the line, if extended, would be straight, cannot be told. In the case of the 2 per cent overload, or rated load, the line connecting three points is nearly straight, while with the greater overload it is somewhat curved. It is fair to say, however, that the saving of steam is about 1 per cent for every 10 degs. of superheat, within the limits of superheat here employed.

THERMAL EFFICIENCY

The thermal efficiency of a turbine can only be determined with correctness on the brake horse-power basis. As, however, the chief interest in the thermal efficiency from a commercial standpoint lies in comparing it with that of a reciprocating engine, and as the latter is always referred to indicated horse-power, what might be called the internal steam horse-power of this turbine was estimated by assuming that it bears the same relation to the brake horse-power that the indicated and brake horse-powers of a reciprocating engine bear to each other. It is difficult to say just what the friction of a reciprocating engine is, as data are variable. Tests that have been made point to 6 per cent as being a common friction rate for engines with generators mounted on their shafts. This gives rise to the "internal steam horse-power" given in the following table, and the other quantities follow:

		Dry Steam	100° Superheat	180° Superheat
1	Rated* load, brake horse-power	593.17	594.60	592.27
2	Internal steam horse-power = B. H.-P. ÷ 0.94	631.03	632.85	630.07
3	Total steam used per hour, lbs	8,249	7,384	6,779
4	Steam used per internal horse-power per hour, lbs	13.07	11.67	10.76
5	Gauge pressure at throttle, lbs.	154.40	155.7	153.6
6	Atmospheric pressure, lbs	14.17	14.28	14.24
7	Absolute steam pressure, lbs	168.57	169 98	197.84
8	Superheat	0	109° F.	181° F.
9	Temperature condensed steam	95.3° F.	95.8° F.	94.7° F.
10	Heat of liquid per pound, B. T. U.	339.8	340.5	339.4
11	Heat of vaporization per pound, B. T. U.	854.3	853.8	854.5
12	Heat in superheat per pound, B. T. U.	0.0**	52.3	86 9
13	Total heat in one pound of steam, B. T U.	1,194.1	1,246.6	1,280.8
14	Heat of liquid in condensed steam, B. T. U.	63.8	63.8	62.7
15	Heat used by turbine per hour, B. T. U.	1,130.8	1,182.8	1,018.1

* By rated load in this case is meant the load that was realized when endeavoring to operate the turbine at its rated load.

** This steam contained 2-10 of 1 per cent of moisture, but no allowance has been made for it.

From the above the following are obtained:

CASE OF DRY STEAM

B. T. U. used by turbine per minute (1130.8 x 8249) ÷ 60 = 155,466 B. T. U.

TABLE OF RESULTS OF THE TESTS

		Approximately 180° F. Superheat		Approximately 100° F. Superheat				Dry Saturated Steam				Dry Steam and Low Vacuum		Friction Load
		32 Per Cent Overload	Full Load (2 Per Cent Overload)	31 Per Cent Overload	Full Load (2 Per Cent Overload)	77 Per Cent Load	41 Per Cent Load	26 Per Cent Overload	Full Load (2 Per Cent Overload)	77 Per Cent Load	42 Per Cent Load	20 Per Cent Overload	Full Load (2 Per Cent Overload)	
1	Date, 1903	Nov. 28	Nov. 28	Nov. 28	Nov. 28	Nov. 28	Nov. 28	Nov. 29	Nov. 29	Nov. 29	Nov. 29	Nov. 29	Nov. 29	Nov. 29
2	Test No.	10	9	6	5	7	8	11	12	13	14	16	17	15
3	Duration of test, hours	1	1	1	2	1	1	1	1	1	1	½	½	½
4	Revolutions per minute	3,477.2	3,542.7	3,457.6	3,546.5	3,580 1	3,588.7	3,481.4	3,345.0	3,583.6	3,602.1	3,497.8	3,549.6	3,663.9
5	Travel of point in equiv. circle per minute, ft	36,576.7	37,265.7	36,371	37,305.5	37,658.4	37,749.4	36,620.6	37,290.0	37,696.4	37,890.8	36,792.9	37,338.6	38,539.7
6	Average pressure on scale, net lbs	688.0	524.5	688.5	526	390.2	209.7	656.4	524.9	392.2	210.1	623.1	524.2	4.7
7	Work done by brake, ft., lbs	25,166,214	19,545,094	25,042,534	19,622,670	14,695,(78	7,917,945	24,097,794	19,574,617	14,786,041	7,962,374	22,927,153	19,572,126	181,136.7
8	" " " Hp	762.6	592.3	758.9	594.6	445.3	239.9	728.4	593.2	448.0	241.3	694.8	593.1	5.49
9	Average gage pressure of steam near throttle, lbs	151	154	150	156	154	153	153	154	156	156	152	155	157
10	Average temperature of steam near throttle	548° F.	548° F.	469° F.	470° F.	471° F.	454° F.	366° F.	365° F.	373° F.	366° F.	369° F.	368° F.	367° F.
11	Average superheat of steam near throttle	182° F.	181° F.	104° F.	109° F.	104° F.	87° F.	† Dry	† Dry	† Dry	† Dry	† Dry	† Dry	Dry
12	Weight of steam used per hour, lbs	8,520	6,779	9,157	7,384	5,728	3,508	9,928	8,249	6,486	3,876	9,734	8,514	706.
13	Weight of steam per brake horse-power, lbs	11.17	11.45	12.07	12.41	12.86	14.62	13.63	13.91	14.48	16.06	14.01	14.35	128.6
14	Average barometer reading, inches	29.00	29.00	29.09	29.09	29.09	29.09	28.87	28.87	28.88	28.89	28.89	28.89	28 69
15	Average vacuum in exhaust pipe, steam	27.00	27.10	27.1)	27.06	27.10	27.10	26.87	26.84	26.80	26.90	25.90	25.91	26.90
16	Temperature of exhaust steam	99.2° F.	99.4° F.	100.0° F.	101.6° F.	99.8° F.	100.0° F.	101.1° F.	101.3° F.	102.9° F.	102.9° F.	115.7° F.	115.7° F.	109° F.
17	" circulating water, inlet	38° F.	38° F.	39.7° F.	38.6° F.	38.5° F.	38 0° F.	37.0° F.	36 9° F.	37.0° F.	37.0° F.	37.0° F.	37.0° F.	37° F.
18	" " " outlet	49.9° F.	45.8° F.	51.7° F.	47.3° F.	45.4° F.	43.0° F.	49.6° F.	46.7° F.	43.6° F.	41.8° F.	49.0° F.	45.5° F.	39.5° F.
19	Average temperature of condensed steam	91.2° F.	94.7° F.	93.8° F.	95.8° F.	95.4° F.	95.0° F.	92.1° F.	95.3° F.	98.4° F.	97.6° F.	109.8° F.	110.5° F.	95.2° F.

† This steam was not strictly dry but was either very slightly moist or superheated. This was not enough to have a measurable effect on economy.

B. T. U. used per internal horse-power per minute, 155,466 ÷ 631.03 = 246.37 B. T. U.

$$\text{Thermal efficiency, } \frac{33{,}000}{246.37 \times 778} = 0.1722 \text{ per cent.}$$

CASE OF 100 DEGS. SUPERHEAT

B. T. U. per minute (1182.8 x 7384) ÷ 60 = 145,563 B. T. U.

B. T. U. used per internal horse-power per minute, 145,563 ÷ 632.55 = 230.12 B. T. U.

$$\text{Thermal efficiency, } \frac{33{,}000}{230.12 \times 778} = 0.1843 = 18.43 \text{ per cent.}$$

CASE OF 180 DEGS. SUPERHEAT

B. T. U. per minute (1218.1 x 6779) ÷ 60 = 137,625 B. T. U.

B. T. U. used per internal horse-power per minute, 137,563 ÷ 630.07 = 218.33 B. T. U.

$$\text{Thermal efficiency, } \frac{33{,}000}{218.33 \times 778} = 0.1943 = 19.43 \text{ per cent.}$$

These percentages furnish the only proper means of judging of the efficiency of the turbine, or any other heat engine, as they take into account the superheat as well as the other heat in the steam. If they should be compared with similar percentages from reciprocating engines it will be found that they stand in the front ranl and are seldom surpassed.

TIES AND RAIL FASTENERS

A bullet on this subject has just been issued by the Bureau of Forestr, written by Herman von Schrenk, chief of the Department of Forest Products. The pamphlet, which is entitled "Bulletin No. 50," discusses very carefully American and European practice in regard to ties and rail fasteninngs, with special reference to treated timbers. The conclusions of the author in regard to the ties themselves may be summarized as follows:

1. It is not desirable to continue the present method of classifying ties as first class, second class, etc., and culls. Instead, an alternative classification is proposed, which substitutes a division into grades A, B, C, etc., each standing for a certain definite size. Such a classification would throw out the cull tie entirely.

2. It is not desirable to decrease the number of ties of the present breadth now laid per rail length, for the reason that even with an increased stiffness of rail a reduction in the bearing surface on the ballast is not warranted, in view of the fact that a larger bearing surface on the ballast is continually being sought for. In this connection it must be remembered that closer spacing of ties will not be possible, since a certain minimum space must be maintained to permit proper track work. In other words, increasing the breadth of the tie will necessarily mean a reduction in number per rail length.

3. Triangular ties are not desirable, and ought not to be used, because they give less bearing surface on the ballast rather than more.

4. Assuming that tie-plates are to be used on treated timbers of inferior grade, it is a waste of timber to require an 8-in. top bearing surface. It is, therefore, proposed that the present requirement be modified so as to admit timbers having a minimum of 6-in. top bearing surface. At the same time it is proposed that the bearing surface on the ballast be increased above 9 ins., to such an extent as may prove advantageous, depending upon the class of timber from which the ties are made. This would make what is termed a "half-round tie." This tie is really trapezoidal in form, is the standard of the Bavarian State railways, and is considered more economical of wood than any other. It has the following dimensions: Top bearing surface, minimum breadth, 6 ins.; bearing surface on

the ballast, 10-12 ins.; thickness, 7 ins.; length, 8 ft. or more.

5. The half-round tie is advantageous, from a mechanical standpoint, because it gives greater bearing surface per mile and a correspondingly more stable track when spaced at approximately the same distance now used with 7-in. x 9-in. ties.

6. The half-round tie is good for the lumberman, because in numerous instances it will make two ties where it would have been possible to make only one of the rectangular form.

7. The half-round tie is good for the forest, because it will encourage the cutting of large trees and the saving of small ones, and, further, will prevent the waste due to leaving many tops in the woods.

8. Taking all these matters into consideration, it would appear that the half-round tie is worthy of trial. Experiments are now under way to test the practicability of sawing large numbers of these ties. These experiments are being made in cooperation with the New York Central & Hudson River Railroad in the Adirondacks, with beech and birch, with the Santa Fé Railroad, in Texas and Arizona, with various pines, and with the St. Louis & San Francisco Railroad, in Missouri and Arkansas, and the Northern Pacific Railway, in Montana and Washington, with red fir and lodgepole pine.

The pamphlet then discusses the relative merits of spikes, screws, screw dowels, and recommends the two latter. The form of screw spike believed most desirable is one used on the French Eastern Railway. Holes are bored in the ties before the screw spike is inserted. In its favor Mr. von Schrenk claims that the screw spike is far preferable to the spike, and that the form suggested combines the advantages of ease of making, cheapness and longer service than the other types of screws, and, moreover, wears out the thread of the wood less than closer wound screws. Tests with this screw are now under way on several of the roads in the United States. It is suggested that these screw spikes be placed in two ways; four screws per tie and six screws per tie, according to the European model.

As the screw spike forms one of the proposed modifications of the present method of fastening, it is desirable that screws be tested on a broad-based rail without any plate, and also with steel and with wooden plates. In buying screw spikes, only such as show a sufficient strength of head should be accepted. Most screws hitherto used have not had strength enough to stand the vertical blow upon the head.

Recent tests show that the ratio of the holding power of the screw spike, as compared with the common spike, ranges from 1.87:1 for white oak to 4.63:1 for long-leaf pine. The result of lateral impacts shows that under the action of a side blow, such as comes on a rail, a common spike is pulled out from one-fourth inch to one-half inch, while the screw spike is not perceptibly started.

The writer also speaks very highly of the screw dowel, one of whose advantages is that it can be applied to ties in which the holes made by ordinary spikes have worn out.

The subject of tie-plates is also considered. For soft and inferior woods, Mr. von Schrenk recommends that, pending experiments with wooden tie-plates in this country, wherever possible, a flat steel tie-plate be used without spines or flanges on the base of the plate. The flat plates should preferably have a flange on the upper side, to hold the outer edge of the base of the rail. He also recommends that tests be made with wooden tie-plates, of the following dimensions: One-fourth, one-half and five-eighths inch in thickness, 6 ins. to 7 ins. long, and the width of the rail base under which they are to be used. These tie-plates should be made out of soft woods, and should be fully creosoted.

The report comes from Schenectady that the New York Central Railroad is planning to use 9 miles of track near that place for testing its electrical equipment.

CABLE BURN OUT AT ST. LOUIS

The St. Louis Transit Company passed through a trying experience June 3 and 4. The cables in the principal conduit leading from its Central power station at Park and Vandeventer Avenue were all temporarily put out of service by what appeared to be a general short circuit of a number of cables. Just how the trouble originated it is difficult to dtermine, but the effects were very disastrous, and resulted in depriving the company instanter of about two-thirds of its power. The greater part of the power from the Central power house (which is entirely a 500-volt direct-current station) is taken by underground conduit lines, extending from two to three blocks from the station, and is then fed to overhead feed lines. One of the principal conduit lines is that extending toward Grand Avenue.

About 6 p. m., Friday evening, June 3, flames began to issue from the tops of the iron pipes which cover the cable where they are run up the poles. About the same time the cover of one of the manholes was blown off, and flames burst out of the manhole. A short circuit, apparently of all the cables in that conduit, necessitated shutting off power from it entirely, until cables could be separated and tested out. As jumpers had been connected across between feeders at various points, the first thing done was to disconnect these jumpers, and also disconnect the cables at the terminal boxes, so that the short-circuited cables could be tested out. Richard McCulloch, who had two days previously come from Chicago to assume charge of the electrical and mechanical work of the St. Louis Transit Company, happened to be near the scene of the accident, and immediately took charge of the work of connecting temporary overhead cables in place of the burned out conduit line. Fortunately, several miles of 500,000-circ. mil cable were found in the city, and some equalizing feed wire, between the Central and Missouri Avenues power houses, was also taken down and put up as a substitute for the underground cables. The manholes were so hot that they could not be entered until 12 hours after the accident. Normal service was resumed on Sunday. Large crowds were carried to the World's Fair on Saturday, the day following, but, of course, with very crowded cars, owing to the necessary reduction in number of cars run. After cables had been disconnected and the conduit cooled down it was found that three cables were uninjured from end to end. The balance all showed defects. Later, upon disconnecting various sections of the cables, many uninjured lengths were found. Everywhere along the conduit lines leading from the station, evidences of great heat were found. Some cables which tested defective by voltmeter test soon after the accident, were later tested all right, and were put back into service. Heavy rains had been falling and there was considerable water in the conduits. Some of the cables were melted off in the manholes and near the terminal boxes. The cables are paper insulated.

The long-drawn out suit between the city of Toronto and the Toronto Railway Company has been terminated, an agreement having been signed by the solicitor for both parties and approved by the Board of Control of the city. The company acknowledges the right of the city engineer to regulate the speed of cars and to determine the service which shall be considered a proper carrying out of the contract. The company is by Sept. 1 next to double-track and extend the lines on six streets and avenues, and from the present terminus of the double tracks on Winchester Street, to and along five other streets. The company must also discontinue the use of open cars between Oct. 15 and May 1 of each year. All cars must be equipped with heaters by Nov. 15, and when necessary are to be heated until April 15. The city engineer, with the approval of the City Council, is to have the right to determine the speed and service necessary on all lines, and at what intervals the cars on all routes shall run.

UNIVERSAL SAW BENCH

The accompanying cuts illustrate the "Oliver" universal saw bench, which was designed primarily with the object to produce a saw bench that could be used equally well for the finest or coarsest work. The street railway jobbing shop is just the place for a saw bench answering this description. Sometimes the requirements are for a 4-in. plank to be sawn, and at other

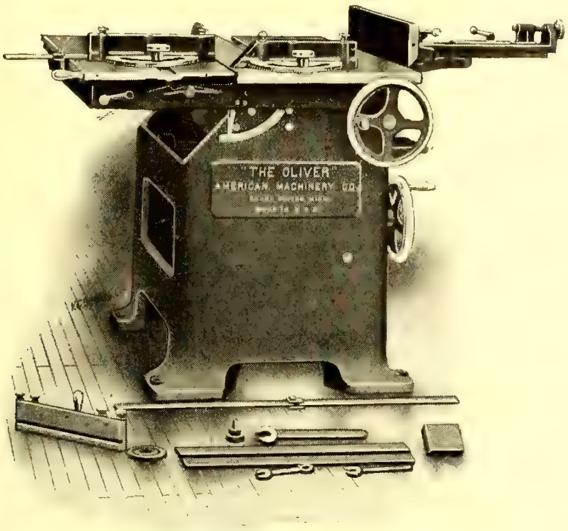


FIG. 1.—COMPLETE UNIVERSAL SAW BENCH

times mouldings and frames must be cut for window casings or other interior work about the cars.

In some places these saw benches are motor driven and mounted upon trucks, and the saw moved to the most convenient position suitable for the work in hand. It has been demonstrated many times that a power saw bench in close proximity

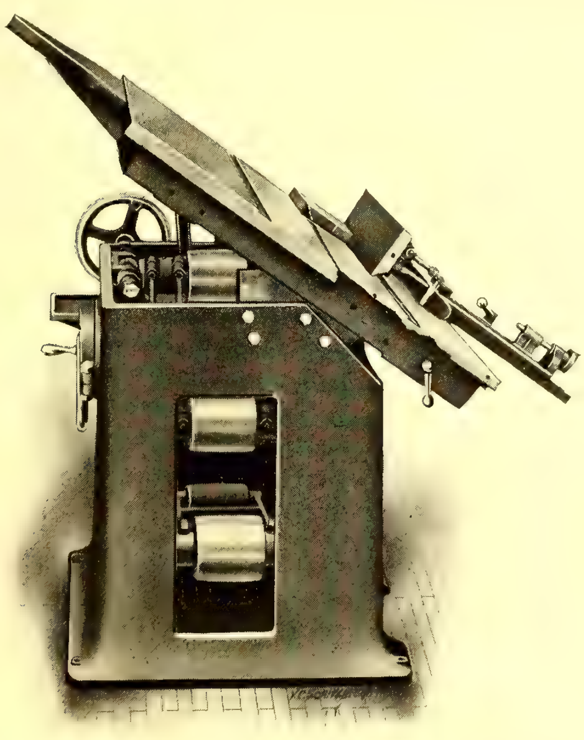


FIG. 2.—UNIVERSAL SAW BENCH, SHOWING TABLE SET AT AN ANGLE

to a car that is being repaired, or a new one that is being fitted up, will save much valuable time.

The complete machine with all the attachments in full view is shown in Fig. 1. Fig. 2 illustrates the machine with the table set at an angle, and the gages set at the proper angle for mitering the joints of a six-sided figure. This makes a compound angle ordinarily extremely difficult to get and figure out; but owing to the fact that the top of the table and the gages themselves are graduated with extreme accuracy, and the dial on the front of the machine (shown in Fig. 1) indicates the exact pitch of the table, work of this sort may be done instantly by any one.

Fig. 3 illustrates the method of ripping stock on a bevel

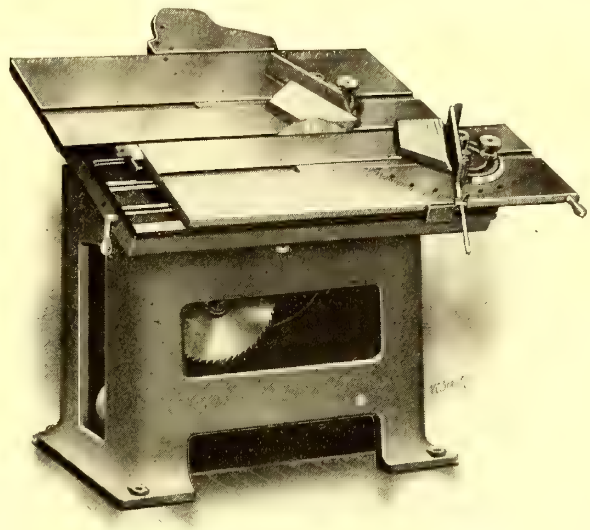


FIG. 3.—METHOD OF RIPPING STOCK ON A BEVEL

by having the gage upon the lower side of the saw; the weight of the work being operated upon is thus supported. The splitting fence shown in this view is capable of being adjusted in every conceivable manner and operated upon either side of the saw.

All the round parts of this machine have been ground upon a universal grinder, making the bearings, especially in the saw arbors, absolutely perfect. Cutter heads may be used upon the machine, as one arbor is especially long for that purpose. A rip-saw may be changed for a cut-off saw while the machine is in full motion, and the table tilted and held at any particular angle without fastening. The sliding table may be locked and the auxiliary gages used instead; or, with the sliding table in use, work 36 ins. wide may be cut off.

This machine is designed for a variety of drives. The countershaft may be set in the rear of the machine or underneath. The motor drive may be either attached to the machine itself, or the motor may be set upon the floor in any convenient position, or secured to the ceiling underneath. The compound idler jack used for taking care of the slack in the belt operates upon both the slack and the tight side of the belt, giving the machine extraordinary pulling power.

Saws from 8 ins. to 20 ins. in diameter may be used with this machine. Its weight is about 2000 lbs., and the size of table 36 ins. x 44 ins.

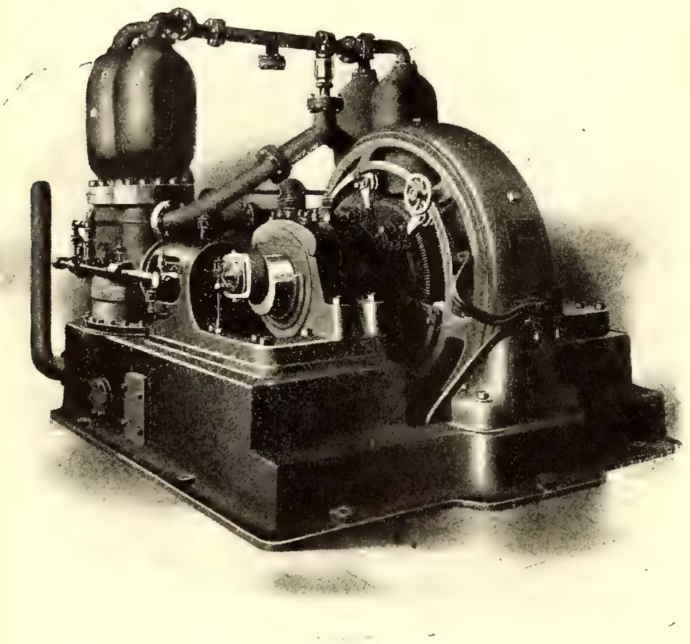
INSTRUCTION MEETINGS ON THE BOSTON & NORTHERN STREET RAILWAY

About once every two months the conductors and motormen of the several divisions of the Boston & Northern Street Railway Company are called together in general meeting—the night crews during the day and the day crews in the evening—and are addressed by superintendents or foremen upon some subject pertaining to the good of the service. This formal address sometimes is supplemented by having conductors and motormen read papers on special subjects. The meetings have been held for some time, and while attendance is in a sense voluntary the company has found that the interest of the men in the meetings is keen and that they are well attended.

HIGH-SPEED MOTOR-DRIVEN PUMP

The operation of pumping machinery by electric motors offers many obvious advantages, such as the centralization of the power plant, elasticity of extension of the system, high efficiency and small first cost and small expense for attendance.

Electric-driven pumps, however, have had one draw-back, which, while not serious, had, nevertheless, to be taken into account. This was the necessity of toothed gearing, belts or



HIGH-SPEED MOTOR-DRIVEN PUMP

other devices to transfer the power from the rapidly revolving motor shaft to the slow-moving crank shaft of the pump.

In the pump shown in the accompanying illustration these objectionable features have been eliminated by the simple expedient of connecting the pump plungers to cranks mounted directly upon the shaft of the motor. This pump has a capacity of about 250 gals. per minute, against 1000-ft. head when running at a speed of about 300 revolutions. So carefully have the internal parts of the pump been designed, however, that its mechanical efficiency is over 93 per cent, approximating closely that of the highest types of large steam pumping engines. The pump is of the duplex type; the cranks at the opposite ends of the motor shaft being set at right angles to each other. The plungers are of the outside packed pattern, and the two plungers of each pump are connected by side rods. The plungers are 3½ ins. in diameter, and have a stroke of 5½ ins. The pump and motor are mounted upon a rigid box-girder frame, and the unit is self-contained and occupies a relatively small space. It contains many novel features of construction, and the most careful attention has been given to the design of the internal parts as well as to the running parts and oiling devices.

It is claimed that this type of pump, which has only lately been introduced, has salient advantages never before attained, including simplicity of construction, small space requirements, cheapness of installation and attendance. An examination of the following figures, which were obtained in a carefully conducted test, will give an excellent idea of the efficiency of this pump. The pumps are built by the Blake & Knowles Steam Pump Works, of New York, in capacities of from 200 gals. to 4000 gals. per minute, and for heads varying

TEST OF HIGH-SPEED DUPLEX PUMP 3½-IN. PLUNGERS, 5½-IN. STROKE, DIRECT-CONNECTED TO 100-HP, SIX-POLE 200-VOLT SHUNT MOTOR

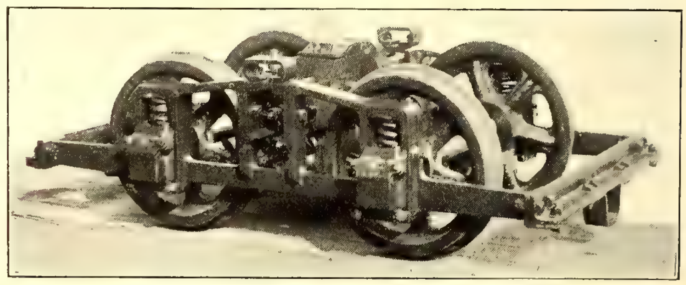
R. P. M.	Motor Input, Watts	Pump		Pump, H. P.	Motor Pump	Efficiencies	
		Gallons Delivered	Pressure, Lbs.			Motor Alone	Pump Alone
					%	%	%
280	28,800	237	110	32.63	78.	86.5	90.1
280	40,600	237	215	48.94	82.2	89	92.36
280	52,550	235	321	62.25	84.4	90.1	93.66
280	60,200	234	425	74.53	84.3	90.9	92.74
309	58,800	232	496	71.79	83.3	----	----

from 100 ft. to 2000 ft. One of these pumps, operated by a direct-current motor, will be exhibited in the space of the General Electric Company, at the St. Louis Exposition.

A NEW TYPE OF INDUSTRIAL LOCOMOTIVE

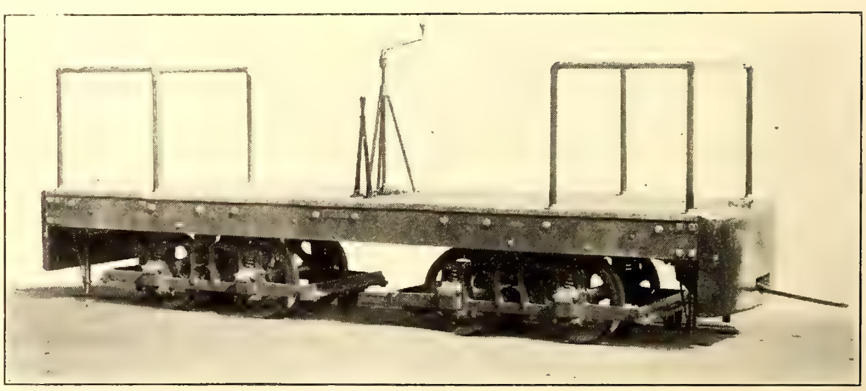
The interesting electric locomotive shown in the accompanying cut was lately delivered to the Whitin Machine Works, of Whitinsville, Mass., by the builders, the J. G. Brill Company. The locomotive was ordered through the General Electric Company, of Schenectady. It is mounted on what are probably the smallest pair of double trucks ever built. The wheel base is only 2 ft. 9 ins., and the wheels 22 ins. in diameter. The track gage is 2 ft. The length of the locomotive over the bumpers is 18 ft., and the width over the sills 4 ft. 3 ins. The bumpers are cast in a single piece, with the face 24 ins. wide, and thickness at center 8 ins. Each bumper weighs 2300 lbs.; the total weight of the locomotive without motors is 13,000 lbs. Four G. E. motors, CB-14, are to be used.

Besides being able to draw a long string of cars the locomo-



LIGHT ELECTRIC LOCOMOTIVE TRUCK

tive may be used for carrying heavy materials. Two-inch pipe railings enclose the ends, and sockets are provided for uprights to support a canopy. The sand-box levers and alarm gong are



DOUBLE-TRUCK ELECTRIC LOCOMOTIVE FOR INDUSTRIAL WORK

placed at the center, near the brake shaft. The side sills are 4½ ins. x 9 ins., plated on the outside with ½-in. plates. The bolsters are 6 ins. x 9 ins., and there are eight crossings, 3¾ ins. x 5¾ ins. The height from rail-heads to underside of sills is 24 ins.

FINANCIAL INTELLIGENCE

WALL STREET, June 8, 1904.

The Money Market

Return of currency from the interior of the country continues in exceptional volume, this being the principal factor in the present money situation. It has been enough to offset, with the help of the Japanese gold, estimated at $30,000,000, which has arrived during the last two months, the export of over $60,000,000 of gold to France. Surplus bank reserves were reported last Saturday in round numbers at $31,000,000, which compares with $32,000,000, the high point of the season on Feb. 27. The bank position has been helped considerably by reduction in loans which has amounted in three weeks to $25,000,000, the decrease partly representing loans made by institutions outside the Clearing-House taking the place of similar credits previously furnished by the member banks and partly the return of capital borrowed by syndicates underwriting new securities issues, released as the securities have been disposed of to investors. The outward movement of gold to Paris has ceased, owing, not to any change in our money conditions, but to the indications that the French demands have for the time being been satisfied. Sterling, however, has continued to advance until it is now fully a half-cent higher than when gold was going out to Paris last month. If this rise keeps on a little further, it will become profitable to ship specie to London, and in the opinion of banking experts such a result is reasonably probable in the near future. Be this as it may, there need no longer be any doubt that we shall have easy money from now on until crop-moving time. The accumulation of idle capital at this center, inasmuch as it is a reflection of declining trade, may be expected to continue, and it bids fair to equal whatever gold withdrawals there may be across the water. Barring the applications for credit from corporations having new securities to float, borrowing requirements have sunk exceedingly low, and this, as much as the excess supply, tends to keep money rates down. Quotations for the use of money have returned to the low level at which they stood when gold exports set in a month and a half ago. Call funds on the Stock Exchange are easily obtainable at 1 and 1¼ per cent. For sixty days the figure is 2½ per cent, and for six months 3 to 3¼ per cent.

The Stock Market

Except for a few individual stocks, for the most part outside of the usually active list, the market has remained motionless during the last two weeks. It has been altogether the stupidest and most unprofitable period that Wall Street has known in recent years. Prices have apparently reached a level where the desire to buy and the desire to sell are equally restricted, and where there is not sufficient impulse in either direction to cause even the ordinary fluctuation of a dull trading market. Of the individual movements the most noteworthy have been the strength of the anthracite coal share, Reading and Ontario & Western more particularly, and on the other hand, the weakness of a number of the minor railroad issues for which the market is always extremely narrow. Earnings are better on the coal roads than anywhere else, and it is commonly appreciated that the anthracite industry furnishes the one conspicuous exception to the depression in general business. These are substantial reasons why this group of stocks should be selected as favorite objects for speculation for the rise. It is confidently believed, besides, that the enormous purchases of Ontario & Western within the last few days foreshadow an announcement of the dissolution of the voting trust, which will place the road in a position to be bought up by one or another of the large systems which are seeking an entrance into New York City. The decline in the various minor specialties expresses the view that these are the roads that are likely to suffer most by the falling off in railroad traffic. Attention was drawn more seriously to this feature of the situation by the default of the Detroit Southern Company's bond interest, made known ten days ago. Doubtless the inferences from this episode have been drawn too indiscriminately; nevertheless, it is felt that other roads of a similar rank are in a position where, if earnings were to fall off any further, there would be a question as to their ability to maintain a surplus. Between these conflicting influences, the general market has moved confusedly, with no real tendency either way. The outcome of the crops is the main thing awaited before opinions as to the future can be ventured with safety. Then there are the presidential nominations, which are due within a month's time, to still further increase the disposition to do nothing. According to all the evidence now present, the dull spell is likely to continue for a few weeks longer anyway.

The local traction stocks have not attracted nearly the same degree of speculative interest that they did a fortnight ago. The whole group has held firm, but has not advanced; dealings have fallen off to a comparatively insignificant volume. Professional sentiment is still favorably inclined, especially toward Brooklyn Rapid Transit, on account of its large summer earnings. But until the pools in these stocks take the initiative again, the speculative coterie is not averse to leaving it alone.

Philadelphia

Dealings in Philadelphia have been quite uneventful during the two weeks period. The market has partaken somewhat of the firmer tone displayed in speculative circles elsewhere, but prices have not varied materially from what they were a fortnight ago. Considerable strength has again appeared in Philadelphia Traction, which, after dipping to 95½, rose to 96 and was freely bought around that figure. Philadelphia Electric has also been very active, selling up to 6½ for the certificates on which $8.75 has been paid in. Philadelphia Company common improved from 38 to 38⅝ and the preferred from 44 to 44½. Union Traction was bid up from 49⅞ to 50⅛. One hundred shares of Philadelphia Rapid Transit changed hands at 12⅜, or ¾ under the last previous sale. Odd lots sold of American Railways ex-dividend at 43, of Fairmount Transportation at 22½ and of Consolidated Traction of New Jersey from 65 to 65¾.

Chicago

It is a very long time since the Chicago traction market has been as active and interesting as it has during the last two weeks. The Federal Court ruling, leaning in favor of the traction companies in the long and tedious controversy over the ninety-nine-year franchise clause, is the thing that has given the security dealings their great impetus. Recoveries in prices, especially among the stocks of the surface roads, have been little short of sensational. City Railway, which sold in the 150s only a few weeks ago, has risen to 180, about 1000 shares changing hands between the latter figure and 164, at which the movement began ten days since. North Chicago, on purchases of about 500 shares, rose 10 points from 70 to 80. West Chicago is up 4 points on sales of 800 shares, while heavy buying of Union Traction, centering in the New York market, carried the common stock up from 5½ to 7. Metropolitan Elevated issues have benefited by the outburst of buying in the street railway securities, the common advancing from 17½ to 21, and the preferred from 48 to 53½ on active trading. There was little doing either in Lake Street, which sold at 3, or in Northwestern, which went at 16½ and 16. South Side was a feature, however, declining from 91 to 89 on heavy selling caused by the announcement that a new issue of bonds might be made to take the place of the $7,500,000 new stock recently authorized. The decline in the market price shows that the bond proposition is decidedly unpopular.

Other Traction Securities

Boston Elevated has been the strong feature of the recent trading on the Boston Exchange, advancing from 140½ to 142¾, the highest price of the year. Five hundred shares sold between 142 and 142¾. Massachusetts Electric preferred rose from 72 to 73, but later sold at 70, ex-dividend. The common was neglected around 18. West End common changed hands between 90 and 90½, and the preferred at 111⅜. The directors of the United Railways Company, of Baltimore, voted to suspend the interest on the income bonds, thereby fulfilling the expectation that the road had been seriously hurt by the destruction of property during the fire. The recent weakness of the company's securities finds in this a satisfactory explanation. The income bonds broke 4½ points more to 43¾, rallied sharply to 47½ and then eased to 45½ again. The stock made a new low record at 5¾, 600 shares selling around that figure. The general 4s, after a half-point decline to 89½, rallied to 90. Other Baltimore transactions for the two-weeks' period included Pittsburg Traction 5s at 113, Atlanta Street Railway 5s at 106 to 106½, Virginia Electric Railway & Development 5s from 94 to 95¼, Anacostia and Potomac 5s at 97, Macon Street Railway 5s at 91, Lexington 5s at 100, City & Suburban, of Balti-

more 5s at 112½, and Baltimore City Passenger 5s at 105⅜. On the New York curb there has been very little feature. A few sales of Interborough Rapid Transit were recorded at 112, and Washington Railway & Electric 4s jumped up from 76½ to 78.

Cincinnati Street Railway gained strength in Cincinnati last week. About a thousand shares changed hands at between 129 and 140, the latter the highest price in many weeks; Cincinnati, Newport & Covington preferred sold at 85½, and several good blocks of the first 5 per cent bonds at 109½. Detroit United advanced to 61 on small sales. A small lot of Cincinnati, Dayton & Toledo Traction came out at 20.

Cleveland Electric was slightly stronger at Cleveland last week, a number of sales being made at 71¼. Northern Texas Traction sold at 35. A bid of 3¾ was made for the annual dividends on this security. At present it is on a 3½ per cent basis and the bid would indicate that investors think it will go to 4 per cent when the next dividend becomes due. Aurora, Elgin & Chicago 5 per cent bond receipts sold at 75.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with two weeks ago:

	Closing Bid May 24	Closing Bid June 6
American Railways	44½	*43
Aurora, Elgin & Chicago	a14	a13½
Boston Elevated	140½	142¾
Brooklyn Rapid Transit	46⅜	47
Chicago City	156	170
Chicago Union Traction (common)	5½	a6¾
Chicago Union Traction (preferred)	29	28
Cleveland Electric	71	71¼
Consolidated Traction of New Jersey	64¾	65
Consolidated Traction of New Jersey 5s	107	105
Detroit United	61⅜	60⅞
Interborough Rapid Transit	112	111¾
Lake Shore Electric (preferred)	a35	a40
Lake Street Elevated	3	3
Manhattan Railway	143¼	144
Massachusetts Electric Cos. (common)	18	18¼
Massachusetts Electric Cos. (preferred)	71	*70
Metropolitan Elevated, Chicago (common)	16	21
Metropolitan Elevated, Chicago (preferred)	48	52¾
Metropolitan Street	110⅛	110⅝
Metropolitan Securities	77	75
New Orleans Railways (common)	8¾	8¼
New Orleans Railways (preferred)	26⅝	26¼
New Orleans Railways, 4½s	74	74
North American	81	81
Northern Ohio Traction & Light	13½	12
Philadelphia Company (common)	37⅞	38⅜
Philadelphia Rapid Transit	12½	12¼
Philadelphia Traction	95⅝	95¾
St. Louis (common)	13	13¼
South Side Elevated (Chicago)	91	89
Third Avenue	116	116
Twin City, Minneapolis (common)	94½	93¾
Union Traction (Philadelphia)	49⅝	50
United Railways, St. Louis (preferred)	57	57
West End (common)	90½	90
West End (preferred)	111	111

a Asked.

Iron and Steel

Proof that the demand for iron has fallen off heavily within the last month is contained in the figures of the "Iron Age" published to-day. While the total output of pig was 20,000 tons less in May than in April, stocks on hand increased 100,000 tons. This is the first time in several months that a surplus has been shown, and being as large a surplus as it is, it indicates a rather serious state of overproduction. Quotations are as follows: Bessemer pig $13.25, steel $23, steel rails $28.

Metals.

Quotations for the leading metals are as follows: Copper 12¾ and 12⅞ cents, tin 27¾ cents, lead 4⅜ cents, and spelter 5 1-16 cents.

AN ELECTRIC RAILWAY BASEBALL LEAGUE

J. O. Wilson, general passenger agent of the Cleveland & Southwestern Traction Company, of Cleveland, Ohio, has organized a baseball league, which promises to prove a source of profit to his company. The road touches eight important towns, and in six of these—Wooster, Medina, Grafton, North Amherst, Elyria and Wellington—Mr. Wilson has organized teams. A schedule of regular games has been arranged, under which there are two games a week on each of the two divisions of the system. All of the teams are equipped with suitable uniforms, and the company has agreed to furnish free transportation to the players. The company does not share in the profits of the teams, but expects to derive its revenue through the increased traffic through the attendance at the games. Arrangements have been made by the company with the Cleveland papers and with the local papers in all the towns to give the games prominence, and to show the averages of the teams the same as is done with the regular leagues, and the company further assists in the advertising by means of car signs. Thus far the venture has proved very satisfactory. The rivalry between the various towns has already become quite keen.

IS THE BIG FOUR TO ADOPT ELECTRICITY OUT OF CLEVELAND?

It is stated that M. E. Ingalls, president of the Big Four Railway, has ordered plans prepared for the substitution of electric locomotives for steam locomotives in hauling passenger trains in and out of the Union passenger station at Cleveland. The station is an old one, and poor ventilation, coupled with coal soot, adds greatly to the discomfort of passengers.

THE CLEVELAND LOW FARE DECISION

In the STREET RAILWAY JOURNAL of June 4 brief mention was made of the decision of the United States Supreme Court sustaining the United States Circuit Court at Cleveland in finding for the company in the low-fare street railway case. The case had its origin in 1898, when Robert E. McKisson was Mayor of Cleveland. At that time the City Council passed an ordinance requiring the local company to give four-cent fare on two of its leading lines. The case was carried from court to court, until finally it reached the Supreme Court. The decision as handed down by the Supreme Court was read by Justice White. In the franchise ordinance passed by the City Council in 1879 the city reserved the right to reduce the fare on the Kinsman Street line. In 1880, 1883, 1885 and 1893 the city passed extension and consolidation ordinances involving that line and fixing the fare at five cents, with no reservation to reduce it. These ordinances provided for a single fare over the entire system of what was then the Cleveland City Railway Company. But the ordinance of 1898, taking advantage of the power reserved by the ordinance of 1879, fixed the fare on Kinsman Street at four cents.

In his opinion, Justice White declared that the consolidation and extension ordinances passed in 1885 and thereafter, fixing the fare at five cents, superseded the ordinance of 1879. They were binding contracts and could not be impaired by the four-cent ordinance of 1898. Even according to Ohio decisions the ordinances passed in 1885 and afterward were binding contracts. While Sec. 2502 of the Ohio Statutes provides that a company shall not be released from any obligation or liability imposed by a grant, Justice White said it had been held in the case of Clement vs. Cincinnati that a contract between a city and street railroad company may be modified in good faith for the better accommodation of the public.

The court reasoned that the City Council meant to allow the railroad company to charge full five-cent fares because of the longer rides and transfers that came in with the extensions and consolidations. It then declared the ordinance of 1898 void, because it impaired contracts entered into by the city and street railroad companies after the passage of the 1879 ordinance. The same decision, Justice White said, applies to the suit brought by the Cleveland Electric Railway Company to prevent reduction of the fare on the Euclid Avenue line to four cents under the ordinance of 1898.

Judge Sanders, the attorney for the railway company, in speaking of the decision, stated that by the decision the Supreme Court has again affirmed that street railway ordinances, when accepted, are contracts written for the protection of the Federal Constitution, and that so long as the ordinance by its terms remains in force, it is not within the power of a City Council to change its terms or impose new conditions without the consent of the railway company. Judge Sanders claims that the decision will make it impossible for the city to enforce the so-called McKenna or "zone ordinance," which was passed by the City Council some months ago. This ordinance undertook to establish a rate of three cents over a large portion of the system of the Cleveland Company. This case is now in litigation.

SALE OF YOUNGSTOWN & SOUTHERN RAILWAY DENIED

J. H. Ruhlman, secretary and treasurer of the Youngstown & Southern Railway, writes that the statement that the control of the Youngstown & Southern Railway had passed to Eastern interests is erroneous. At the recent annual meeting of the stockholders all the directors were re-elected with the exception of R. L. Andrews, who resigned as general manager and director of the company. The contract for the construction of the road, as mentioned in the last issue of this paper, is in the hands of J. G. White & Company, of New York, who will build the line after plans and specifications made by the engineer of the company, E. Gonzenbach.

THE LEHIGH VALLEY REORGANIZATION

Bondholders of the Philadelphia & Lehigh Traction Company, representing $1,400,000 of the $1,900,000 bonds outstanding, met at Philadelphia Friday, May 3, to hear and discuss the plan presented by the committee for the reorganization of the company. The plan involves the merger under one corporation of the Lehigh Valley Traction Company, the Philadelphia & Lehigh Valley Traction Company, the Allentown & Slatington Street Railway Company, also controlling electric light companies, and the Bethlehem & Nazareth Street Railway Company. A new first mortgage is to be created on the united system for $4,600,000 to take up the present underlying $3,000,000 of Lehigh Valley Traction Company bonds (of which $2,770,000 are outstanding), and $1,830,000 of the bonds is to represent new cash to be used by the company. Of the new capital more than one-half will be spent on the improvement of the system, including the building of a new power house, a new electric light plant and machine shop. The balance of the cash is to pay preferred claims, receivers' certificates and to redeem securities pledged as collateral.

There will be a second mortgage (or more likely deferred bonds secured by a first mortgage) aggregating $2,000,000. These will be distributed among the present bondholders of the various lines, including the Philadelphia line. For the balance of their bonds they are to receive preferred stock. General creditors and preferred stockholders are to receive preferred stock for their claims. Common stock of the Lehigh Valley Traction Company receives common stock of the new company. A syndicate has been formed which will underwrite all assessments and relieve the security holders. The total amount of the underwriting is $1,830,000.

The outcome of the discussion was the adoption of a resolution approving the plan, but not to be binding upon any bondholder until after fuller examination he has actually signed the reorganization agreement.

SEVENTY-FIVE MILES AN HOUR ACCOMPLISHED BY ELECTRIC SLEEPING CAR

On Friday, May 20, Lafayette, Ind., enjoyed the distinction of receiving the first visit of the only electric sleeping car now in active service. The car in question is owned by the Holland Palace Car Company, and it was accompanied by its inventor, Harris F. Holland, and a party of railroad officials, including C. C. Reynolds, general manager of the Indianapolis & Northwestern Traction Company, with members of his family from Lebanon; F. D. Norville, general agent of the road at Indianapolis; J. W. Chipman, manager of the Indianapolis & Eastern Traction Company; Guy J. Jeffries, superintendent of the Indianapolis & Northwestern Traction Company; Charles N. Wilson, general manager of the Columbus Greensburg & Richmond Traction Company; Rev. Alexander McFarran, pastor of the First Presbyterian Church of Lebanon; Joseph W. Selvage, general manager of the Holland Palace Car Company; L. W. Henley, of the Indianapolis "Star," and D. S. Johnson, representing "McClure's Magazine," who is gathering material for a special article on interurban development in Indiana.

It is claimed that the car in its run from Indianapolis to Lafayette broke all interurban transit records, a speed of 75 m. p. h. having been attained on a 5-mile tangent between Zionsville and the Marion County line. The trip was made for the primary purpose of testing apparatus and clearances, and resulted to the entire satisfaction of all concerned. The car was used in the excursion planned by the Indianapolis & Northwestern from Indianapolis to connect with the Manon excursion from Lafayette to Chicago May 21. It was the first occasion in history of a sleeping car being engaged in accommodating regular traffic on an interurban line. The Holland Company management has tendered the use of the "Frances" to Prince Pu Lun for his contemplated trip to Lafayette.

INDEPENDENT SYSTEM SEEKS FRANCHISES IN BALTIMORE

The Maryland Electric Railways Company is once more seeking the right to operate a street railway line in Baltimore. An ordinance granting the company authority to lay tracks on streets in every section of the city has been introduced in the Second Branch of the City Council, and referred to the Committee on City Passenger Railways. The ordinance differs from its three or four predecessors, in that it covers more streets and pledges the company to pave from curb to curb the streets on which its tracks are laid. This is in addition to an annual park tax of 9 per cent of the gross receipts from lines within the city limits and an annual franchise tax to be fixed by the Board of Estimates.

The ordinance was taken to the City Hall by James B. Guyton, a former member of the second branch of the Council. Mr. Guyton and W. Irvington Cross are attorneys for the company. Mr. Guyton said the concern was a new one, composed almost entirely of Philadelphia, New York and other Northern capitalists. "It is a bona fide concern," said Mr. Guyton, "and the passage of the ordinance will mean the expenditure of $6,000,000 or $8,000,000 in Baltimore for construction, street paving and other work."

Mr. Guyton said that there was also some local capital in the new company.

SERIOUS ACCIDENT ON THE LAKE SHORE

One of the worst accidents in the history of electric railroading in the central West occurred on the Lake Shore Electric Railway near Norwalk, Ohio, Thursday, June 2. An eastbound limited car collided, head-on, on a curve with a westbound express car. Both cars were going at a very high rate of speed. The floor framing of the express car was higher than that of the limited, and it swept over more than half the length of the limited before it could be brought to a stop. Six passengers in the smoking compartment of the limited were crushed, five of them being killed almost instantly. One man on the express car was also killed. Only one person was taken out of the smoking compartment alive, and he is in a precarious condition. Sixteen other persons were more or less injured.

The inquest into the accident would seem to indicate that the motorman and conductor of the express car were to blame. The accident occurred at a curve a short distance west of Siding 66 on the main line. The limited had orders to run through to Berlin Heights, where it was to pass the westbound limited and a regular car, nothing being said about the express car. The express cars do not run a regular schedule, for the reason that they are frequently laid up in loading bulk freight, but they receive orders as extras, and the rules provide that they must clear regular cars by five minutes. The testimony at the inquest indicated that the motorman of the express had attempted to make the 6 miles from Berlin Heights to Siding 66 with a margin of time of only seven minutes. The motorman of the express was quite severely injured, and his testimony has not yet been taken.

An interesting point in connection with the wreck was the fact that none of the trucks of either car left the track, and the cars were taken to the shop on their own wheels. This is accounted for by the heavy weight of the motors and the low center of gravity of a heavy car of this type. The limited was making 50 miles an hour and the express 45 miles an hour when the collision occurred. This is the first time that a passenger has been killed or badly injured in the history of the Lake Shore Electric or the four roads which were consolidated in forming this property.

CHANGES IN THE LEGAL DEPARTMENT OF THE NEW YORK CITY RAILWAY COMPANY

The work of the law department of the New York City Railway Company has reached such proportions that on and after July 1, 1904, it will be divided between two departments: one to be known as the "Trial Department," for the preparation and trial of accident cases; the other to be known as the "General Law Department," for the remainder of the company's legal business.

The general law department will continue to be in charge of the general solicitor of the company, Henry A. Robinson. James L. Quackenbush, of Buffalo, will, after July 1, have charge of the trial department, with the title of "General Attorney," and Ambrose F. McCabe will be his chief assistant.

The company has issued a notice to its employees that after July 1 the chief investigators and all other employees of the company whose work is in connection with the preparation and trial of accident cases, will report to the general attorney. All other employees of the legal department, including those connected with the appeal department, will continue to report to the general solicitor.

A TROLLEY INFORMATION BUREAU

A central office for supplying information in regard to the trolley trips possible in the neighborhood of Boston has been opened at 365 Washington Street, in that city, by Robert H. Derrah. Mr. Derrah was one of the pioneers in the trolley excursion business, and was the originator of the Boston and New York trolley trip, over which he personally conducted a party several years ago. At this office itineraries and descriptions of trolley trips in all parts of Massachusetts can be obtained. During the summer Mr. Derrah will also personally arrange for a number of special trips, of one to three or more days in length. The first of these was held on June 6 and 7, when a party left Boston early on June 6, going to Springfield, Holyoke, and Mount Tom, Northampton and Greenfield.

NORTHWESTERN TRACTION COMPANY WINS SUIT

Judge Baker, of the United States Circuit Court, has made a ruling in the case of the city of Crawfordsville and the Consolidated Traction Company against the Indianapolis & Northwestern Traction Company favorable to the latter. The rulings were on demurrers and in favor of the Northwestern in every particular. The decision gives the Indianapolis & Northwestern Traction Company the legal right to the streets of Crawfordsville for the use of the company's tracks as against the claim of the Consolidated Traction Company, which is composed mostly of Crawfordsville capitalists. The ruling fixes the legal status of both companies.

The court held that the franchise granted to the Consolidated Company was unconstitutional, because by such terms a monopoly was created in favor of the Consolidated Company. The right of the Indianapolis & Northwestern Company to occupy the streets for a street railway line is sustained and the restraining order heretofore issued against the Northwestern Company at the instance of the Consolidated Company, together with all collateral orders made under such proceedings, is dissolved and set aside, and the Indianapolis & Northwestern Traction Company is authorized to proceed with the construction of its lines in Crawfordsville.

The case has been in the court for more than a year. The Northwestern Company was first granted a franchise by the city. Later the City Council rescinded its action and granted a similar franchise to the Consolidated Company. The Northwestern Company paid no attention to the later action of the Council and at an unexpected time attempted to lay tracks within the city limits. This precipitated a riot and the police and fire departments were called to suppress disorder. Later the company succeeded in entering and laying its tracks in the midnight hours. At this point the local court granted an injunction against the Northwestern Company. Upon an appeal to the Federal Court the city of Crawfordsville withdrew from the suit, but at the order of the court it was continued a party to the suit. It was the purpose of the city to grant a franchise to the Consolidated Company and require all other companies entering the city to use the Consolidated Company's tracks.

HIGH-SPEED STEAM-LOCOMOTIVE TESTS IN GERMANY

A recent report from United States Consul-General Mason, in Berlin, Germany, gives some additional particulars of the high-speed experiments with steam locomotives on the Berlin-Zossen line, referred to in a recent issue of this paper. The electric motor trials were completed, as will be remembered, during the autumn of last year, with the net result that the two motor cars obtained speeds of 117.32 m. p. h. without injury to the car or motor, or discomfort to passengers.

The track having been carefully examined and the deteriorating effects of the electric-motor-car trials noted and repaired, the experiments with steam locomotives began about the end of February and were continued until a few days ago. The tests included engines of four different types, each built by a different German firm, or company. In order to make the conditions as nearly as possible those of actual service, the load consisted of six vestibule cars of the standard European express type, weighing about 30 tons each, one of which had been equipped with instruments to measure and record speed, oscillation, and draw-bar pull. Each engine was first tested with the full train, and another series of trials made with three cars only.

The first trials were those of a locomotive built by the Egestorf Machinery Company, at Hanover. It is of the same general model as the "Atlantic" type in the United States—that is, carried on ten wheels, viz., the four-wheeled forward truck, then the two pairs of coupled drivers, and a pair of trail wheels under the cab to sustain the afterportion of the boiler, which is of extraordinary size and large heating surface. This machine, with a train of six cars, attained an average speed of 111 km (68.97 miles) per hour throughout the run, and with three cars a pace of 79.41 m. p. h.

The second machine of Grafenstadt construction is a compound locomotive, likewise of the Atlantic type, in which the cylinders are placed far back and the piston head geared by a short connecting rod to the crankpin of the rear driving wheel. This engine made with the full train a run of 118 km (73.32 miles) and with three cars 76.42 m. p. h., and showed good results as to fuel and steam consumption.

The third contesting machine was an eight-wheeled compound engine equipped with Schmidt's device for superhetaing steam. It was designed by Baurath Garbe and built by the well-known firm of A. Borsig, at Tegel, near Berlin. This engine was not built specially for these trials, but is one of a number of the same type which have been constructed by the same firm and supplied for service to the royal Prussian railway administration. The driving wheels are 78 ins. in diameter; heating surface, 963 sq. ft.; surface of superheater, 288 sq. ft.; normal working pressure, 12 atmospheres (176.4 lbs.) to the inch; and weight, when ready for service, 120,051 lbs. This engine attained with the full train 128 km. (79.53 miles) and with three cars a speed of 84.5 m. p. h., the energy developed being about 2000 hp.

The fourth competitor was an engine of a wholly original type, designed by Chief Engineer Wittfeld, of the Prussian railway administration, and built by Henschel & Sons, of Cassel. Before being brought to Berlin it was tested on one of the State lines near Göttingen, and since the trials were finished it has been dismantled and shipped for exhibition at the World's Fair in St. Louis. Its most striking peculiarities are that it is so built that the engineer stands in front within a glazed cab like the motorman of an electric car, and both engine and tender are covered with a sheathing of sheet iron with glazed windows, and so arranged as to provide a covered passage from front to rear. The engine carried on twelve wheels, viz., a four-wheel bogie in front and rear and between them the two pairs of drivers, coupled in the usual manner. This arrangement is for the purpose of securing a smooth steadiness of motion despite curves or irregularities of track surface. The engine is of the compound type, the high-pressure cylinder being located midway between the sideframes, where its piston connects with an inside crank on the forward driving shaft. The low-pressure cylinders, of which there are two of equal diameter, are external and drive two outside cranks set parallel to each other and on the same side of the axle 90° from the inside crank that connects with the high-pressure cylinder. This secures an even balance between the reciprocating parts, from which important results have been expected. The boiler is, from the European standpoint, enormous, having 2,766 sq. ft. of heating surface, and it is calculated that, with a coal consumption of 2.5 lbs. per hp-hour, it will develop about 1775 hp. It weighs 76.8 tons and cost $23,800. The tender weighs 47 tons and carries 7 tons of coal and 4400 gals. of water, which it is equipped to take up at speed. At the recent tests this engine slightly surpassed all its competitors, attaining a speed of 128 km (79.53 miles) per hour with six cars and 85.12 miles with half that number. While, therefore, its speed with the full train was the same as that of the Borsig superheater, the Cassel machine did 1 km (0.62 mile) better with the light load, a difference so slight that it might easily have been influenced by varying conditions of wind.

This, in substance, is what is now publicly known concerning the results of these most interesting trials. The comparative advantages of all the contesting engines—their relative consumption of fuel and steam, their general efficiency at high velocities, and their smoothness of movement on curves of different radius—will be known only to the government experts until the whole mass of notes and records made during the experiments and subsequently on other portions of the line shall have been formulated and published.

Among the incidental demonstrations made by the tests was the fact that with the pneumatic brakes now in use on German vestibule cars it required a full minute and a distance of 1093 yards to stop a train of six cars running at 85 miles an hour.

Pending the preparation and issue of the official report on which the ultimate conclusions will be based, a Berlin engineer, Dr. Reichel, has given some comparisons of cost between steam and electric traction from the standpoint of German practice and illustrated by the recent experiments with both motive forces. A steam train of five cars and a standard locomotive weighs 330 tons, seats 168 passengers, and uses at full speed 1400 hp. The electric train of one motor car and four trail cars weighs 260 tons, seats 180 passengers, and utilizes 1000 hp. Each train and engine costs for initial construction about $100,000. The operating cost of the steam train is fixed by Dr. Reichel at 12½ cents per 100 seat km, and 11½ cents, or 1 cent cheaper, for the electric train.

THE TERMS FOR OPERATING OVER THE NEW BRIDGE IN NEW YORK

Bridge Commissioner Best has issued a formal statement in which are made public for the first time the exact terms and conditions of the contract which he signed on May 21 for the handling of street railway cars on the Williamsburg Bridge. The parties to the contract are the Bridge Commissioner, the Brooklyn Heights Railway Company, the Coney Island & Brooklyn Railroad Company, the New York City Railway Company and the Bridge Operating Company.

In its general scheme this contract is similar to the existing contract for operation on the Brooklyn Bridge. Owing to the different circumstances, however, it has some distinctive features. Among them is the requirement for the incorporation of the Bridge Operating Company, which is to provide cars for the local bridge service as distinct from the through service to be provided by the other companies. Local bridge passengers will pay a fare of 3 cents. The contract provides, however, that the Brooklyn and New York railway companies must carry through passengers across the bridge without charging an extra fare.

The north pair of tracks is to be equipped for use by the underground trolley system, so as to permit operation of through cars across the bridge to the Brooklyn terminal by the Metropolitan system. The south pair of tracks is to be equipped with the overhead trolley system so as to permit Brooklyn cars to cross to the Manhattan terminal. Commissioner Best expects to have the latter equipped in this way ready for service on or before July 15. The equipment of the north pair of tracks will necessarily take some time longer.

The trolley tracks, terminals and equipment are to be constructed by and remain the property of the city; the railway companies merely having a right to use them. For the use of the electrical equipment, terminals, etc., the railroad companies are to pay a rental to the city of $10,000 a year. They are also to pay a toll of 5 cents for each car per round trip across the bridge.

The term of the contract is ten years, from Sept. 1, 1904, but this may be extended under certain conditions.

REMARKABLE LONG DISTANCE RUN

One of the most remarkable long distance runs on record was made across Central Ohio from Dayton to Zanesville on May 27. With a desire to impress the United Commercial Travelers' Association with the possibilities of through electric travel, the Dayton, Springfield & Urbana Railway Company made a proposition to carry the members of the association to a meeting in Zanesville, agreeing to take them in steam road time. Two parlor cars were used. The first car ran from Dayton to Columbus, 77 miles, in two hours and thirteen minutes, over the Appleyard lines, and then from Columbus to Zanesville, 64 miles, over the Columbus, Newark & Zanesville Railway, in two hours and 1 minute, a total of four hours and fourteen minutes for 141 miles. The second car left Dayton twenty minutes behind the first and made practically the same time. The cars ran through on schedule, and the operation of the regular cars was not in any way interfered with. Practically no stops were made, except for grade crossings, but it must be borne in mind that the cars were obliged to observe city ordinances and city schedules over 3 miles of track in Dayton, 4 in Springfield, 1 in London, 6 in Columbus, 2 in Newark and 2 in Zanesville, a total of 18 miles on city streets. The portion of the road from Newark to Zanesville, 33 miles, has just been opened and is not in shape for high-speed work.

NORFOLK & SOUTHERN LETTING CONTRACTS

The Norfolk & Southern Railway Company, the control of which, as noted in the STREET RAILWAY JOURNAL of April 30, has been acquired by the Chesapeake Transit Company, is now letting contracts for additional central power house and substation equipment, cars, etc., to be used in connection with its Norfolk-Virginia Beach, West Virginia, system, which was hitherto a steam line and a competitor of the Norfolk-Virginia Beach line of the Transit Company.

The Chesapeake Transit central station is to be equipped with a 500-kw inverted rotary, to be built by the General Electric Company. The existing equipment consists of two 500-kw, 550-volt General Electric generators, direct-connected to 750-hp Allis cross-compound Corliss engines. There will be three sub-stations, in each of which 300-kw General Electric rotaries will be installed. Twelve cars will be ordered, ten open measuring 45 ft. over all. They will be built by the John Stephenson Company, of Elizabeth, N. J. The open cars will have two 57 General Electric motor equipments each, while the closed will each be fitted with four 73 General Electric equipments. Four 50-ft. cars now used on the steam road will each be equipped with four 73 General Electric motors. The American Electrical Works, of Providence, R. I., will supply the trolley and high-tension cables, and the Magnet Wire Company, of New York, will undertake the contract for the 500,000 c. m. feed wire. The Ohio Brass Company will furnish the bonds and overhead material.

The new Norfolk-Virginia Beach electric line is expected to be ready for operation by July 1.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED MAY 24, 1904

760,505. Car Axle; John M. Wilcox, Cleveland, Ohio. App. filed Oct. 13, 1903. Comprises a fixed sleeve, two independent rotable tubular axle-sections journaled therein, wheels fastened respectively to the axle-sections, a tie-rod passing through both axle-sections and having one projecting end which is threaded, a nut on said threaded end and means connecting the tie-rod with the axle-section adjacent to the threaded end, whereby their relative rotation is prevented.

760,536. Automatic Car Gate; William N. Hackett, Boston, Mass. App. filed June 4, 1903. Means whereby the gates may be opened and closed automatically on either side of the car by turning over the seat backs.

760,556. Motor Car; Alexander Palmros, Columbus, Ohio. App. filed Sept. 5, 1900. An electric locomotive in which the side frame thereof is recessed for the reception of the car axle and springs.

760,598. Pole Clamp or Coupling; Clyde B. Wynegar, Greenwood, Ind. App. filed March 7, 1904. A device designed to expedite the replacing of old poles with new ones, and means for automatically aligning the pole.

760,641. Trolley Pole; Alfred W. Morgan, Long Beach, Cal. App. filed Nov. 16, 1903. Details.

760,643. Third Rail Guard for Electric Railways; Vincent M. Newman, Bayside, N. Y. App. filed Feb. 16, 1904. The guard is slotted for the reception of the plow to engage the third-rail and sections of one side of the guard are hinged to permit the removal of the plow when necessary.

760,656. Electric Track Switch Operating Mechanism; Charles W. Squires and James B. Squires, Springfield, Mass. App. filed Jan. 20, 1903. Supplemental switch mechanism for determining of which a pair of solenoids shall be energized to actuate the switch tongue.

760,662. Car Fender; Peter B. Sullivan and George F. Taylor, Randolph, Mass. App. filed Sept. 2, 1903. A novel device connected with the fender, which automatically applies the brake on the car and simultaneously cuts the current from the motor whenever the fender strikes an obstacle.

760,736. Trolley Pole Head; John E. Greenwood, Utica, N. Y. App. filed Sept. 25, 1903. Two trolley wheels mounted in tandem on independent pivoted frames.

760,737. Safety Clamp for Rails; Thomas J. Harleman, Packerton, Pa. App. filed March 28, 1904. A bar provided at each end with special connecting clamps adapted to electrically bridge the rails of a railway when safety signals are to be set.

760,740. Means for Safely Conducting Electric Currents; Edward A. Jarvis, Port Richmond, N. Y. App. filed Dec. 16, 1903. The third rail is laid in a conduit provided with a conducting roof, the collector shoe being provided with a powerful electromagnet which attracts the third rail to the roof of the conduit, whence current is taken by the shoe.

760,781. Car Fender; John C. Cooper, Baltimore, Md. App. filed March 4, 1904. Details of construction.

760,801. Automatic Trolley Controlling Device; Horace W. Nichols, Philadelphia, Pa. App. filed Sept. 9, 1903. A spring drum and ratchet arrangement controlling the trolley cord.

760,828. Trolley; John S. Weckman and Robert J. Millard, Carnegie, Pa. App. filed Oct. 17, 1903. Details.

760,846. Electric Railway Switch; Rupert L. Border, Pittsburg, Pa. App. filed Oct. 15, 1903. Details.

760,916. Running Board for Railway Cars; Martin S. Nolan, Waltham, Mass. App. filed Oct. 21, 1903. A longitudinally shiftable carstep having hinge connections with the carbody and constructed to lift to horizontal and lower to vertical position, and means to support the same in horizontal position.

760,947. Electric Bond for Railway Rails or Other Conductors; John S. Alexander, New York, N. Y. App. filed Feb. 25, 1903. The abutting ends of two rails are recessed to form a chamber

having a contracted opening at the surface of the rail; a spreader is placed in the chamber and a forked conductor is then driven through the narrow opening and forced into good contact with the rails by the spreader.

760,969. Car Fender; Jacob Derx, St. Louis, Mo. App. filed April 4, 1904. A fender mounted for swinging movement to inoperative position at the side of the car.

760,988. Electrically Controlled Switch; William H. Hillyer, Atlanta, Ga. App. filed Jan. 21, 1903. Circuits so arranged that the car automatically takes current from the trolley wire to actuate the magnets which control the switch tongue.

761,000. Trolley; James A. Lavery, New York, N. Y. App. filed Nov. 7, 1903. Two guard fingers mounted on the trolley and adapted to meet at their upper ends above the trolley wire, a rod with which the lower ends of the guard fingers have sliding connection and springs surrounding the rod for moving the upper ends of the jaws together.

761,046. Automatic Switch Mechanism for Railways; William E. Harris, New York, N. Y. App. filed Aug. 4, 1903. Mechanism adapted to be operated a suitable distance from the switch, means carried by a carrier truck for effecting an operation of the mechanism, levers to reciprocate the trucks and resilient members to elevate the levers and reciprocating members to an inoperative position.

UNITED STATES PATENTS ISSUED MAY 31, 1904

761,296. Convertible Car; Henry E. Haddock, Philadelphia, Pa. App. filed Aug. 21, 1903. Details of sliding panel construction.

761,308. Trolley Wheel Guard; Curtic W. Leslie, Pittsburg, Pa. App. filed Nov. 5, 1903. Spring mounted guide arms for guiding the wheel onto the wire.

761,347. Maximum Traction Truck; Walter S. Adams, Philadelphia, Pa. App. filed Sept. 16, 1903. The truck is provided with longitudinally and transversely disposed semi-elliptic springs which support the carbody and means independent of the spring for connecting the carbody and truck to receive all stresses incident to the propulsion of the car.

761,353. Car Truck; John A. Brill and Walter S. Adams, Philadelphia, Pa. App. filed March 22, 1900. Details of construction.

761,354. Car Truck; John A. Brill and Walter S. Adams, Philadelphia, Pa. App. filed April 4, 1900. A truck having large driving wheels and small trailing wheels, a truck frame, a cross-bolster spring-supported from the truck frame outside the wheel base and adjacent the driving wheels, and a draw-bar extending from the bolster toward and adjacent the axle of the driving wheels.

761,417. Safety Apparatus for Use on Railway Cars; Sidney H. Short, London, England. App. filed Feb. 11, 1902. In case of a break down of the insulation of the trolley pole and base, an alarm is automatically sounded so that the pasengers on the roof of the car may be warned before anyone comes in contact with the trolley pole.

761,421. Car Fender; Leo M. Snyder, Dubois, Pa. App. filed April 1, 1904. Those portions of the fender liable to strike a person are composed of elastic air-filled cushions or tubing.

761,432. Collector for Third-Rail Systems; Alfred K. Warren, New York, N. Y. App. filed Feb. 25, 1903. The shoe is mounted at the end of a pivoted arm and is electrically connected with the car circuit by a flexible conductor wound around the axis of the arm.

761,536. Automatic Car Switch; Morris Nuss, Philadelphia, Pa. App. filed Sept. 25, 1903. Details.

761,540. Motor Suspension; William G. Price, Kingston, N. Y. App. filed Nov. 19, 1903. The car truck is provided with equalizer bars which support the motor.

761,553. Third-Rail Support; Louis Steinberger, New York, N. Y. App. filed Dec. 7, 1903. The insulator supporting the third-rail has a conical cavity into which a supporting pin projects, affording certain lateral free movement of the insulator on its support.

761,557. Car Fender; Onesime Thibault, Fall River, Mass. App. filed Jan. 13, 1904. Novel means whereby the fender is caused to automatically follow curvatures of the track.

761,565. Trolley Mechanism; John H. Walker, Lexington, Ky. App. filed July 29, 1903. A flexible conductor between the trolley base and pole.

761,566. Trolley; John H. Walker, Lexington, Ky. App. filed July 29, 1903. Details.

761,567. Trolley; John H. Walker, Lexington, Ky. App. filed Dec. 24, 1903. A sliding contact shoe is mounted to the rear of the trolley wheel.

761,574. Trolley Protector; John H. Best, Jr., Sandusky, Ohio. App. filed Jan. 8, 1904. Details.

PERSONAL MENTION

MR. GEORGE W. BACON, of Ford, Bacon & Davis, was married June 1 at St. Cloud, Minn., to Miss Caroline T. Mitchell, of that city.

MR. FRED BILLINGS, formerly chief engineer of the Manitowoc & Northern Traction Company, of Manitowoc, Wis., has been appointed chief engineer of the Sterling, Dixon & Eastern Electric Railway, of Sterling, Ill.

MR. C. W. OBERT has been appointed associate editor of the STREET RAILWAY JOURNAL. He was formerly on the editorial staff of the American Engineer and Railroad Journal of this city, and has had an extended experience in both steam railroad, electrical and technical newspaper work.

MR. EDWIN H. CHAPIN, New York representative of the National Car Wheel Company, has moved his offices from the shops of the company at 556 West Thirty-Fourth Street, to 35 Nassau Street. This downtown office will prove much more convenient to the customers of the company than the former uptown office.

MR. RANDALL MORGAN and a party of Philadelphia gentlemen who are interested in traction properties in the vicinity of Indianapolis and Cincinnati made an inspection of these properties last week. At Cincinnati the gentlemen were entertained at an elaborate banquet by Mr. W. Kesley Schoepf, of the Cincinnati Traction Company, at which time they were introduced to a number of prominent Cincinnati capitalists. After inspecting the Cincinnati city lines, the entire party went over the Cincinnati, Dayton & Toledo Traction line, which adds weight to the report that the Philadelphia interests are increasing their holdings in this property and will provide the money required for practically rebuilding the system with a view to connecting it with the Indiana lines controlled by the syndicate. An outline of the proposed improvements for the Cincinnati, Dayton & Toledo was given in a recent issue of the STREET RAILWAY JOURNAL.

MR. C. C. TYLER has resigned his position as superintendent of the works of the Westinghouse Electric & Manufacturing Company at East Pittsburg, Pa., and has been appointed general superintendent of all the works of the Allis-Chalmers-Bullock interests in the United States. Mr. Tyler, who will enter upon his new duties on June 15, will make his headquarters at Milwaukee. His record in the practical management of great machine-shops is one of the best in the country, and it has long been under the appreciative observation of men who understand the value of such ability. Before Mr. Tyler went to Pennsylvania he had made an excellent reputation, and at Pittsburg, where he has been for half a dozen years, he enhanced this by the results he achieved in increasing the efficiency of the Westinghouse electric works. In the equipment of manufactories, in the design and construction of machine-tools, in the handling of machinery and material, in processes of manufacture, and in fact in all that pertains to the economy of machine-shop administration, Mr. Tyler is recognized as an expert who has no superior in this country. In entering upon his larger field of duty, he is sure to carry with him the congratulations of the engineering profession.

MR. W. W. WHEATLEY, formerly manager of the railroad department of the Public Service Corporation, of Newark, N. J., and now general manager of the Federal District Railway Company, which operates the extensive electric traction system (the Wernher-Beit lines) in and around Mexico City, Mex., has issued a circular announcing that Mr. Paul H. Evans has been selected as engineer and purchasing agent for the company. Mr. Evans will have charge of all the engineering of the company—electrical, mechanical and civil—which includes all construction and maintenance work, in addition to purchasing all materials and supplies. The following department heads will hereafter report to him instead of to the general manager: Mr. J. L. McCreary, superintendent of maintenance of way; Mr. H. S. Bolton, electrical engineer; Mr. Marshall Miller, consulting engineer, and Mr. J. C. Jackson, storekeeper. Mr. Evans has been in Mexico for some years. He went to that part of the world first in 1889 as superintendent of construction for the old Thomson-Houston Company, and had charge of all the construction work in which the company was interested in at that time. After that company's consolidation with the Edison Company, and the formation of the General Electric Company, Mr. Evans became chief engineering expert for the Mexico City branch, which looks after the interests of the General Electric Company. During the time of his service with the General Electric Company he placed to his credit the construction of some of the most notable electric power transmission plants in the republic, among them being that of the Guadalajara Electric Light Company at Guadalajara, State of Jalisco, and the Regla-Pachuca plants. Before going to Mexico Mr. Evans was connected for three years with the Atlanta, Ga., street railway system.

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, JUNE 18, 1904 No. 25

Published Every Saturday by the
McGRAW PUBLISHING COMPANY

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues)............................... $3.00 per annum
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) ....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid.................. $6.00 / £1-5s / M 25 / Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Sanders

The street car sander, like the railroad coupling, has been a favorite field for the exercise of misdirected inventive ability, yet if the average street railway man were asked his opinion as to the merits of the various street railway sanding devices, on the market, he would probably, to put it mildly, fail to wax enthusiastic as to their performances. Street railway sand-boxes have been devised and put on the market which should certainly be able to feed sand onto the track if anything on earth could under operating conditions, but we are rather inclined to think that a steam railroad man, with whom we talked the other day, is right in the assertion that the trouble with the street railway sanding devices is not so much in the devices themselves as in the care and attention given to the sand supplied and to the condition of sand pipes in general on street railways. On steam railroads, where a sand supply is usually not anywhere near as necessary as in electric railway operation, we find that a great deal of attention is given to this detail of operation. Nothing but fine screened sand is used, and the sand is thoroughly dried. Every precaution is taken to prevent moisture from getting into the sand after it is dried. While some electric railways have a well organized sand-drying department, and look after sand-boxes and sand supply with great care as a regular matter of business, there are too many where the sand supply is entirely a secondary consideration, and it is safe to say that street railway sanding apparatus will always be unsatisfactory as long as the sand supply is not looked after. Sand absorbs moisture very easily, and wet sand is sure to cause trouble sooner or later. Sand-boxes and feeding mechanisms are made which will feed almost any kind of sand, but the trouble comes in the pipe leading down to the rails, which is tolerably sure to become clogged if wet sand is fed through it, the difficulty being added to by the fact that the bottom of the sand pipe is likely to be wet with mud or covered with frozen mud and ice. With sanders, as with many other things, eternal vigilance is the price of reliability.

Preparations for Summer Traffic

Each recurring season brings its round of duties, alike to the husbandman and to the weary editor, and when we tear the June 15 leaf off our calendar and start on the "summer season," it behooves us once more to stir up our friend the manager on the improvement—nay, the sanctification, of his summer traffic. Talking the other day with our friend, Mr. Suburbs, we received an urgent invitation to come out and spend a day with him at Lonesomehurst-by-the-Sea, some 30 miles out of town. When we enquired the best route, he cordially advised the boat for the outward trip, but added, "Going home, you'd better take the electrics; it's a pretty ride down to Bundleheim, and takes only 90 minutes—then you can get an express for the city." Now, the distance from Lonesomehurst to Bundleheim is only 10 miles, and when we asked further instructions as to this beautiful ride in the electrics, this is what we got: "You take the green car that passes my corner every 20 minutes, and ride over to Sculpinville; then wait for a red car that runs to Bundleheim every half hour." We heard later that the road with the red car had passed a year's interest on its bonds, and was about to be reorganized. The situation is not altogether a fancy picture; it is typical of altogether too many beautiful suburban trolley rides. One waits around for awhile, catches a semi-occasional car, wanders across country on it for awhile, waits around a while more, and then catches on to the running-board of a crowded car that takes him the next stage, and so on ad nauseam.

The net result is bad for the public and even worse for the roads concerned, as travel, which would otherwise be profitable, is turned away by the inconveniences. The trolley ride is becoming an institution in American cities, but it is now too closely confined to certain definite routes, in the main to those over which through cars are run, or upon which the service is

so ample that little time is wasted in waiting. A scant service is effective only when it maintains a rigorous schedule and can be trusted to make certain and prompt connections with other lines. And in dealing with suburban traffic generally, and with summer excursion traffic in particular, large earnings come only when the service is made convenient for the public. We have often speculated on the probable result of applying the shrewd traffic-building methods of steam roads to these problems of summer transportation. Suppose half a dozen roads doing a summer resort business were to put their heads together and figure on the encouragement of travel. At certain hours of the day, morning and evening, their traffic is usually fairly heavy, but an active excursion business runs, as a whole, reversely to this regular traffic. For several months in the summer it is capable of being made highly profitable if skillfully handled. First, the public must be made to know the available routes, and, second, it must be made convenient for the public to take them. At present very few roads make public accurate information as to their service and connections. It is not enough to say that cars run over the lines to X every 20 minutes, and that at Y there is a connecting line to Z. A simple time-table, with all connections, ought to be available, so that one can figure out a trolley excursion with reasonable certainty beforehand, and not be seriously in error when he comes to try it.

Another feature of summer business ought to be the establishment of through excursion lines. In planning a trolley excursion, as things now are, one is extremely likely to find that a part of the route involves not only a change of cars but a change to a line which has a heavy traffic of its own, so that a party reaches it only to find a succession of overcrowded cars. Where there is a promising chance for excursion business, through cars should be run, and a friendly arrangement with connecting lines should make this possible by exchanging, within reasonable limits, track privileges. By so doing the through cars would be considerably expedited by the freedom from local traffic, and the real excursion business would be greatly encouraged. We have sometimes wondered, too, whether it might not be wise to make especial provision for excursion traffic in the way of reserving accommodations for a small extra fare, with or without the use of special chair cars. If a party could be quite certain that by getting special tickets it could be assured of finding at 1 p. m., Saturday, comfortable seats on a through car to Lonesomehurst, it would generally prefer to pay a small extra amount for the accommodation. Experience has shown that chair cars are crowded for even short runs on suburban excursion lines, and the same principle would hold for an electric road, with the additional advantage that it would encourage longer trips. All this means some extra expense and labor for the railway company, but we think it would pay. To be sure, railroad officials sometimes loudly assert that parlor cars do not pay, but if one of two competing steam lines should abolish its parlor car service in the supposed interest of economy, and cut down its through express service for the same reason, it would find abundant cause for repentance. And the situation in electric railroading has very similar characteristics, although the service is at present less completely developed. Doubtless, the first through express trains were greeted with prophecies of failure.

Tail Lights

Recent accidents have called forcible attention to the necessity for tail lights, which are independent of the supply of electric current, both for city and interurban cars. Tail lights, which will reveal the presence of a car when the trolley is off or the lighting circuit fuse is blown, are especially necessary on interurban cars, but there are plenty of places on most city lines where there is danger of rear end collisions if no oil tail lights are carried. The maintenance of a lot of oil lanterns is admitted to be a nuisance, as well as a fire risk, but it seems to be a necessary evil—at least until some cheap and reliable substitute for the oil lantern is available. As desirable as it may seem to do away with oil lights entirely on a city electric line, there is no evading the fact that they can only be omitted at considerable risk and at some inconvenience.

On most roads a conductor's hand lantern is needed for signaling over steam railroad crossings and for use in case the current supply fails, or in case of accident. Lanterns being maintained for these purposes, it is not a great additional expense to maintain tail lights in addition. It is conceivable that a city road, operating every mile of its track over well-lighted city streets, where a car would always be visible without regard to the lights it carries, and where the speed is low, might possibly safely dispense with oil lanterns of all kinds, but such conditions rarely exist.

Engine and Turbine Efficiencies

Reports of efficiency tests on turbines of various kinds and on reciprocating engines are coming in rapidly just now, but the accumulation of figures has not yet made any considerable change in the general data. The test of a 400-kw Westinghouse-Parsons unit, which we reported in our issue of June 11, raises, however, some interesting practical questions. As our readers will remember, this test gave some notable results from the use of superheating to a rather unusual extent, reaching 11.17 lbs. of steam per brake horse-power-hour on a moderate amount of overload. The recorded thermo-dynamic efficiency ranged from a little over 17 per cent to nearly 19½ per cent, referred to the thermal units actually present in the steam employed, these figures being comparable with the best results reached by reciprocating engines of the compound condensing class. So far as these results are concerned the outcome of the tests was highly satisfactory, but to the practical man no such formal tests are altogether satisfactory. It is, of course, commonly known that it is hard to keep up to test conditions in every-day running, but when this opinion is closely analyzed it is evident that the discrepancies commonly found are generally due to causes quite outside of the engine itself. Granting that the load conditions can be maintained, there seems to be no good reason why test conditions cannot be quite nearly duplicated in every-day operation.

Of course, it is well understood that the load conditions cannot generally be duplicated, but this is not of itself the vital point. Cost of power is the matter at issue in the operation of a steam plant, and this cannot be settled on the basis of thermodynamic efficiencies alone, important as these are from a theoretical standpoint. The fixed charges on the plant are of serious consequence, and even putting these aside it is the "demnition total" of the fuel and labor charges that counts with the management. The kind of efficiency test that one should most like to see would be one extending clear from the coal pile to the terminals of the generator, and including all the items. Of course, objectors will at once raise the point that this involves the efficiencies of the boilers, and even of the firemen, but these are items which have to be paid for and cannot be forgotten in the final reckoning. And particularly in the case of high superheating with independent superheaters, the

cost of the process must be taken into account. Nobody disputes the increased efficiency that comes to a heat engine from increasing the range of temperature of the working fluid directly, or by increasing the vacuum. But how about the cost of this gain in extra heat supplied to the steam itself and to the various auxiliaries, which latter take much more energy than the casual observer imagines? A point in superheating, or in increased vacuum, will evidently be somewhere reached at which the game will not pay for the candle. Where are these points?

Our impression is that they have not yet been reached, and we hope that such will prove to be the case. Nevertheless, it would be a very desirable addition to the data of steam engineering to have tests made upon a basis that would throw light on the cost of all the additional refinements that make for high efficiency. Never mind if various apparently extraneous items do creep into the list—they all get into the yearly balance sheet. Figures upon the practical efficiency of superheating to various degrees and by various methods would be particularly welcome. We know at the present time about what to expect from boilers in evaporative efficiency and in life—let us have similar data of performance and endurance from superheaters of the most approved modern types. And if reciprocating engines are concerned what is the effect of high superheating on the cost of lubrication and the endurance of the working parts? We have been getting wonderful data from abroad on triple-expansion engines, worked at a high degree of superheat, but some of these interesting details are lacking from the data published. What could we expect from first-class turbines under similar conditions? We do not find fault with the tests we have published—we consider them valuable, and hope there will be many more of them. In these days, however, when there is active and strenuous competition between steam engines and steam turbines, with gas engines beginning to take a hand in the game, information as to the total result to be obtained from 1 lb. of fuel of known thermal value is particularly to be desired, and equally important is a knowledge of the various items of expense that enter into each stage of utilization. The futility of basing opinions on interior thermodynamics alone is well shown in the case of the gas engine, which thus considered would be quite in a class by itself.

Practical Considerations in Steam Engine Selection

In connection with reciprocating engines, the paper published last week, on "The Use of Superheated Steam and of Reheaters in Compound Engines of Large Size," points out some interesting and valuable conclusions from an analysis of several tests made upon compound engines of recent design. A great many refinements in steam engine design have been developed by the engine builders, and have been largely adopted in power plant installations, but data as to the real value of many of these features have not been generally available. In this paper the data obtained from twenty-eight important tests of large vertical compound engines are analyzed, and as a result many striking facts and much needed comparisons are brought out and made clear.

Even the most cursory examination of Mr. Marks' paper would tend to indicate that the introduction of superheating is fated to revolutionize present steam engine practice. It appears more than probable that the use of cylinder jackets, according to our present ideas, as well as the use of reheaters between cylinders, will be found of little or no real value if superheated steam is used. The conclusion is clearly drawn in the analysis to the effect that the jacketing of high-pressure cylinders is of little value when superheated steam is used, amounting to only a few per cent; reheating is also found a source of loss unless its practical results are that of superheating the steam entering the low-pressure cylinder, by an amount of at least 30 degs. F., and is not really effective unless it superheats about 100 degs. F.; in the latter case it is stated that a saving of only 6 per cent to 8 per cent may be expected.

With such small savings as these it appears that there is altogether too little margin of economy to warrant the installation of the extra complication which would be necessary to bring about these results. Not only the cylinder jacket, but also the reheating receiver, is a source of trouble and annoyance in requiring considerable attention for maintenance. If the slightest leak develops in the reheater it must be cut out or subject the operation of the engine to unknown losses. In many power plants it has been found, under certain conditions of unfavorable operation, that reheaters operated to a serious loss of efficiency for the engine performance as a whole. In fact, it may be stated in this connection, that in a large power plant in the vicinity of New York City, in which a number of cross-compound, horizontal, slow-speed engines are used, the reheating equipment of the receivers was long ago removed, and the engines are now operating with the reheating shells operating merely as separator receivers—in this capacity they are very effective in ensuring the delivery of dry steam to the low-pressure cylinders, and their use is of considerable value.

The jacketing of high-pressure cylinders is undoubtedly still advisable for use upon engines operating with saturated or wet steam, and will be probably found to make reasonable showings of saving in most cases; but the jacketing of the low-pressure cylinder is, in the paper, shown to be absolutely unnecessary, particularly when superheated steam is used in the high-pressure cylinder, or an effective reheater is used. There are, undoubtedly, certain conditions under which the jacketing of the low-pressure cylinder may be effective in making a slight saving, but at the best, with the worst conditions of saturated steam and cylinder condensation, the net saving would be only a few per cent, so that the extra expense of the jacket and its care and maintenance do not seem to be warranted. In this case, as well as that of jacketing the high-pressure cylinder, it is more than probable that the steam could be used much more profitably if passed through the cylinders than into the jackets.

Another important fact, which was brought out by the investigation of the tests referred to, is that the variation, within ordinary limits, of the ratio of stroke to diameter of steam engine cylinders does not have any marked effect upon the economy of the engine—particularly when superheated steam is used. The size of an engine is, of course, in any case, an important factor in the determination of its efficiency, but it is interesting to note that variations of proportions for any given size have not effected any appreciable increase of economy of operation. Inasmuch as such variations of the ratio of stroke to diameter are of little or no value, one of the strongest arguments possible is offered for the use of the standard proportions for any given size and type of engine. The standards of the various engine builders are usually the best obtainable for each of their types, having resulted from continued investigations and long study of the subject, and cannot be excelled for ordinary power plant purposes. The results of these tests and analyses should be conducive to the abolition of specialized designs where the savings effected are doubtful.

THE POWER PLANTS OF THE NEW ORLEANS RAILWAYS COMPANY

The New Orleans Railways Company, which conducts a general power and lighting business in addition to its street railway operation, draws at present from some seven power houses, located, with one exception, along the Mississippi River. These have an aggregate output of something over 29,000 hp, and burn about an equivalent of 200 tons of coal daily. On the basis of 2 lbs. of oil being equivalent to 3 lbs. of coal, one-half is oil and the other half is coal. Previous to the consolidation of interests, now represented by the New Orleans Railways Company, two other stations were also in operation, one the property of the Orleans Railroad Company, of 600-hp capacity, and the other, the property of the Merchants' Electric Company, of 1280-hp capacity. Both stations were located some distance from the Mississippi River, though each near a so-called basin canal, but being small in size as compared with the other stations, were abandoned not long after the merging of the properties. The former plant was built for a railway output, while the output of the latter was entirely alternating-current. The apparatus of both has been disposed of. Of the stations now maintained, the most interesting ones are the Edison Station No. 1, which supplies a power and lighting demand by means of both alternating current and direct current, the latter probably amounting to 70 per cent of the total output, and the so-called Annex plant, on Market Street, at the rear of two, adjoining, older stations on South Peters Street. These two stations are the subject of some extended reference in the present connection.

VIEW ON CANAL STREET, SHOWING FIVE LINES OF TRACK

Copyright, 1902, by Teunisson Photo.

Of the other stations, the St. Charles plant, formerly the property of the St. Charles Railroad Company, is entirely a railroad station, giving an output at 550 volts. It comprises four units, three of 300-hp rating, driven from 14-in. and 26-in. x 36-in. Hamilton-Corliss engines, and one 600-hp unit, having a 22-in. and 44-in. x 48-in. Allis engine. The boiler plant comprises 1500-hp, and is equipped with economizers. The boilers are fitted for burning oil.

Another station for an all-railway output is located on the corner of Tchoupitoulas Street and Napoleon Avenue. Here there are four belted units, each of 200 kw, and driven from a 14-in. and 36-in. x 48-in. Lane & Bodley engine. There are 1200 hp in boilers, with arrangements for oil burning.

The third all-railway plant is located on the corner of North Peters and Elysian Streets, known as the Claiborne station, and contains three units, two of 450 hp and a third of 1275 hp. The boiler plant, aggregating 1800 boiler horse-power, is served by a stack 175 ft. high and 7½ ft. in diameter.

The fourth railway plant occupies approximately one-half the block on South Peters Street in front of the Annex plant. It is known as the main station, but comprises a miscellaneous equipment of railway generators, belt-driven from a jack shaft, which in turn is operated from a number of condensing engines. While this is the largest of the railway stations enumerated, having 4750 hp in engines, the new vertical units in the Annex station are to carry the load taken by the main station, and also the load now carried by the Napoleon Avenue station.

If the Edison Station No. 1, the plant for serving the general power and lighting demand of the city, is regarded as being approximately in the center of the city, it will be found that the St. Charles and Claiborne stations are about 7000 ft. distant from the Edison Station No. 1, and that the main station and the Annex are 8500 ft. distant, while the Napoleon Avenue station is over 3 miles from Edison No. 1. The abandonment of the latter will thus bring the generation of the railway current nearer to the business center of the city. As explained in the description of the Annex plant, the designs contemplate the erection of a boiler plant alongside of the Annex building. Pending the installation of the high-pressure water-tube boilers, which will there be installed, the boiler plant of the main station will be utilized for supplying the required steam. This brief enumeration thus shows that there are at present five railway stations, with the early intention of doing away with two of them.

The seventh station, being also the second Edison station, adjoins the main power station. While Edison No. 2 and Main stations occupy the entire block along South Peters Street from Richard to Market, they were originally owned by two independent companies. This station is commonly known as the municipal lighting plant, as it generates direct current for arc lighting only. Its boilers are available for steam requirements of both plants, and the firing space is continuous across the fronts of both installations of boilers. There are eighteen 125-light Brush machines and one 125-light Wood machine, all belt-driven from a jack shaft.

EDISON STATION NO. 1

Edison Station No. 1 occupies part of a block bounded by Union, Dryades, Gravier and Baronne Streets, and occupies a building 100 ft. x 140 ft. in ground area. This is of the class in which boiler and engine rooms are side by side, and its exterior, which is of buff brick, has been finished off with water-tables, trimmings to the windows and the usual architectural embellishments which are nowadays bringing public service power stations into a class of majestic structures. Its generating equipment consists of two lines of vertical steam-driven units, aggregating, all told, 7750 hp, and these deliver both direct and alternating current for the general lighting and

power demands which the railway company controls in addition to the railway traffic. The station is operated condensing, and with a steam pressure of 200 lbs. per square inch. The interior of the engine room is in keeping with the appearance of its exterior. The floor is largely of marble mosaic, and there is a wainscoting some 12 ft. high from the floor line of white glazed brick, with a light blue dado near the top. Above the wainscoting the walls are yellow. The roof is of tiles, supported from steel roof trusses. The condensers are located below the engine room floor, which are enclosed on the main floor level by a polished brass railing. A 25-ton overhead traveling electric crane, built by the Morgan Engineering Company, of Alliance, Ohio, serves the engine room from one end to the other.

NEW ORLEANS RAILWAYS COMPANY'S LIGHTING STATION NO. 1.—BARONNE STREET

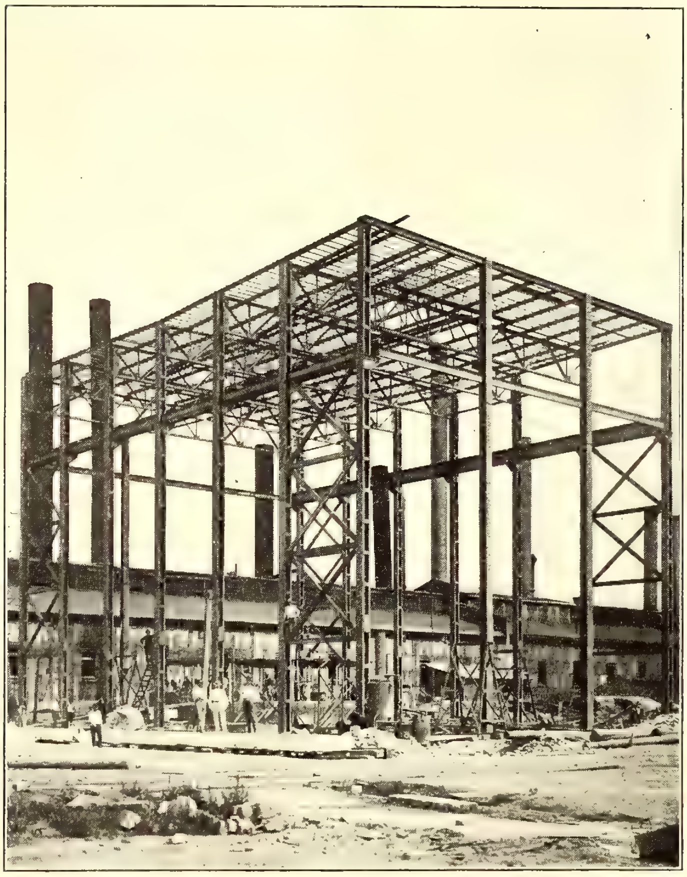
The boiler equipment comprises four batteries, of two boilers each, aggregating, all told, 4400 hp. Two batteries are fitted for oil burning and two for coal. Fuel economizers, of the Green type, are provided, located above the rear of the boiler settings, and the smokestack, which rises in one corner of the boiler room, starts a short distance below the connection from the economizer setting. Its construction in this respect is noteworthy, the stack being carried on a structural steel framework, which allows for utilizing the floor space underneath it. The stack is 9 ft. in diameter and 200 ft. high.

The boilers are of the Babcock & Wilcox water-tube manufacture. The oil-burning boilers have 224 tubes, 4 ins. in diameter and 18 ft. long, placed sixteen wide and fourteen high, and two 42-in. steel drums. Billow oil burners are employed, and these are supplied with oil from two small Snow pumps in the firing space of the boiler room, installed in duplicate. Steam is used for atomizing at 40 lbs. per square inch. The oil is drawn from four tanks buried in the yard outside the boiler room, each tank having a capacity of about 14,073 gals. These are filled from a pipe line from a 55-000-barrel storage tank, situated in outskirts of city. This storage tank receives its oil by barge from Beaumont oil fields. They are provided with float indicators with counterbalance extending above ground, so that the level of the oil can be learned at a glance, and each tank is provided with a vent coming through the ground, each vent fitted with a cap, which is screwed on just far enough to prevent its being shaken off by any slight exterior jar.

The coal-burning boilers have 192 tubes each, spaced sixteen wide and twelve high. As the boilers are regarded as of equal capacity this relation of the number of tubes will indicate that the oil-burning boilers require 16 per cent more heating surface. The coal is delivered in dump wagons, which discharge into a shallow hopper at one end of the boiler room, as indicated in the accompanying plan. The coal is weighed in this hopper and then passed through a crusher into a conveyor, which carries it to overhead bins from which it is spouted to the boilers. Each spout is arranged for weighing, so that the weight of coal delivered to each boiler can be recorded. The overhead coal storage of the boiler plant amounts to about 830 tons.

Five of the generating units have a direct-current output and three alternating current. Units Nos. 1, 2, 3 and 4 consist

of E. F. Williams' engines, built by William Tod Company, of Youngstown, Ohio, and General Electric generators. The engines, Nos. 1 and 2, are triple expansion. No. 1 has 21½-in.,



STEEL FRAMEWORK IN CONSTRUCTION JUNE 22, 1901—ANNEX PLANT

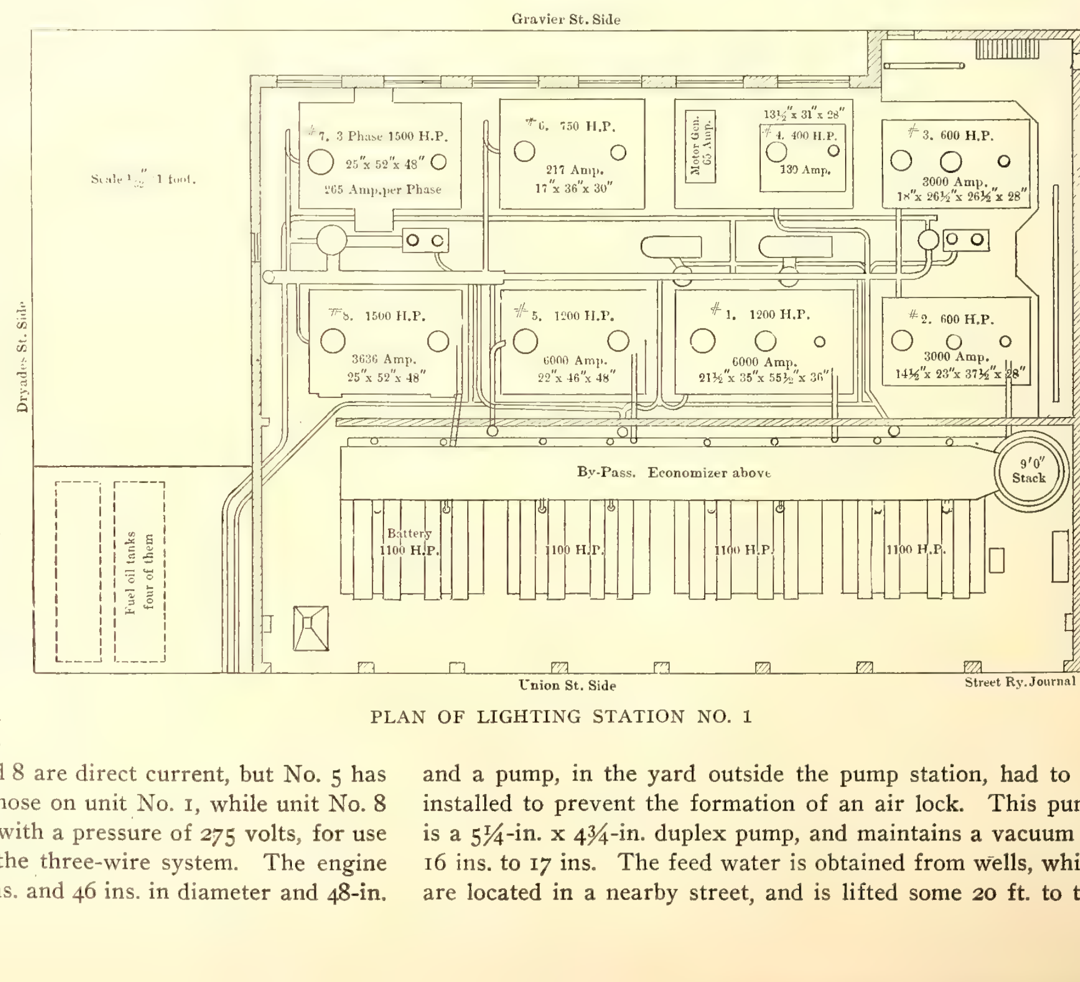
35-in. and 55½-in. cylinders and 36-in. stroke, and has a rating of 1200 hp at 100 revolutions. Nos. 2 and 3 are of the same capacity, 600 hp, but the engine of No. 2 has 14½-in., 23-in. and 37½-in. cylinders, while the engine of No. 3 is a three-cylinder compound engine with an 18-in. high-pressure cylinder and two 26½-in. low-pressure cylinders. Both engines run at 150 r. p. m., and each has a stroke of 28 ins. It will be noted that in engine No. 3 the ratio of low to high-pressure cylinders is 4.33 to 1. Each of these three units drives two 135-volt dynamos for the three-wire direct-current distribution system in use. The two dynamos of unit No. 1 have a capacity of 400 kw each, and those of units Nos. 2 and 3 of 200 kw each.

Units Nos. 5, 6, 7 and 8 consist of McIntosh & Seymour vertical compound engines and General Electric generators. Nos. 5 and 8 are direct current, but No. 5 has two generators similar to those on unit No. 1, while unit No. 8 has one electrical machine with a pressure of 275 volts, for use across the outside legs of the three-wire system. The engine of No. 5 has cylinders 22 ins. and 46 ins. in diameter and 48-in. stroke, and is rated at 1200 hp at 100 revolutions. No. 8 has cylinders of 25 ins. and 52 ins. in diameter and 48-in. stroke, and is rated at 1500 hp.

The three alternating-current units give an output of three-phase current at 2300 volts and 60 cycles per minute. Unit No. 4 is of 400 hp, or 300-kw capacity, and has a 13½-in. and 31-in. x 28-in. engine, running at 150 revolutions. Unit No. 6 is of 750 hp, or 500-kw capacity, and has a 17-in. and 36-in. x 30-in. engine, also running at 150 revolutions. Unit No. 7 is of 1500 hp, or 1050-kw capacity, and its engine is of the same size as that of the direct-current unit No. 8. Besides these steam-driven units there is a motor generator in the engine room which is arranged to receive direct current at 250 volts and deliver alternating current at 2300 volts. This has a capacity of about 150 kw.

The condensing machinery is of the jet type, with air pumps of both the steam-driven and the electric-driven type. The exhaust, as well as the live steam piping, is carried in a basement under the engine room, which arrangement has lent much to the good appearance of the engine room. The live steam pipes, it may be stated, are provided at each engine with a Stratton separator, which is placed below floor. The exhaust pipes are all connected into a single main, to which all of the condensers may be connected. There are four of these, one for each pair of units. The condensers at opposite ends are of the twin Blake type, and the intermediate are electrically driven. One of these has a 22-in. x 12-in. Knowles triplex pump, driven by a 220-volt, 50-hp motor; the other has a 17½-in. x 10-in. pump, driven by a 25-hp motor. The condenser between units Nos. 7 and 8, which is designed to take care of any three engines, has 18-in. x 44-in. x 24-in. cylinders, and has a cone 60 ins. in diameter. The piping leading to this is controlled by an electrically-driven Chapman gate valve, on which is mounted a 1.5-hp motor.

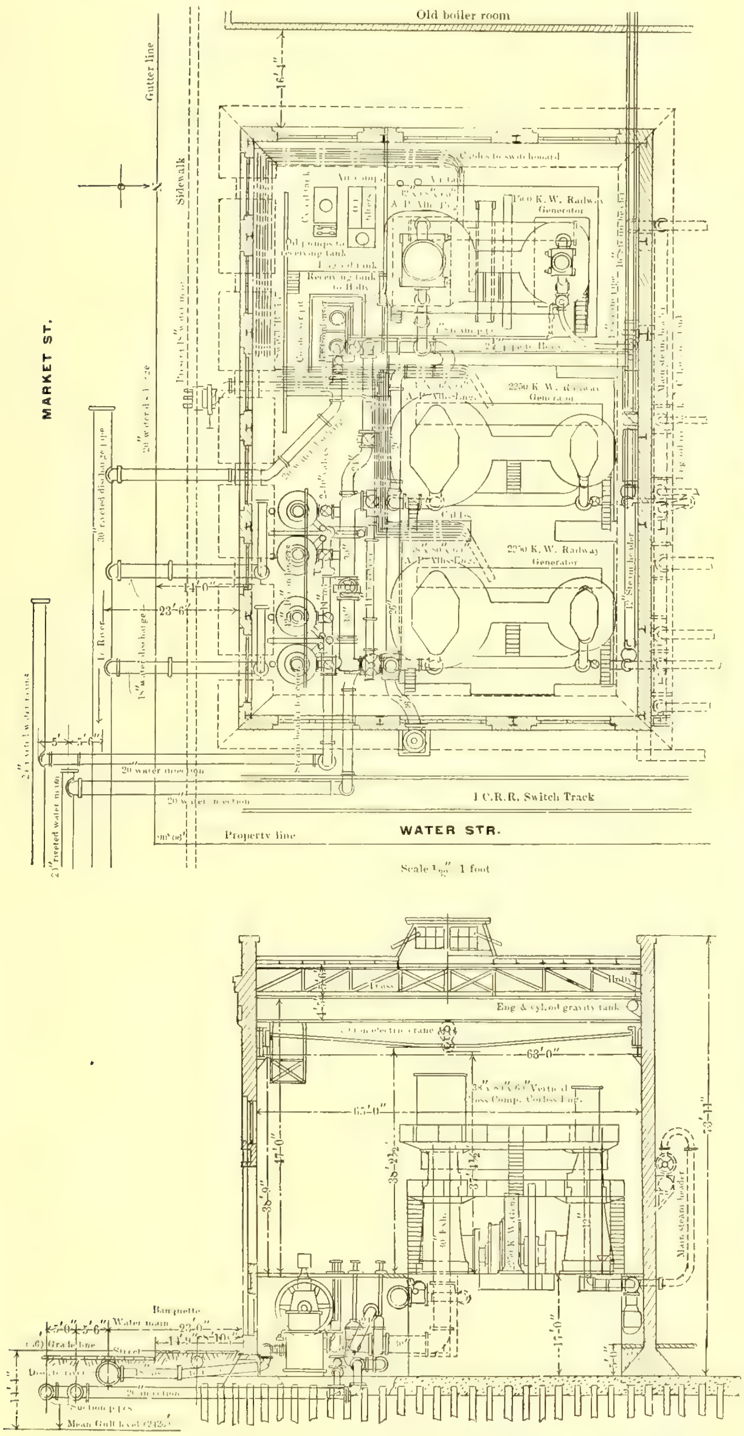
The condensing water is taken from an artificial canal (connected with Lake Pontchartrain) by a long line of pipe. This contains a vertical loop, owing to the formation of the ground. A considerable quantity of air collects in the top of this loop,



PLAN OF LIGHTING STATION NO. 1

and a pump, in the yard outside the pump station, had to be installed to prevent the formation of an air lock. This pump is a 5¼-in. x 4¾-in. duplex pump, and maintains a vacuum of 16 ins. to 17 ins. The feed water is obtained from wells, which are located in a nearby street, and is lifted some 20 ft. to the

wooden tank in the yard. For this purpose there is an air compressor, of the Laidlaw-Dunn-Gordon single-fly-wheel type, 12 ins. x 14 ins. x 12 ins. in size, which maintains a pressure of about 15 lbs. Water is pumped from the receiving tank to an overhead tank, and from this it flows by gravity to a Webster feed-water heater underneath the framework supporting the chimney, and thence goes to the feed pumps in the boiler room.



CROSS SECTION OF BUILDING LOOKING WEST Street Ry. Journal

PLAN AND CROSS-SECTION OF ANNEX RAILWAY PLANT

The feed-water heater receives the exhaust from the condenser air pumps and the feed and other pumps about the plant.

The equipment of the station, as described, covers an electrical plant which is in excess in its demand for steam over what the boiler plant was normally expected to produce. In other words, the boiler plant was installed with the provision of a relay, or idle unit, to allow for extensive cleaning or repairs of any other units. The demands for current, however, led to the installation in the engine room of additional machinery beyond what was originally calculated, so that at times all boilers have to be operated. This problem is to be solved by increasing the original rate of evaporation in the boilers by providing a second smokestack. It appears that the present chimney has insufficient cross-section to carry away the gases in case it were increased in height to raise its capacity. At the opposite end of the horizontal smoke breeching, into which all the boilers discharge, a chimney, a counterpart of the first one, is to be built, and contracts are about to be made for the work. Like the first stack, it will be supported above the boiler room floor on a structural steel base, so that passage room may be

RIVER SIDE OF ENGINE ROOM—ANNEX PLANT

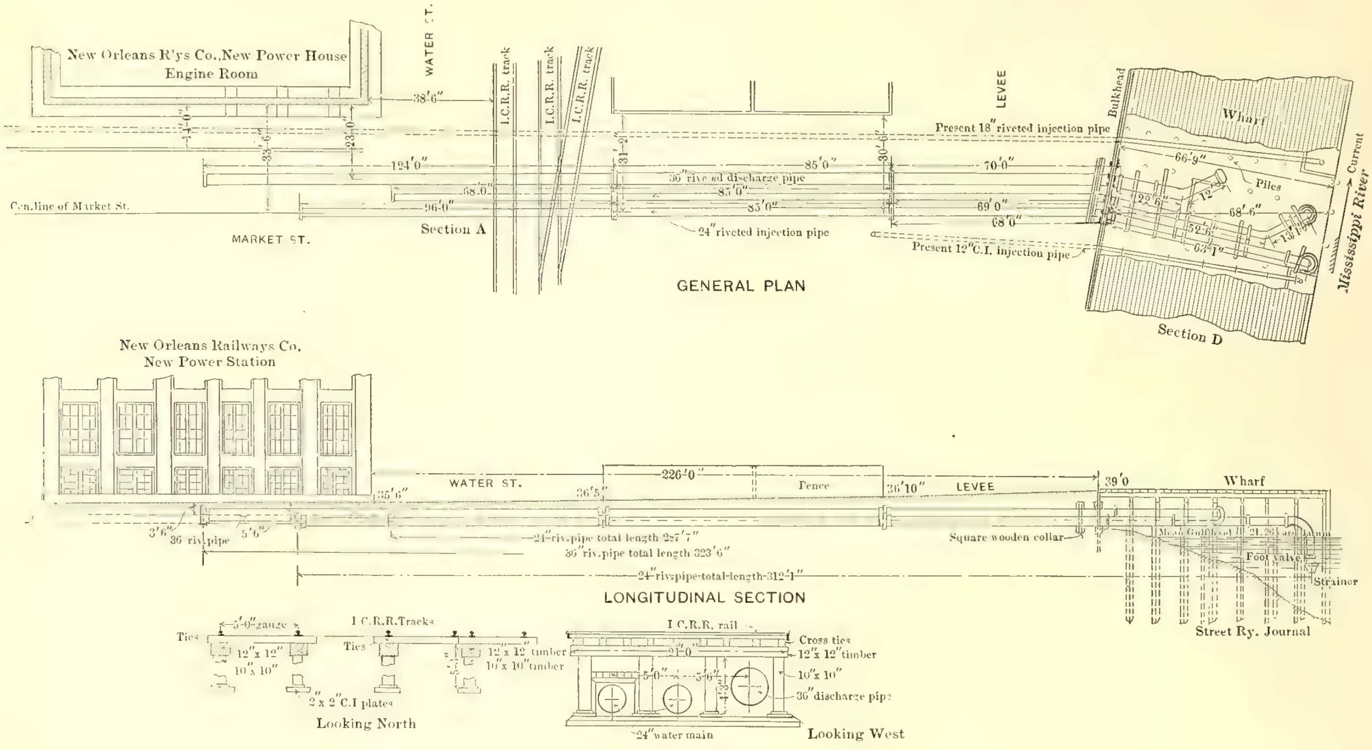
maintained into the boiler house and the engine room at this point. The steel frame base rises some 24 ft. above the foundation castings, or about 19 ft. above the grate level. The total height of the chimney proper is 136 ft., or 156 ft. 11 ins. above the grates. It is built of steel, and is 9 ft. in inside diameter.

With regard to the equipment of the engine room it should be stated that the 500-kw single-phase generator of No. 6 unit is to be replaced by a 500-kw direct-current General Electric generator, with an output of 275 volts. A 50-hp motor-generating exciter set, with one Tirrill regulator for automatically maintaining the desired volt of the alternating-current output, is to be furnished, having a compound winding for increasing the voltage under heavy load conditions. Besides additions to the switchboard equipment an additional air compressor for deep-well feed-water pumping is to be installed, together with a boiler feed pump and a water-storage tank. In connection with the feed water, the fact that artesian well water is available for use in the boilers without any treatment whatever is of interest. The water is obtained from the 700-ft stratum under New Orleans, and gives the following remarkable analysis, the figures being grains in 1 gal.: Chloride of sodium, 6.16; carbonate of soda, 14.36; carbonate of potash, .14; silica, 1.57; organic matter, 1.75; total solid, 25.31; free carbonic acid, 1.36.

THE ANNEX PLANT

Of the various plants owned by the New Orleans Railways Company, the latest constructed is the South Peters Street and Market Street annex plant. This is a new railway generating station erected behind a lighting station on South Peters Street,

from the boiler plant of which it receives steam. It has space for1500-kw and two 2250-kw direct-current railway units, and the third is already in process of erection. It was arranged by E. B. McKinney, superintendent of power of the New Orleans Railways Company.

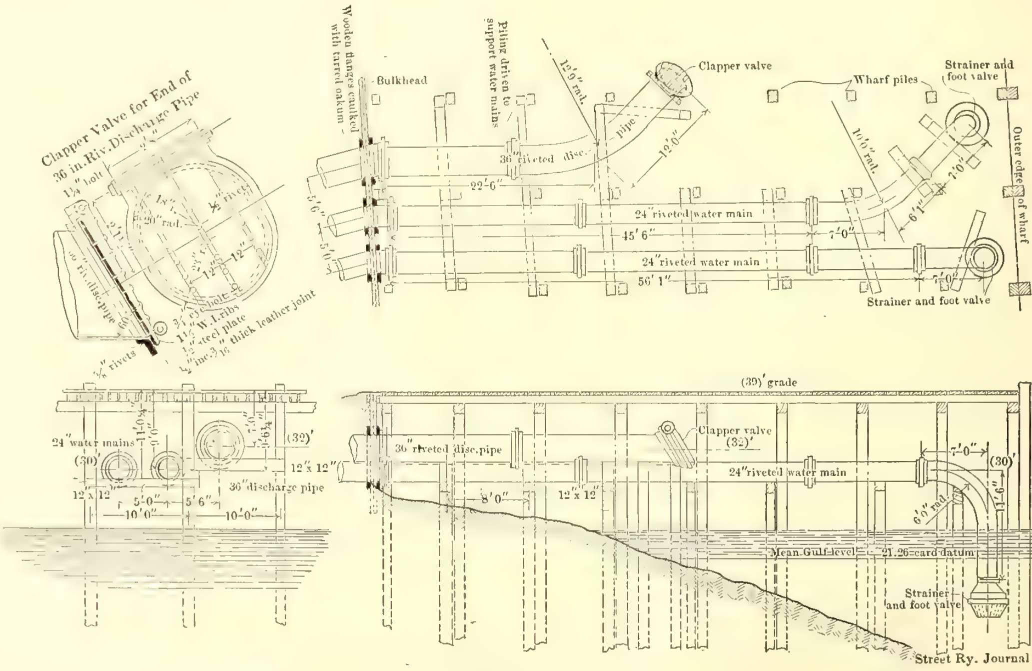


Showing Supports under Ill.Cen. Track overhead of Water Main

GENERAL PLAN AND SECTION, SHOWING ARRANGEMENT OF SUCTION AND DISCHARGE MAINS AT ANNEX PLANT

The building is of modern construction, lofty, well lighted and carefully designed, both with respect to recognized commercial refinements and to architectural embellishments, such as are now not unusual in the power generating stations of modern street railways. The foundations for the machinery not being carried far below grade level, the engine room floor has been placed somewhat above the street line and a basement formed around the foundations. The structure has a steel frame, but both the walls and the foundations are of brick work. The bricks are buff in color, with face brick on the outside. A noteworthy feature is the construction of the engine room floor. This is supported by brick arches, but these are covered with a double timber floor, consisting of ⅞-in. matched oak boards laid on 1-in. pine. The building is served by an electric traveling crane, of 30 tons capacity, built by the Whiting Foundry Equipment Company. The machinery frames are painted a dull, dark red, the roof trusses are a light brown, and the under side of the roof shows the tiles of which the latter is constructed. The floor is unbroken except for wells over the condensers, the steam machinery being operated condensing.

The generating units consist of an Allis-Chalmers vertical cross-compound engine of 32-in. and 68-in. cylinders and 60-in. stroke, and a General Electric 1500-kw direct-current machine, generating 550 volts at 75 r. p. m., and two Allis-Chalmers engines, 38-in. x 80-in. x 60-in. stroke, connected to two Westinghouse 2250-kw generators, generating 575 volts at 75 r. p. m. Steam pressure is ordinarily 125 lbs., and the vacuum ranges from 27½-ins. to 28-ins. The plant lies near the Mississippi



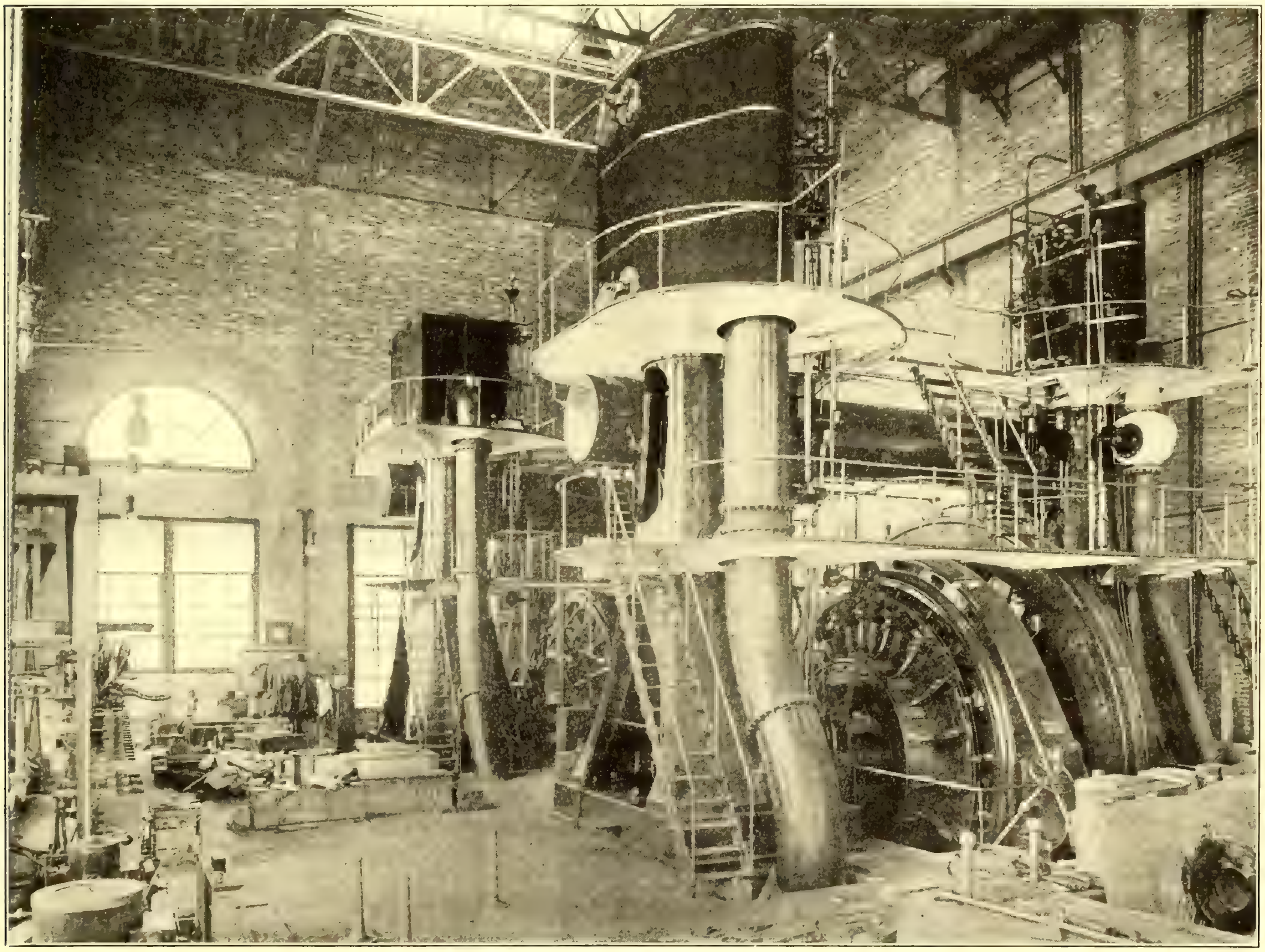
ENLARGED PLAN AND SECTION, SHOWING WATER MAINS UNDER WHARF, SUPPORTED ON 65-FT. PILES, ALSO CLAPPER VALVE FOR DISCHARGE PIPE

River, and jet condensers are employed, each condenser having a pair of 30-in. x 48-in. x 28-in. double-acting pumps, made by Dean Brothers' Steam Pump Works, of Indianapolis. The discharge from the condenser has a temperature of from 98 degs. to 100 degs.

An oil circulating system has been installed for both the

engine and the cylinder oil. In the basement there are two 3-in. x 2-in. x 3-in. Worthington pumps, which deliver to two overhead tanks, one for the engine oil and the other for the cylinder oil. Each of these has a capacity of 325 gals. The engine oil gravitating to the basement is passed through a Turner oil filter of 744 gals. capacity, and pumped to the overhead tank for use over again. These tanks are supported against the inside wall of the station, some 65 ft. above the basement floor. In the basement there is also a receiving tank for cylinder oil, this of 425 gals. capacity.

The boiler plant from which steam is delivered is equipped for both oil and coal burning. For the oil the circulating system, controlled by the National Supply Company, of Chicago, is employed, including a 4½-in. x 2¾-in. x 4-in. Snow pump for pumping the oil. The oil is brought from tanks in the yard outside, and is at a temperature of about 93 degs. F., and is delivered to the burners under 45 lbs. pressure and atomized by steam at 22 lbs. or 23 lbs. The oil tanks are fenced in with a corrugated iron fence, so that outsiders have no access to them.



INTERIOR OF ANNEX PLANT ON MARKET AND WATER STREETS

SUCTION AND DISCHARGE PIPES

One of the many interesting features of the main power house of the New Orleans Railways Company is the manner in in which the waters of the Mississippi River are utilized for cooling water in the jet condensers of the plant, through two 24-in. suction and one 36-in. discharge pipes, the arrangement of which was made by Charles H. Ledlie, of St. Louis. The method of construction is shown in the accompanying diagrams.

The position of the suction pipes is located up-stream, while the discharge pipe is turned down stream to prevent the possibility of the discharged cooling water getting back through the cooling pipe at a low stage of the river. The general diagram shows the locations of the old 12-in. and 18-in. pipes, also the method of supporting over the pipes the steam railroad tracks running along the river front, adjacent to the power house. The steady flow of the Mississippi River water into the pipes is often interrupted by the presence of fish in the strainers, causing them to become clogged, and requiring, as a rule, the services of a diver to clear the strainers. To avoid this trouble the foot valve and strainer are made tapering, as shown. Owing to this form the fish necessarily fall off of their own weight as soon as the use of the pipe is discontinued, which, of course, eliminates the usual necessity for a diver.

The second diagram also shows the method of supporting the suction and discharge pipes on piles, independent of any wharf support, which prevents any jar or strain on the pipes which might otherwise be caused by the landing of vessels at the wharf. The pipes are made of ¼-in. steel-riveted piping with flanges, in as long lengths as could be procured, and this character of piping was used in preference to cast-iron on account of the vibration of the ground, due to the peculiar quality of the soil in this section, and the continuous passing of steam railroad freight trains. The diagram also shows the effective and inexpensive clapper valve, which closes automatically during high water, and prevents a possible overflow.

MISCELLANEOUS

In connection with the foregoing statement of the power generating capacity of the plants of the New Orleans Railways Company, advantage is taken of the opportunity to reproduce among the accompanying illustrations a photograph of Canal Street. Here are shown the five lines of railway tracks, which stand on a level in the center of the street, that is a few inches

above the general street level. This, of course, has the advantage that wagons are not hauled along the street railway tracks to obstruct traffic. In conclusion, it will be of interest to record the following facts concerning New Orleans: It has a population of 300,000 people; 30 miles of dock facilities, and 700 miles of streets, of which 175 miles are paved.

E. C. Foster is president and manager of the New Orleans Railways Company; John G. Woods, the general manager of the railroad department; A. L. Black, electrical engineer; E. B. McKinney, superintendent of power, and F. C. Rojo, master mechanic. The provision of a new chimney in Edison Station No. 1 and the changes in the equipment of that plant are the work of Messrs. Sanderson & Porter, engineers and contractors, of New York City.

STREET RAILWAY EXHIBITS AT THE WORLD'S FAIR

In the last issue of the Street Railway Journal particulars were given of some of the most interesting exhibits at the St. Louis Fair. In this issue a number of other exhibits are illustrated and described. It has been impossible to complete the list of exhibits of street railway interest at St. Louis in these two issues, but others will be taken up in the next few succeeding numbers of this paper.

CONSOLIDATED CAR HEATING COMPANY

The Consolidated Car Heating Company's exhibit in the Transportation Building is arranged to show both steam and

EXHIBIT OF THE CONSOLIDATED CAR HEATING COMPANY

hot-water heating systems for electric roads. Several of the standard forms of Consolidated electric heaters are exhibited, and also new types of cross-seat heaters and heaters of special sizes. One part of the exhibit is devoted to quick-brake switches and switches for various combinations for regulating the degree of heat. A switchboard, as used on the new elevated cars of the Brooklyn Heights Railroad for the control of heaters, is one of the interesting features in the switch and regulator department of the exhibit. There is a new hot-water system for heating interurban cars. The fittings used with this hot-water heating system are similar to those used with this company's steam railroad car equipment. The exhibit is fitted up to represent the half of a steam or interurban coach.

LAGONDA MANUFACTURING COMPANY

Every engineer or user of steam who attends the St. Louis Exposition will, of course, be interested in the Steam, Fuel and Gas Building, in which is located the immense boilers of American, French, German and English manufacture, in all some 40,000 hp, which furnishes steam for power and other purposes for the entire Exposition. Not the least interesting display along this line is that made by the Lagonda Manufacturing Company, of Springfield, Ohio, whose space, 15 ft. x 20 ft., is directly in front of and midway of the line of boilers referred to above. Here the company has a very attractive display of its entire line of tube cleaners and other boiler room and steam specialties.

THE ALBERGER CONDENSER COMPANY

Two large condensers in the exhibitors' power plant, in the Machinery Building, have been supplied by the Alberger Condenser Company, of New York. One of these is the barometric type, and the other is a surface condenser. The barometric condenser is used for the 500-hp Allis-Chalmers engine, which is the largest in the building. This is located at the southwest corner of the block occupied by the big Allis-Chalmers engine. A single Corliss combination engine and vacuum pump, direct connected to a rotary circulating pump, is located at the southwest corner of the space close to the Alberger barometric condenser, air cooler and tail pipe which it supplies.

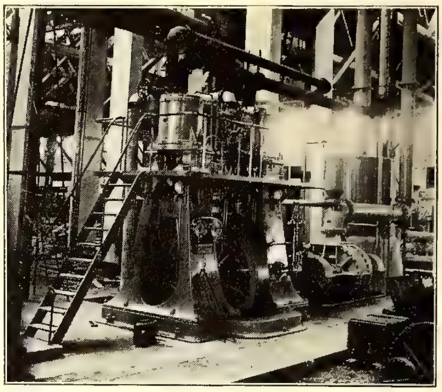


EXHIBIT OF THE ALBERGER CONDENSER COMPANY

The surface condenser equipment is intended for use with several engines operating the Intermural Railway plant, and consists of an Alberger surface condenser of 5000 sq. ft. of tube surface, horizontal Corliss dry vacuum pump, and a centrifugal circulating pump and engine.

THE BROWN-CORLISS ENGINE COMPANY

Two notable high-speed Corliss engines in the exhibitors' power plant are those of the Brown-Corliss Engine Company, of Corliss, Wis., which are driving 500-kw railway generators for the Intermural Railway. These are vertical, cross-compound condensing engines, running 138 r. p. m. Their rated horse-power is 750 with 150 lbs. steam pressure, and running at the most economical point of cut off. The cylinders are 18-in. and 36-in. x 36-in. stroke. The cylinders are made double ported, and ports are made large enough so that the piston heads partially cover the pockets at the end of the stroke.

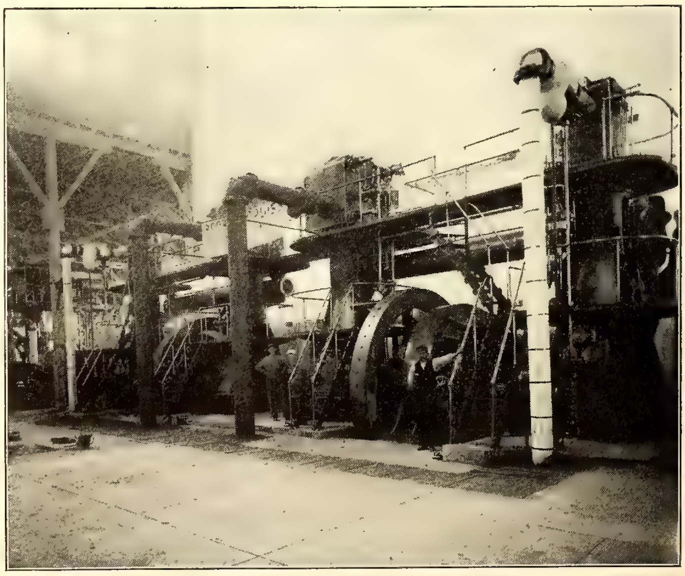


EXHIBIT OF THE BROWN-CORLISS ENGINE COMPANY

The movement of the valve gear and dash pot is very small. All these things tend to make possible quick action of valve gears and quick opening of steam ports necessary for a high-

speed Corliss engine. The clearance of the piston heads at the end of the stroke is 3.16 ins.

These engines have been giving continuous service for the Intramural, and although high speed for Corliss engines, apparently are not working up to their limit of rotative speed. The high speed of this unit, of course, makes it smaller than slower speed units of corresponding capacity.

ST. LOUIS CAR COMPANY

The most extensive exhibit of electric cars and trucks to be found at the Exposition is that made by the St. Louis Car Company. This company has not only succeeded in getting together a very interesting historical collection, showing the growth and evolution of the modern electric car from the stage coach, but also shows a number of modern cars, differing considerably in their construction, but all good representations of certain types. The historical exhibit begins with an old stage coach (the father or grandfather of the interurban electric car) which saw service in the early sixties in the Louisiana Purchase territory. Next in order after the stage coach, is one of the old bob-tailed horse cars from Louisville, and next to it a most peculiar little narrow-gage bob-tailed mule car, now made in large numbers for large plantations in Cuba. Then comes the beginning of mechanical traction, represented by the first cable car. This car is complete with grip and brake mechanism. It was put in service on the Clay Street line in San Francisco in 1873. This is followed by the first electric car, built by the St. Louis Car Company in 1887, for the Topeka Railway. This car was in service until the first of this year, and is shown just as it was taken off the road, with light trucks and double-reduction motors. Next in line is a sample of a car built for export, of which over 500 have been sent to Argentine Republic. Two types of double-deck cars, one on single trucks and the other on double trucks, as used in Great Britain, are shown. The exhibit of modern American cars includes the standard car of the St. Louis Transit Company, the car of the Northwestern Elevated Railroad, of Chicago, the car built for the subway lines of the Interborough Rapid Transit Company, of New York, a heavy trailer built for the Key Route in Oakland, Cal., and the heavy combination closed and open interurban car for the Pacific Electric Railway, of Los Angeles. The crowning feature of this exhibit is to be the magnificent private car built for President John I. Beggs, of the Milwaukee Electric Railway & Light Company. This car, which at present writing is not completed, will undoubtedly be the finest and most expensive electric car ever built. It is arranged in various compartments, so that a small party can live on this car just as on any steam railway private car. The different compartments are finished in various kinds of rare woods in very beautiful sections. The car is to have sleeping and parlor compartments and kitchen. It is made to the maximum length

BOOTH OF THE ST. LOUIS CAR COMPANY

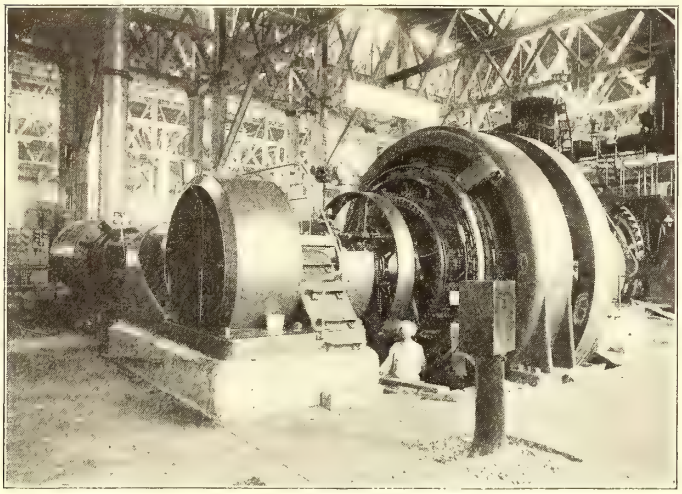
that can be operated over the city lines of the Milwaukee Electric Railway & Light Company, and is intended for high-speed interurban use.

Each end of the car is an observation compartment, finished in East India vermillion wood, with a motorman's cab at the left side. Each observation room has an upper and a lower berth, and in one of them is a typewriter desk. In the center is the dining room, finished in Philippine rosewood, with marquetry designs and inlaid lines throughout. A sideboard and fireplace add to the beauty and usefulness of this room. The circular table and chairs are of special design. The refrigerator extends through to the kitchen, and has a partition dividing it into two compartments. Besides the dining room, two observation rooms and kitchen, there are two compartments. One compartments has a sofa, upper and lower berth, dressing case and folding washstand. It is finished in Hungarian ash. The second compartment has a writing desk and folding bed, which folds up in a cabinet under a book case. This is finished in Prima Vera. The kitchen, which is finished in quarter-sawed oak, has a range 26 ins. x 30 ins., a refrigerator and linen lockers. The toilet room, finished in zebra wood, is equipped with washstand and closet. The passageways are finished in vermillion. Ceilings are full Empire, decorated to harmonize with the finish of each room. The bottom window sashes are arranged to drop. The upper sashes are gothic, with art glass. These sashes are stationary. The car is to be equipped with electric heaters and with Peter Smith hot-water heaters. The trucks will be St. Louis 23-E, M. C. B. type, equipped with four G. E.-74 motors, with type-M train control.

INTRAMURAL CAR BUILT BY THE ST. LOUIS CAR COMPANY

The other modern cars in this exhibit have all been illustrated and described in detail in the columns of the Street Railway Journal in the past. The Northwestern Elevated car is a good

example of what is considered standard construction and arrangement for elevated cars. The New York subway car has some peculiar features in the way of fireproof construction and



CROCKER-WHEELER GENERATOR IN INTRAMURAL POWER PLANT

vestibules. The sheathing is of copper. The Key Route car for Oakland is a compromise between steam and street railway construction. The car for the Pacific Electric Railway is an example of the combination open and closed construction in use on the Pacific Coast. The St. Louis Transit Company car is a very wide city car, with an extremely long Dupont platform.

Besides the cars there is also shown a great variety of trucks made by this company. The M. C. B. type of heavy interurban truck is represented by the No. 23-B truck. The short wheelbase truck for city service, No. 47, in which this company takes much pride, and the Hedley truck for interurban and elevated service, No. 50, are also exhibited. The exhibit of general supplies, including bearings, trimmings, seats, arc headlights, arc lamps for interior lighting, brakes, shoes, brake handles and sand-boxes, is also very comprehensive. The company has a booth fitted up as an office for the reception of its friends. Another important part of this company's exhibit, which is not found in the Transportation Building, is the rolling stock of the Intramural Railway. All cars for the Intramural Railway were built by the St. Louis Car Company. These Intramural cars, which are representative of the car which has been built in

EXHIBIT OF THE LUNKENHEIMER COMPANY

large numbers for certain city systems for the past few years, are 44 ft. long over all, with 34-ft. bodies. They have the channel steel bottoms, on which this company holds the patents. They are the same as the cars used on the Chicago City Railway, being first designed for that company, and are intended to give a very low platform with a double truck. With the addition of steps (which are unnecessary on the Intramural, because of the station platforms) these cars become standard city cars.

THE CROCKER-WHEELER COMPANY

All the 500-volt direct-current railway generators in the Machinery Building which supply the Intramural Railway were supplied by the Crocker-Wheeler Company, of Ampere, N. J. This Intramural Railway power plant, which is a part of the exhibitiors' power plant in the Machinery Building, consists of six generators, driven by various types of engines. The largest generator, which is of 900-kw capacity, is direct connected to a Buckeye engine, running 100 r. p. m. Two generators of 500 kw are direct connected to Brown-Corliss engines, each running 135 r. p. m. One generator of 600 kw, running 85 r. p. m., is direct connected to a Lane & Bodley Corliss engine. One of 400 kw is operated by a Fleming 4-valve engine, running 150 r. p. m., built by the Harrisburg Foundry & Machine Works. One generator of 500 kw is operated by a Murray Iron Works Corliss engine, running 100 r. p. m. All these generators supply current through a railway switchboard, supplied by the Walker Electric Company, of Philadelphia. These machines all operate

EXHIBIT OF THE HALE & KILBURN MANUFACTURING COMPANY

well as regards sparking and heating, and they have given a very satisfactory service since the opening of the Intramural.

THE LUNKENHEIMER COMPANY

The Lunkenheimer Company, of Cincinnati, shows a large number of the great variety of globe valves and other steam specialties which it manufactures. A new oil pump for cylinder and bearing lubrication is exhibited. The exhibit includes water columns of three types, adapted to be operated from the floor of the boiler run without the necessity of an attendant climbing a ladder. All types of pop valves, check valves and gate valves are shown, and the exhibit must be studied in its hundreds of details to be appreciated.

THE HALE & KILBURN MANUFACTURING COMPANY

A splendid exhibit of car seats for electric railways is made by the Hale & Kilburn Manufacturing Company in the Transportation Building. Thirteen different styles of electric car seats are shown, besides numerous steam railway seats. The electric car seats average about 30 ins. in width, that being the width in most common demand. The thirteen varieties of electric car seats range all the way from a wood bottom "walk-over," for use in very narrow summer cars, to high-back wide "walk-overs" for use in interurban cars, which differ only in width from those used by the steam railways. Some of the latter have 26-in. backs with head rolls. One of the neatest seats shown is what is called the "Neverbreak Walk-over," for steam and interurban service, with single foot rest shifted with the back. The Hale & Kilburn "walk-over" construction has

proved so well suited to the limited space available in electric cars that it has almost become the standard for electric car cross-seats. Just the combination of features to be used is entirely a matter of selection with the customer, as he can be supplied seats with or without arms, with several different types of base, or with double or single foot rests, shifted automatically or fixed in place. One of the most interesting things about this exhibit is the part containing the construction of Hale & Kilburn cushions. The rattan is backed by strong canvas, and the springs bear against this canvas through the medium of wide steel strips. The back of the booth is covered entirely with rattan seat material. Perhaps, after all, the best exhibit of this company is not in the company's booth itself, but in the numerous exhibition cars found elsewhere in the Transportation Building in which Hale & Kilburn seats have been used. All the cars in the exhibit of J. G. Brill Company have these seats, as have also the electric cars exhibited by the American Car & Foundry Company and the John Stephenson Company.

H. B. CAMP COMPANY

In the court of the Electricity Building the H. B. Camp Company has a neat exhibit of conduit ducts. One-half of a manhole is shown, with a Camp multiple-duct conduit entering it. Besides this, many samples of different duct sections made by the company are shown, including the Camp divided tile conduit, which can be used either as an unbroken tile or can be

EXHIBIT OF CAMP CONDUITS

split open. Several kinds of bends and straight line conduits are included in the exhibit.

THE HEINE SAFETY BOILER COMPANY

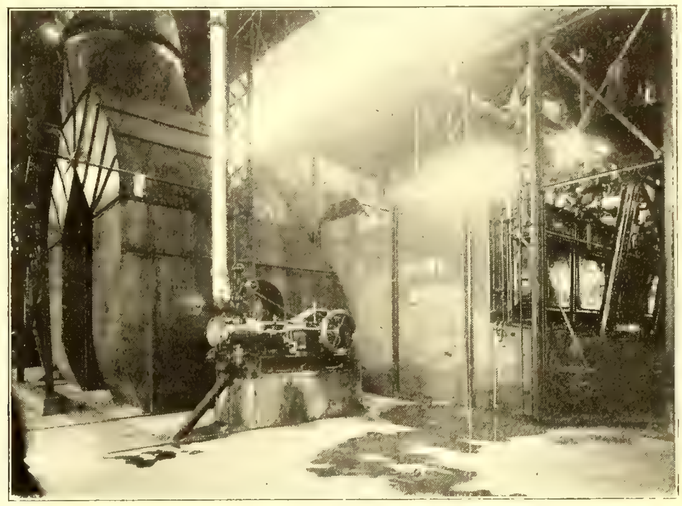
A large bank of water-tube boilers, made by the Heine Safety Boiler Company, of St. Louis, will be found in the boiler house, and an exhibit showing the construction of the Heine boilers and their different parts is located in the northwest corner of the Machinery Building. In the boiler plant there are eight single-shell boilers, rated at 400-hp each. These boilers are designed for a working pressure of 175 lbs. per square inch. Each boiler has 176 18-in. tubes and a drum 48 ins. in diameter. In common with all the boilers in this plant they are connected to induced-draft apparatus. They are equipped with Green traveling chain grates supplied with fuel from overhead coal bunkers.

Besides the eight boilers in the main boiler house, three 250-hp boilers of the double-shell type will be found in the power plant of the Ferris Wheel, and also some boilers of the single-shell type in the fuel test plant of the outside mining exhibit.

The company's exhibit space in the Machinery Building has a part of a full size Heine boiler showing the construction of the boiler heads, and also a complete model of a Heine boiler. The quality of steel tubing used in Heine boilers is illustrated by some tubing which has undergone some very severe treatment in the way of bending and flattening without breaking.

WESCO SUPPLY COMPANY

The exhibit of the Wesco Supply Company, of St. Louis,



HEINE SAFETY BOILERS IN POWER PLANT

covers an area of 5300 sq. ft., taking up all of Block No. 8 in the Electricity Building, and comprising a number of exhibits furnished by the several large manufacturing companies whom the company represents. One portion of the space is devoted especially to electric railway goods. Among the most important of these exhibits will be the line of overhead and construction material, furnished by the Electric Railway Equipment Company, of Cincinnati, who will also set up some practical machines for use in putting up trolley lines. The Leonhardt Wagon Manufacturing Company, Baltimore, Md., has one of its new improved revolving tower wagons on exhibition, made to appear ready for trouble work. The Globe Electric Manufacturing Company, of Cleveland, Ohio, has several of its arc and incandescent headlights on exhibition, showing some of them connected up and operating from a 500-volt circuit. In

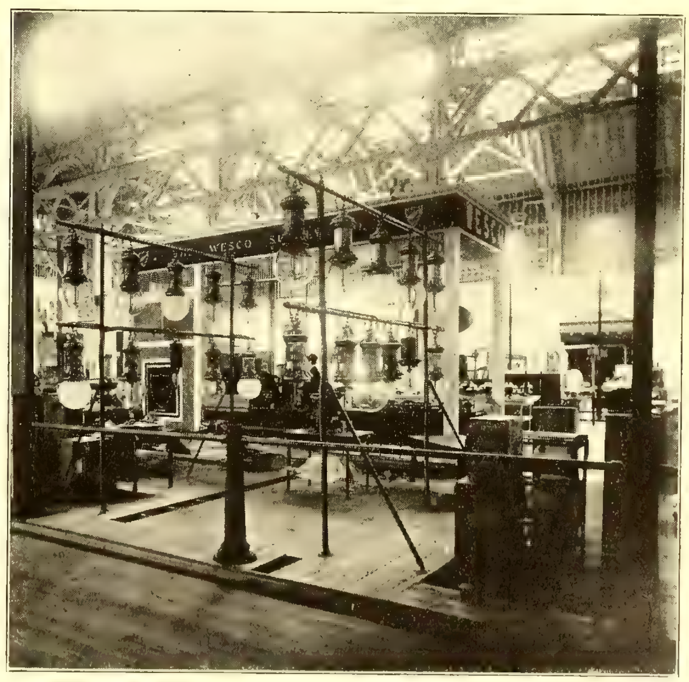


EXHIBIT OF WESCO SUPPLY COMPANY

addition to the above, other manufacturers of apparatus and electrical supplies used by street railway companies, have exhibits in this space. The Stombaugh guy anchor exhibit, by Matthews & Bro., and the wheel truing brake-shoe exhibit, shown in the Wesco space, were described last week.

RODGER BALLAST CAR COMPANY

Interurban construction men will be interested in the track ballasting cars of the Rodger Ballast Car Company in Transportation Building. Three Hart convertible ballast cars are

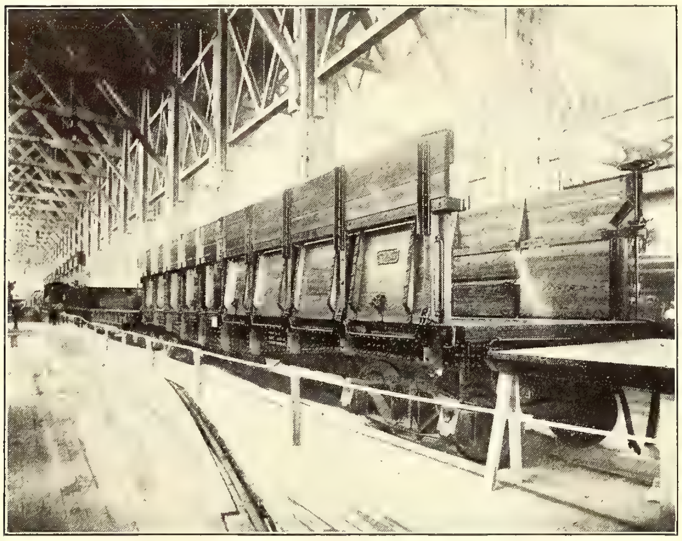


EXHIBIT OF THE RODGER BALLAST CAR COMPANY

shown. Two of these have sides hinged at the bottom, which can be swung out and down, so as to leave the car practically a flat car if desired. These cars have dump bottoms, which, however, can be closed if the car is to be converted into a flat car. The third car has bottom dump and sides hinged at the top, so as to swing out at the bottom. It can be used either as a bottom dump or as a side-dump car. It can be arranged to unload with a plow, according to the old method common with flat cars, and can, therefore, be put to practically all the uses of a gondola, dump and flat car. These cars are also in use hauling coal and material in the service of the Exposition.

THE CRANE COMPANY

The Crane Company has in the Machinery Building a large and very instructive exhibit of its well-known types of high, low and medium-pressure steam valves and fittings. At the main entrance of the space there are two immense valves; one an automatic relief valve, 36 ins. in diameter, for use in the exhaust of a steam engine operated on a condenser. The other is a 36-in. gate valve. Seven kinds of flanged joints for high pressure steam work, with wrought-iron pipe, are shown, which illustrate well current practice. The most popular and lowest in first cost is a semi-steel cast flange, screwed onto the pipe, the end of the pipe and flange then being turned off. The taper on the threaded end of the pipe and on the flange are the same. In another, and more expensive form of joint, the flange is shrunk onto the end of the pipe, and the end of the pipe is then expanded in the flange. The bearing surface between the flange and the pipe must be machined off for the shrinking operation; consequently, this is more expensive than the threaded construction. A third form of flange is one inwhich the pipe is cold rolled into a recess which turned in the flange. The pipe is expanded by the rolls into the recess. A fourth form of joint construction consists in welding the pipe into the flange. The four general schemes of fastening pipe flanges to the ends of the pipes are further modified by different forms of flanges. For customers who prefer it, flanges are made with a recess which will permit a copper ring to be inserted just outside of the joint, between the pipe and flange. This ring can be hammered into the recess, so as to caulk any leaks which might develop between the pipe and flange.

The most prominent feature of the exhibit, and one which shows the facilities of the Crane Company for pipe bending,

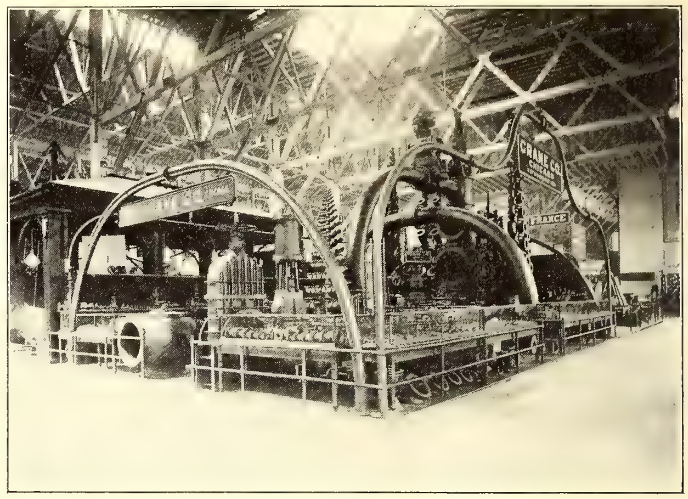


EXHIBIT OF THE CRANE COMPANY

is an arch made of two 20-in. pipes, bent to a curve of 10-ft. radius. Surmounting this arch is a vertically-operated globe valve, in which the opening and closing of the valve is accomplished with an electric motor. Such valves are intended for use in large steam plants, where, in emergencies, it may be desirable to shut off steam from a certain section of piping without going to the valve to do it, as, for example, when there is a bad leak or a breakage in the steam fittings of a boiler. Electrically-operated valves in such a case may save the complete shutting down of the plant.

The exhibit is very comprehensive. The company makes over 10,000 articles for steam, gas and water, and in this exhibit an example is shown of nearly every device or fitting made by the company. This does not mean that all sizes of any device are shown, but that a sample of one size is exhibited.

EXHIBIT OF THE BROWN HOISTING MACHINERY COMPANY

The exhibit is, therefore, truly representative of all the products of the Crane Company. These fittings are made for all pressures up to 2000 lbs. per square inch, the latter being the safety limit of double extra heavy pipes and fittings. It makes

automatic relief valves for use on hydraulic presses and testing machinery good for pressures up to 1000 lbs.

THE BROWN HOISTING MACHINERY COMPANY

In connection with the Yale & Towne Manufacturing Company, the Brown Hoisting Machinery Company, of Cleveland, Ohio, shows locomotive cranes of 10 tons and 15 tons capacity and much other hoisting and conveying apparatus, including trolleys and travelers, tramrail equipment, crabs and winches and a hand bridge crane. The Yale & Towne exhibit includes a great variety of hoisting blocks operated by electric motors and by hand. Those interested in hoisting apparatus for repair shops and car houses, or in the handling of heavy special work in track work shops, will find much worth seeing here.

LEONHARDT WAGON MANUFACTURING COMPANY

A tower wagon made by the Leonhardt Wagon Manufacturing Company, of Baltimore, is exhibited by the Wesco Supply Company in the Electricity Building. This wagon has the ladder type of tower which can be raised or lowered, and revolves so that the wagon can be placed at one side of the track with the tower over track if necessary. To support the platform when it overhangs the track, long supporting poles are provided which are attached to the rear of the wagon when the tower is in the position shown in the accompanying engraving. There are a number of details in connection with this wagon which are worth studying on the part of the superintendent of overhead construction.

THE HARRISBURG FOUNDRY & MACHINE WORKS

One of the units of the Intramural power plant in the Machinery Building is driven by a Harrisburg Foundry & Machine Works Fleming, 4-valve, tandem, compound, automatic engine of 600 hp. This engine operates at the high speed of 150 r. p. m., but is, nevertheless, very smooth in operation, and although it is located near Corliss engines having much lower rotative speeds, the high speed of the engine would not attract the attention of the casual observer. The engine has cylinders 15-in. and 40½-in. x 26-in. stroke. The governor is located on the shaft and acts on one of the eccentrics. There are three eccentrics. One of these eccentrics is controlled by the governor, and, therefore, controls the point of cut-off of the high-

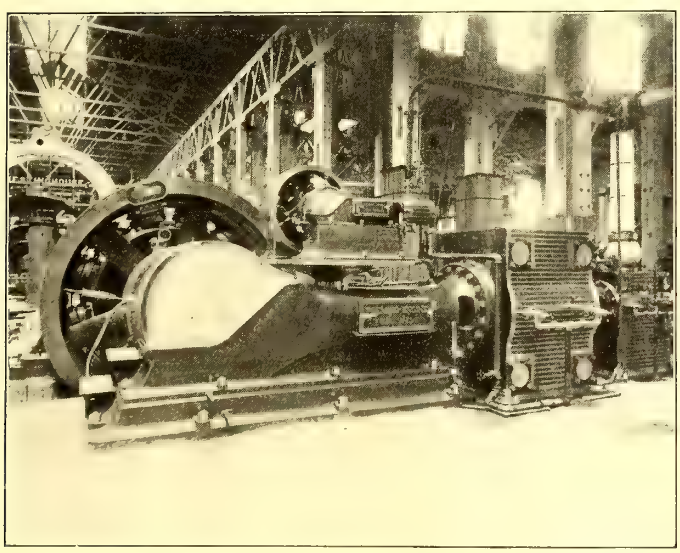


EXHIBIT OF THE HARRISBURG FOUNDRY AND MACHINE WORKS

pressure cylinder. The second eccentric is fixed on the shaft, and controls inlet valves of the low-pressure cylinder. These inlet valves, therefore, have the point of cut-off fixed. The third eccentric opens and closes the exhaust ports, four in each cylinder. The engine is automatically lubricated. The crank chamber is closed and partly filled with oil, the crank pin and guide rods are lubricated by the splash of oil in the crank chamber. Near the top of the crank chamber, above the lever and the main bearing, is a trough which receives some of the oil splash and delivers it by gravity to the main bearing.

THE AULTMAN & TAYLOR MACHINERY COMPANY

The exhibit of the Aultman & Taylor Machinery Company's water-tube boilers and chain grate stokers consists of eight 500-hp boilers, built to carry 250 lbs. steam pressure. Each boiler contains 5080 sq. ft. of heating surface, and is equipped

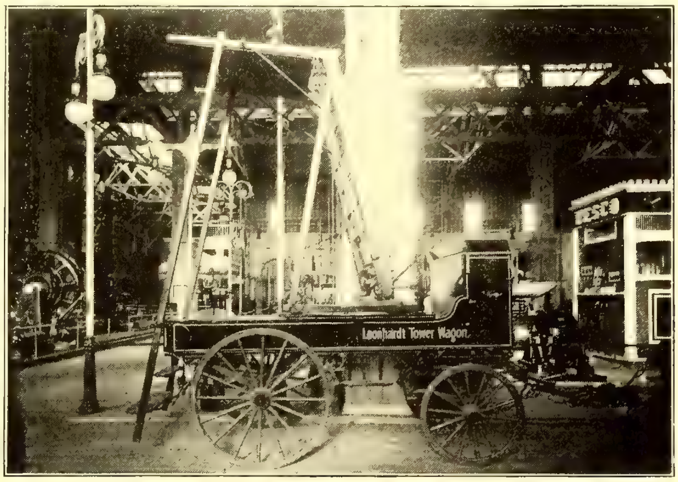


EXHIBIT OF LEONHARDT TOWER WAGONS

with the company's own chain grate stoker; also four boilers, 500 hp each, of 175 lbs. steam pressure, each equipped with a chain grate stoker; also have eight 400-hp boilers for 175 lbs. steam pressure, and containing 4000 sq. ft. of heating surface, and equipped with a chain grate stoker. All of these boilers are of the "Cahall" horizontal water-tube type, and each installation is equipped with an independent induced draft apparatus, and the coal is fed to the stoker hoppers by storage tanks and the conveyer system. The company also has three 250-hp "Cahall" vertical boilers, each boiler containing 2536 sq. ft. of heating surface, and each is equipped with a chain grate stoker. Each of these three boilers has an independent stack and is operated with natural draft. The above makes a total of 8014 hp of boilers and stokers, all of which are in operation, and are developing in the neighborhood of 12,000-boiler horse-power, and supplying steam for over 25,000-engine horse-power. This plant is said to be by far the largest boiler exhibit that was ever made, and it constitutes about 60 per cent of the entire exhibitors' boiler plant at the Exposition. The high-pressure boilers are used for operating the steam turbines that are located in the Palace of Machinery. All the boilers and stokers are located in the central portion of the Steam, Gas and Fuel Building, which is directly west of the Palace of Machinery.

In addition to the working exhibit, the Aultman & Taylor Machinery Company has a very large non-working exhibit, situated in Block 53 on the northwest corner of the Palace of Machinery. This exhibit consists of one 125-hp horizontal water-tube boiler, equipped with the company's superheater and chain grate stoker. The boiler is bricked up on one side, leaving the other side exposed, and the entire system can be examined. The company also has one cross-drum type horizontal water-tube boiler of 100-hp capacity, bricked up entirely on one side, and also one 100-hp "Cahall" vertical water-tube boiler, bricked up in similar manner. In addition to these three full-sized boilers, the company has all of the parts in unassembled condition, as well as a very pleasant office fitted up in this space.

THE NATIONAL CARBON COMPANY

An exhibit booth, constructed entirely of carbon, is the unique display made by the National Carbon Company in the Electricity Building. The posts and railings of this booth are made from large electric furnace and electrolytic carbons. The

carbon products in the booth include carbon brushes for railway motors and generators as well as carbon for the dozens of other uses to which carbon is put in electrical work.

HEADQUARTERS OF THE STREET RAILWAY JOURNAL

The booth of the McGraw Publishing Company and of the STREET RAILWAY JOURNAL, are in Section 1 of the Electricity Building. This space is at the head of the main aisle. A large electric sign, bearing the name of the company, over the exhibit, can be seen at a distance of 500 ft. Directly under

HEADQUARTERS OF THE STREET RAILWAY JOURNAL

this are illuminated signs reproducing the cover pages of the four principal engineering periodicals, which cover the entire field of engineering, and are known to more than 50,000 readers. A comfortably furnished library is provided, with facilities for receiving mail sent in care of the company, writing material, etc., all of which are at the disposal of the subscribers of this paper. A register showing the visitors then at the Exposition is also maintained. Complete files of the following publications are available for the inspection and reference of visitors: "Electrical World and Engineer," STREET RAILWAY JOURNAL, "The Engineering Record," "American Electrician," "Electrochemical Industry," "American Street Railway Investments," "Electric Railway List and Buyers' Manual," "Central Station List and Manual of Electric Lighting," as well as technical books on all branches of engineering.

THE D. & W. FUSE COMPANY

The D. & W. Fuse Company, of Providence, R. I., exhibits two boards in the Western Electric Company's exhibit, showing this company's different forms of cut-out boxes. One of these boards is devoted to open porcelain cut-outs with cartridge fuses mounted upon them, and the other panel is devoted to cut-outs enclosed in iron boxes. In the latter is included the iron fuse box intended for use on electric cars. This cut-out has heavy contact jaws, into which a large fuse cartridge is pushed, giving a contact similar to a knife switch. Many other fuses suitable for car lighting circuits, as well as the regular line of lighting circuit fuses, are shown.

MINIATURE RAILWAY COMPANY

The Miniature Railway Company, of New York, which makes and operates miniature steam railways for pleasure resorts, has several such railways operating parallel with the Intramural Railway, between the Intramural and the Pike. These tiny railways are built with 15-in. gage. The little steam locomotives are almost exact models of large locomotives, as far as their small size will permit. The locomotives weigh 3500 lbs., and are capable of pulling five canopy-top cars. The miniature railways are proving popular, especially with the children, and seems to be a very profitable attraction.

AN EXTENSIVE ENLARGEMENT OF POWER PLANT FOR THE BOSTON & WORCESTER STREET RAILWAY

The development of traffic upon the Boston & Worcester high-speed electric railway, which was opened for service through to Worcester early last summer, has been phenomenal, having reached, before summer was over, an amount which was almost double the maximum that was expected and provided for. In anticipation of inevitably heavier traffic conditions it was early this year decided to largely increase the capacity of the power plant in order to care for the extremely heavy loads due to summer travel. As stated in an article which appeared in our "souvenir" issue of 1902 (Oct. 4, page 550), describing this system, the present equipment consists of a 1000-kw generating unit and one of 500-kw capacity. This proved to be inadequate for operating the road under the unexpectedly heavy traffic that soon developed upon the system. In addition to this the condenser equipment was hampered in the summer months of last year by a lack of water in the steam from which the circulating water supply for the condensers was taken.

Additional generating equipment is to be provided in the form of a 2000-kw Curtis steam turbine, with direct-connected generator of the usual vertical type, which will be installed in the engine room adjacent to the present generator units. The turbine will deliver three-phase alternating current at 13,200 volts, and will be operated in parallel with the present generators driven by reciprocating engines for the long-distance transmissions. For the boiler room two additional Aultman & Taylor horizontal water-tube boilers, of 600-hp capacity each, are being installed.

Provision is being made for an extra supply of condenser circulating water by the installation of three cooling towers by the Alberger Condensing Company, New York. This water cooling apparatus is to be of sufficient capacity to be able to furnish the entire circulating water supply for the plant in case the river becomes practically dry. The cooling towers are of the well-known Alberger vertical steel-shell type, operated with draft furnished by induction motor-driven fans, and are each 24 ft. in diameter. As is well known, these towers use wood (cypress) slats, set upon edge, over which the water drips in flowing through. The cooling towers are located to the east of the engine room portion of the building, and are conveniently arranged for the piping connections to the engine room basement.

The three towers are designed to provide cooling water sufficient to permit the entire generating equipment of the station, including the turbine and both reciprocating engines, to be operated condensing when worked at full load under most unfavorable circumstances of hot, sultry weather conditions and high humidity. Their design was based upon the cooling under such unfavorable conditions of the circulation water from the condensers for the combined generating equipment of 3500 kw, being guaranteed to supply the circulation cool enough to maintain a 27-in. vacuum when 60,000 lbs. of steam are used per hour (assuming 20 lbs. per kilowatt-hour) in the station.

In addition, the sub-station electrical equipment at the main power plant, as well as also at Westboro, is being doubled in capacity. Another 500-kw General Electric rotary converter is being installed at each place, and a novelty is being incorporated in this equipment in the form of the single-unit, three-phase transformer, which type has not been extensively used in this country. These self-contained transformers are each of 550-kw capacity, in contradistinction to the 500-kw capacity of the rotary converters. The use of the single three-phase transformers, instead of three single-phase transformers, is an interesting departure in sub-station apparatus and will be watched with interest by those having to do with electrical transmission work.

REPAIR SHOPS FOR SMALL ROADS

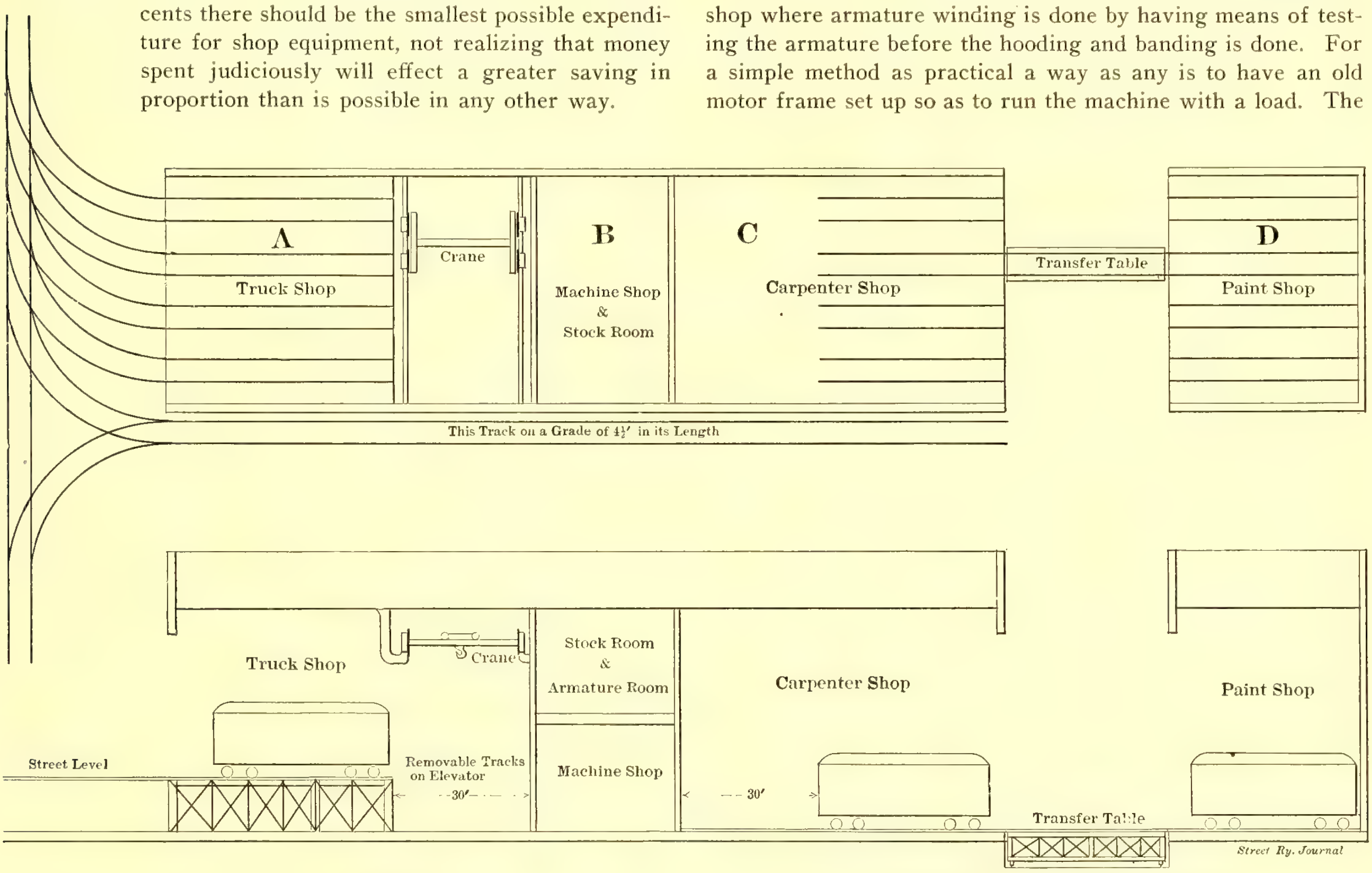
BY FRANCIS G. DANIELL

In the equipment and management of large electric railway properties the repair shop is an essential whose design is given the greatest attention, but on the small and medium sized road the facilities provided for repairs and renewals of rolling stock are too often neglected.

Nothing reflects so much on the management, or gives the casual observer such a poor opinion of the physical condition of a railroad property, as to see the cars in a dilapidated condition, with fenders bent, paint scratched, bolts loose on the trucks, and the accompanying rattle and grind of worn gears. In a great many cases the fault lies not with the men at the shop but with the "powers that be," who seem to think that as the repair department does not show any receipts in dollars and cents there should be the smallest possible expenditure for shop equipment, not realizing that money spent judiciously will effect a greater saving in proportion than is possible in any other way.

Little things which pay big returns are a blower for the forge, which will nearly double the output of the blacksmith shop, and a power grindstone, which will save one man whenever there is any grinding to be done. Another machine which will pay big interest is a winder for banding armatures, and which can be made out of an old lathe. The writer built one at a total cost of $30, which paid for itself in a month. Still another machine which will be a great saver is an hydraulic lift for removing axles from the trucks. In one shop which I have in mind, the cost of jacking up one end of the car, so as to run out the wheels, changing the gear and putting back under the car ready to run out, was from $9 to $12. When the proper arrangement of the pit was made and the hoist installed the cost was reduced to $3 or $4. The time was reduced in proportion. The cost of the hoist and its installation was about $200.

A great deal of time and money can be saved in a small shop where armature winding is done by having means of testing the armature before the hooding and banding is done. For a simple method as practical a way as any is to have an old motor frame set up so as to run the machine with a load. The best method is to drive another motor as a dynamo, and by using different frames two different types can be tested at once. The frames can easily be wired so as to run either one as the motor or generator at pleasure.



PLAN AND LONGITUDINAL SECTION, SHOWING CONVENIENT ARRANGEMENT OF REPAIR SHOPS

Power-driven machinery is the greatest factor of economy in these shops. While, theoretically, the current consumed may cost money, practically there would be no difference in the coal bill and no appreciable increase or expense anywhere. On the other hand, there is no limit to the different uses to which power can be put to good advantage in the shop.

Of course, the matter of shop equipment can be overdone, and this must be guarded against as well as the other extreme. For example, it would be uneconomical in most instances to undertake the manufacture of trolley wheels, the cutting of gears and pinions, or, in fact, the manufacture of any part which can be secured in the open market from a specialist. On the other hand, a great deal of work is now often sent to local machine shops which can be done at home, at a great saving not only in money but in time. Thus, the usual price for turning a commutator by a job shop, including transportation to and from the car house, is $1, and the work will ordinarily consume at least a day. This often means the loss of the car for a day and a half. If this job is done at home the actual time consumed will be 1½ hours, at a cost of 50 cents, and the car will be out of service only half a day.

In designing a building, or group of buildings, to be used for repair shop purposes, the great object to be borne in mind is to arrange them so as to do away with all unnecessary handling of material, and with this in view the design shown in the sketch is submitted.

The plan, as shown, is divided into four parts, A, B, C, D. A and B should be located in the relative positions as shown, but C and D may be placed in any position to suit the land on which they are to be built. Room A is the truck shop. Room B is two stories in height. The lower floor is the machine shop. The upper floor contains the stock room and armature room. A good elevator should be provided for this floor. Room C is the carpenter shop, and room D is the paint shop.

Considering first the truck shop, the plan is to have the floor level at the entrance, 4 ft. below the track level, and have the cars come into the truck room on elevated tracks. The last

10 ft. of each track are arranged to be removable; that is, the rails can be dropped down to the floor level by means of an elevating mechanism capable of raising the weight of one truck and the part of the car supported on it. With a single-truck car, of course, this would be the entire weight of the car; with a double-truck car it would be one-half the weight of the car. As the height of travel would not be over 4 ft. the elevator can be arranged to work with screws and sprocket wheels, driven with a chain, one chain to drive all screws.

Across the rear end of the truck room there should be a traveling crane, with a capacity of about 1½ tons, which will lift any motor now in use. Of course, if it is thought desirable to lift the entire truck a heavier crane would be necessary.

The walls between A and B and between B and C should be fire-walls, on account of insurance.

A Y, or loop, should be provided somewhere near the shops so that the cars can be turned around. In this way the truck wanted or the end damaged can always be run into the shop as desired.

The dimensions of the buildings should be such that the distance between the end of the tracks and the walls in A and C should be about 30 ft. The length of the tracks in these rooms should be governed by the length of the cars, so that each track will hold one car. In this way each car can be run out as soon as completed without waiting for any other.

As stated in the beginning of this article, the object in view is to get the work as near as possible to the machine upon which the work will be done. For example, let us bring in a double-truck car to be overhauled. The car is run in on one of the tracks until one of the trucks rests on the removable section of track. This end of the body is held in position by some means provided, preferably by rods or cables from above. The car being then in position the motor leads and brake rods are disconnected, and the truck is lowered to the floor level, and run out where it is under the crane. Here the motors are opened. The armatures are then taken out and run into the machine shop, where the commutators are dressed or sent up-stairs to have new hoods or bands put on if required. While the motor is being gone over any necessary repairs are made to the truck, brake rigging, etc.

To assemble the car the operations are simply reversed. The wheel press and boring mill can be placed at one side in A, so that the crane can be used for carrying the axles to them. The lathes, drill presses, planers, etc., should be placed on the lower floor in B, and provided with an overhead track with a capacity of 1500 lbs. This will lift any armature now in use.

In C the benches should be arranged along the sides, and the rip-saw, buzz-planer, band-saw, etc., put in the space between the ends of the track and the wall. This will enable any car damaged in collision to be brought in so that the damaged end will be near the machinery.

Any car which is put into the carpenter or paint shop will naturally stay in a longer time than those that go into a shop to be overhauled, so that a transfer table is perfectly satisfactory as a means of putting the car in the building.

As shown on the plan it is proposed to run a track alongside the building, and have the transfer table reach this track as well as the carpenter shop and paint shop.

RAILWAY PAPER IN GRAND RAPIDS

The initial number of the "Street Railway Weekly," published by the Grand Rapids Railway Company, of Grand Rapids, Mich., has appeared. Two receptacles have been installed in every car to retain the issues of the weekly, which is free to all patrons of the lines. The paper has all the departments of a metropolitan daily and a few additional, such as schedules of owl cars and hints about transfers.

INTERURBAN ELECTRIC RAILWAY PRACTICE IN INDIANA

Robert P. Woods, vice-president of the Indiana Engineering Society, recently read a paper before that society on the interurban electric railways of Indiana. He states that the first interurban electric road in that State was inaugurated on July 15, 1893, when the line between Brazil and Harmony, 3.3 miles in length, was put in operation. The first a. c. system was operated Jan. 1, 1901, on the line between Indianapolis and Anderson. There are now twenty-two systems, of which fourteen employ high-tension alternating current for distribution. Statistics of these lines are given on pages 936 and 937.

The turnouts are provided with spring switches and single or double-spring frogs, the latter sizes vary from a No. 7½, used with a lead of 66 ft., to a No. 10, having a lead of 82.50 ft. The former is the best adapted to a double bracket, single-pole form of construction, and the latter where cross-suspension is used at turnouts. One of the leading roads has taken out all spring switches, and substituted plain split switches, believing them more safe. The outer rail of curves is raised above the inner one from ½ in. to ¾ in. per degree of curve, depending on the speed of cars. Easement curves are used on the higher speed lines.

The following is a fair approximation of the proportions of the weights of T-rails now found in the various tracks:

Thirty per cent, weighing 60 lbs. per yard; 50 per cent, weighing 70 lbs.; 14 per cent, weighing 80 lbs.; 6 per cent, weighing either 40 lbs., 56 lbs., 66 lbs., 73 lbs., 75 lbs., or 90 lbs. Included in the foregoing is a small amount of girder rail.

Ties are uniformly 6 ins. x 8 ins., spaced 2 ft. apart; on some of the earliest trains ties were smaller, but substitution is gradually being made with standard sizes. The principal kinds are white oak, chestnut, cedar, burr and red oak. The cedar, however, are not used on curves. The rail-bonds are of all styles, the most prevalent being the concealed No. 0000 flexible copper bond about 10 ins. long.

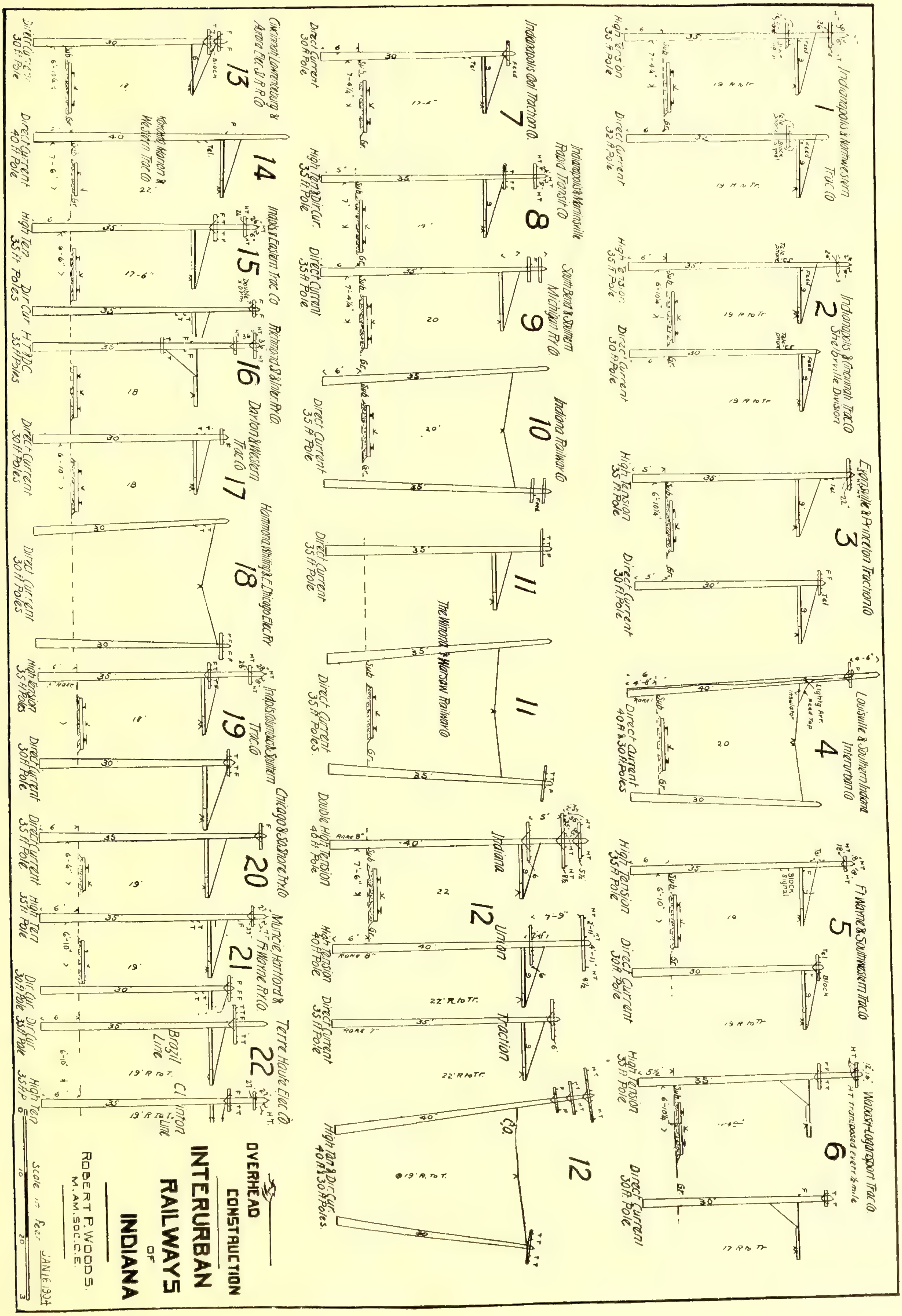
Copper cross bonds for connecting the rails have been omitted on some lines, but the more frequent practice is to place them from 300 ft. to 800 ft. apart.

The track is ballasted with gravel or stone, the former predominating. Six inches is usually placed under the ties, and to the top of the ties in the center of the track. On two of the high-speed lines the depth of ballast has been increased to 8 ins. and 9 ins.

In the overhead construction the bracket type is the principal arrangement on about 90 per cent of the entire mileage. The cross suspension is mostly in cities and towns. The poles are principally cedar, spaced 100 ft. apart; limited amounts of chestnut, cypress and Oregon pine, however, have found favor. It has been the evident intention to give the poles some rake, but it is difficult to tell from observation what the amount was originally on all the various lines. The practice now is to give a bracket pole about 7 ins. rake in 35 ft.

The practice of using timber bents and trestles to span small openings is gradually decreasing. Concrete arches and steel concrete arches are taking the place of the wood and small steel beam spans. Illustrating in part the extent of this change in practice, mention is made that the Union Traction and the Indiana & Northwestern each constructed thirty-three of these steel concrete arches, varying in span from 5 ft. to 20 ft., on their new work during the last year. A decided change is taking place in the stresses provided for steel spans; where a loading of 25-ton cars was formerly provided for a couple of years ago, the practice now is to provide for loads of 50-ton to 100-ton cars.

Railways of late are constructed almost entirely on private right of way, the usual width being about 50 ft. The general alignment and grades are becoming more like those of steam railroads.



OVERHEAD CONSTRUCTION
INTERURBAN RAILWAYS OF INDIANA
ROBERT P. WOODS. M.AM.SOC.C.E.
JAN 16 1904
Scale in Feet

No.	NAME	Mileage	Date of Openings and Lengths	No. Cars Schedule	Make	Length	Weight	Capacity	Heater	Toilet	Controller	Air-brake	Trucks	Motors	Loc. Power Station	D. C. & H. T. Voltage	Generators	Rotary Converters	Transformers
1	Indianapolis & Northwestern Trac. Co.	68.8	Indpls to Fkfort, Oct. 9,'03, 44.6 Fkfort to Lafayette, Dec. 2,'03, 24.2 Lebn to Crvlle (not open), 23.[illegible]	7 hourly	Jewett Laconia	60 ft 8¾ in	35 tons	66	hot water	yes	Multiple both ends	West'gh	Peckham No. 36 M C B	No. 73 G E 4-75 hp	Lebanon	550 to 600; 26400	3-800 k w a c Gen'l Electric	2-350 k w G Electric	9-300 k w air cooled
2	Indianapolis & Cincinnati Trac. Co	29.0	Indpls to Shelbyv, Sept. 12,'02, 29.0	3 hourly	Jackson Sharpe	44 ft 5 in		45	hot water	yes	Lorain 1 end	Christ'sn	Peckham No. 26 A A	No. 34 Lorain 4-50 hp	Shelbyville	600 ; 16000	1-600 k w a c Bullock	1-250 k w Bullock	3-135 k w oil cooled
3	Evansville & Princeton Trac. Co.	28.3	Evansv to Princ, Dec 13,'03, 28.3	4 hourly	St. Louis	42 ft 7 in	@ 22½ tons	42	hot water	yes	West'gh 1 end	West'gh	St. Louis No. 23 A	No. 56 Westg 4-55 hp	Ft. Branch	600 ; 10000	2-400 k w a c Westinghouse	2-300 k w Westinghouse	3-125 k w oil cooled
4	Louisville & Southern Indiana Trac. Co	6.4	Jeffersnv to N. Alb, May 16,'03, 6.4	2 half hourly	St. Louis	43 ft 4 in	@ 23 tons	50	hot water	no	Multiple both ends	West'gh	St. Louis	No. 57 G E 4-50 hp	New Albany	600 ; none	1-500 k w Dir. Cur.	No AC	No AC
5	Ft. Wayne & Southwestern Trac. Co.	45.0	Ft Waynto Huntg, Dec 13,'01 26.0 Huntg to Wabash Sept. '02, 19.0	5 hourly	Stevenson Jackson Sharpe	44 ft 6 in		46	hot water	yes	Lorain 1 end	Christ'sn	Peckham No. 14 A X	No. 34 Lorain 4-50 hp	Huntington	600 ; 16000	2-500 k w a c Westinghouse	1-300 k w Westinghouse	6-150 k w oil cooled
6	Wabash & Logansport Trac. Co	33.2	Wabash to Peru, July 25,'01, 18.4 Peru to Logansp't, May 13,'03, 14.8	4 hourly	Jewett	40 ft 7¾ in	@ 20 tons	44	electric	some	G. Elect. both ends	National	Peckham No. 26	No. 67 G E 4-40 hp	Boyd Park	600 ; 13200	1-450 k w a c Gen'l Electric 2-250 k w d c Westinghouse	none	none
7	Indianapolis Coal Trac. Co.	14.0	Indpls to Plainfld, Sept. 15,'02, 14.0	2 hourly	No standard	car			No power	statio	n, both	cars and	power furnished	by the India	napolis City	Traction and	Terminal Company.		
8	Indianapolis & Martinsville Rapid Transit Co.	30.0	Indpls to Moorsv, Aug. 2,'02, 16.0 Moorsv to Martinsv, May 1,'03, 14.0	4 hourly	Jewett	47 ft 0 in	@ 27½ tons	48	electric	yes	Lorain 1 end	Christ'sn	Peckham No. 14 A X X	No. 34 Lorain 4-50 hp	Mooresville	550 to 625; 13200	2-450 k w a c Gen'l Electric	2-200 k w Gen Elec	6-110 k w oil cooled
9	South Bend & Southern Mich. Ry. Co.	6.0	So Bend to State Ln, Aug. 3,'03, 6.0	2 hourly	St. Louis	41 ft 0 in	@ 16 tons	40	electric	no	G. Elect. both ends	West'gh	St. Louis No. 23 A	No. 49 Westg 4-35 hp	S. Bend, Osceola & Dunlaps	550 to 600; none	South Bend, 2-225 k w Westinghouse 1-225 k w, 1-300 k w Gen'l Electric Osceola, 1-225 k w G E 1-250 k w Westinghouse Dunlaps, 3—D Thomp-Houston No. 62 about 65 k w d c	No AC	No AC
10	Indiana Railway Co	27.0	Goshen to Elkhart, Dec. '98, 11.0 Elkhart to So Bnd, Sept. '99, 16.0 (System 9 and 10 under one management)	3 hourly														No AC	No AC
11	The Winona & Warsaw Ry. Co	2.2	Winona to Warsaw, Aug. 8,'03, 2.2	2¼ hourly	Cincinnati open car	39 ft 8 in		65	none	none	West'gh both ends	Christ'sn	Peckham No. 14 BZ	No. 68 Westg 4-40 hp	Winona	550 ; none	2-100 k w d c Westinghouse	No AC	No AC
12	Indiana Union Trac. Co	163.3	Marion to Jonesboro, Sept. '93, 5.0 Andersn to Alexdr, Jan. 1,'98, 12.0 Alexdr to Jonsboro, Sept. '98, 16.0 Alexdr to Elwood, June '99, 10.0 Muncie to Andrsn, Aug. 1,'00, 18.0 Andrsn to Indpls, Jan. 1,'01, 36.0 Elwood to Tipton, Jan. 1,'03, 10.2 Indpls to Kokomo, Dec. 3,'03, 56.1	16 hourly 8 bi-hourly (limited)	St. Louis Cincinnati	52 ft 6 in 56 ft 0 in	30½ tons 35½ tons	52 58	hot water hot water	yes yes	West'gh 1 end West'gh 1 end	Christ'sn Christ'sn	St. Louis Baldwin	No. 50 C Westg 2-150 hp No. 85 Westg 4-75 hp	Anderson	550 to 650; 15000 and 30000	3-1000 k w a c Westinghouse 2-1000 k w a c Westinghouse 1-450 k w Storage Battery	3-250 k w Westinghouse Westinghouse	15-250 k w 7-500 k w oil cooled
					Of this, Indian	apolis to	Broad Rip	ple, six	miles was	opene	d Sep. 11,	1894.							
13	Cincinnati, Lawrenceburg & Aurora Street R. R. R. Co.	10.7	Aurora to State Ln, Apr 12,'00, 10.7	5 hourly	Jewett	42 ft 6 in	@ 25½ tons	44	electric	none	G. Elect both ends	Christ'sn	Peckham No. 14 AEH	No. 57 G E 4-50 hp	Nor. Bend, O.	600 ; none	2-400 k w a c Westinghouse	No AC	No AC
14	Kokomo, Marion & Western Trac. Co	9.5	Kokomo to Greentn, Oct. 4,'03, 9.5	1 1½ hourly	No standard	car.			No power	stati	on, both	cars and	power furnished	by the Koko	mo Street Ra	ilway and Pow	er Company.		
15	Indianapolis & Eastern Trac. Co.	63.0	Indpls to Grenfld, June 17,'00, 21.0 Grenfld to Knightn, June 1,'02, 13.5 Knightn to Dublin, June 15,'03, 17.5 Dunrieth to N Castle, Sep 7,'03, 11.0	6 hourly hourly bi-hourly bi-hourly	Kuhlman	52 ft 9½ in		54	hot water	yes	G. Elect. 1 end	Christ'sn	Dorner & Dupont	G. Elec. Lorain 4-35 hp	Philadelphia	575 ; 13200	2-450 k w a c Siemens-Halske 1-150 Amp, Bullock Booster	3-300 k w Stanley	oil cooled
16	Richmond St. & Interurban Ry. Co	19.3	Richmond to Centvl, Oct. 2,'01, 5.8 Centrevl to Dublin, Nov. 16,'03, 11.2 Cambrge to Milton, Nov. 16,'03, 2.3	3 hourly	St. Louis	42 ft 3 in	@ 22½ tons	42	hot water	yes	West'gh 1 end	Standard	St. Louis No. 23 A	No. 56 Westg 4-55 hp	Richmond	575 ; 13200	2-300 k w a c Siemens-Halske	1-400 k w Bullock used as a generator	3-150 k w Wagner
17	Dayton & Western Trac. Co	4.5	Richmd to Stat Ln, Aug. 15,'03 4.5	2 hourly	Kuhlman						both ends	Christ'sn	Peckham		Power furnis	hed by the Ric	hmond Street and Interurban Ry. Co. P	ower Station in	Richmond,
18	Hammond, Whiting & E. Chicago El Ry.	13.3	Hamnd to E. Chicago, Nov. '93, 3.0	E. Chicago to	Roby, May 24,	'04, 6.3 mile	Hammond	to Fors	ythe, Apr	il, '97,	4 miles.	Single	truck Jewett cars	hourly sched	ule, power fur	nished by the	South Chicago City Railway Co. Power	Station in South	Chicago, Ill
19	Indianapolis, Columbus & Southern Trac. Co.	41.5	Indpls to Greenwood, Jan. 1,'00, 11.0 Greenwod to Fnklin, June 6,'02, 9.5 Franklin to Colmbs, Sep. 21,'03, 21.0	5 hourly	Jewett	45 ft 0 in	@ 26 tons	46	hot water also elect	yes	G. Elect. 1 end	Christ'sn	Peckham No 14 AEH	Stanley 4-50 hp	Edinburg	650 ; 15000	1-500 k w a c Stanley 1-600 k w a c Stanley (latter being installed)	1-300 k w Stanley	3-150 k w oil cooled
20	Chicago & South Shore Ry. Co	13.5	Laport to Mich. Cy, Feb. 1,'03, 13.5	2 hourly	Jewett	49 ft 4½ in	@ 26½ tons	56	hot water	yes	West'gh 1 end	Christ'sn	Peckham No. 26 & 14 A X X	No. 56 Westg 4-55 hp	Laporte	550 ; none	2-T H 4 Pole 90 k w	No AC	No AC
21	Muncie, Hartford & Ft. Wayne Ry. Co.	41.8	Muncie to Hartfd, Feb. 11,'03, 18.5 Hartfrd to Montplr, May 7,'03, 9.3 Montplr to Bluffton, Dec. 1,'03, 14.0	3 hourly 1 bi-hourly	Stevenson Niles	45 ft 5 in	@ 26 tons	46	hot water	yes		Christ'sn	Peckham No. 26	No. 57 G E 4-50 hp	Eaton	625 ; 15000	2-540 k w a c Gen'l Electric	2-400 k w Gen Elec	6-75 k w
22	Terre Haute Electric Co.	34.0	Brazil to Harmony, July 15,'93, 3.3 Brazil to T. Haute, Sep. 1,'00, 15.7 T. Haute to Clintn, Dec. 13,'03, 15.0	3 hourly 2 hourly	Stevenson Laconia	40 ft 6 in		46 38	electric	no	West'gh both ends	Standard	St. Louis MCB Brill No. 27 G	38B Westgh 4-50 hp	Terre Haute and Brazil	550 ; 11000	Terre Haute, 1-300 k w d c Westghouse 1-300 k w d c Gen'l Elec., 1-200 k w d c Westinghouse, 1-300 k w 2 ph a c Westg. at Brazil, 80 k w d c Wood & 100 k w d c G E	1-300 k w 2 Ph West'ghouse	2-165 k w 2-150 k w oil cooled
		704.3																	

No.	NAME	H.T. Lig't Ar.	H.T. Oil Sw.	Engines	Exciter Units	Condensers	Heater and Purifier	Boilers	Stokers	Pumps	Trav'l Crane	Water Supply	Stacks	Location & Distance of Sub-Stations	Rotary Converter	Trans-formers	H.T. Lig't Ar.	H.T. Oil Sw.
1	Indianapolis & Northwestern Trac. Co.	yes	yes	3 Cr. Comp. Dir. Con. Hamilton Corliss 24inx48inx48in, about 1500 hp ea	1 Ide Engine 12inx12in	3 Wheeler	No. 9¼ Cochrane	6 Stirling 500 hp each	Roney	3 Wheeler air and circul.	20 tons	pond fed by springs	1 self-sup. steel 6ftx8ft6inx155ft	Augusta 16, Frank'ort 15.3 Dayton 31.3, Crawfordsville 18	2 300 kw in each Genl Elec	3 250 kw in ea air cooled	yes	yes
2	Indianapolis & Cincinnati Trac. Co.	yes	none	1 Cr. Comp. Dir. Con. Atlas Corliss 18inx34inx36in, about 800 hp	1 Ide Engine 7inx10in	1 Wheeler	none	2 Stirling 400 hp ea	none	2 Dean	none	18ftx18ft well	2 steel 4ftx85ft	Bethel 17.6mi	1 250 kw Bullock	3 94 kw oil cooled	yes	none
3	Evansville & Princeton Trac. Co.	yes	none	2 Cr. Comp. Dir. Con. Lane & Bodley 18inx36inx42in @ 600 hp each	2 Buckeye 7inx10in	2 Jet System Worthingt. P'p	Wainwright	6 Stirling 150 hp ea	none	2 L. D. & G. 9½inx5inx10in	none	creek and 9 artesian wells	3 steel 4ftx64ft	Evansville 14 2 mi	1 300 kw Westinghouse	3 125 kw oil cooled	yes	none
4	Louisville & Southern Indiana Trac. Co.	No AC	No AC	1 Cr. Comp. Dir. Con. St. Louis 20inx40inx48in	No AC	none	Stilwell, Bierce	4 Aultman T. 350 hp ea	none		none	city supply		No AC	No AC	No AC	No AC	No AC
5	Ft. Wayne & Southwestern Trac. Co.	yes	none	2 Cr. Comp. Dir. Con. Hamilton Corliss 22inx44inx36in; 18inx36inx48in	1 Ide Engine 1 motor set	1 Wheeler with cooling tower	Cookson	4 Stirling 250 hp ea	none	Snider, Hughes 7inx4½inx8in	none	1 385ft deep well	4 steel 5ftx100ft	Lagro 14 2, Roanoke 10.3 Ft. Wayne 21.3 mi	1 250 kw in ea Westinghouse	3 75 kw oil cooled	yes	none
6	Wabash & Logansport Trac. Co.	yes	none	2 Simp Allis Corliss belted 22inx48in, 400 hp 1 Cr Comp Slater DC 22inx38inx42in, 750hp	1 G Elc Marine	1 Evans	Cochrane	3 Aultman T. 2 350 hp, 1 500 hp	none	2 Warren 2 Dean	none	Wabash rivr and 3 wells	1 steel 4ftx170ft 2 steel 5ftx128ft	Peru 12.5 mi Logansport 25 mi	1 200 kw Genl Elec	3 75 kw in ea oil cooled	yes	none
7	Indianapolis Coal Trac. Co.																	
8	Indianapolis & Martinsville Rapid Transit Co.	yes	yes	2 Simple Atlas Corliss D. C. 28inx42in, 650 hp each	1 G Elc Marine 1 motor set	1 Buffalo Jet	Cochrane	3 Stirling 350 hp ea	Roney	4 Buffalo	none	creek	steel 4ftx90ft steel 5ftx115ft	Maywood 13 mi Martinsville 14	1 200 kw Genl Elec	3 75 kw in ea oil cooled	yes	yes
9	South Bend & Southern Mich. Ry. Co.	No AC	no ac	2 Simple Buckeye belted 26½inx36in, 650 hp ea	No AC	none	Open Heater	Shell Boilers 5 125 hp, 1 175 hp	none	2 Worthington 7½inx4½inx6in	none	river	1 steel 5ftx110ft	No AC	No AC	No AC	No AC	No AC
10	Indiana Railway Co.	No AC	No AC	2 Simple Buckeye belted 22inx33in, 350 hp ea 1 Allis Chalmers Corliss belted 20inx42in	No AC No AC	none none	Open Heater Closed Heater	Shell Boilers 2 90 hp, 1 150 hp Shell Boilers 2 70 hp, 1 87 hp	none none	2 Worthington 5¼inx3½inx5in 2 Dean 5¾inx3¾inx5in	none none	1 well 4ftx4ftx18ft well	1 steel 5ftx90ft					
11	The Winona & Warsaw Ry. Co	No AC	No AC	2 Simple Ide. belted, 16inx32in @ 150 hp ea	No AC	none	none	2 Babcock & W 175 hp ea	none	2 Worthington 5inx6inx7in	none	6ftx6ftx22ft 3 wells 7ft, 80ft, 100ft	1 steel 4ftx90ft	No AC	No AC	No AC	No AC	No AC
12	Indiana Union Trac. Co.	yes	none	3 Cr. Comp. Rice & Sargent Corliss D. C. 20inx50in 48in, 2000 hp ea 2 Cr. Comp. Rice & Sargent Corliss D. C. 1500 hp ea	2 motor sets 1 Ball Engine	1 Blake 2 Knowles 1500 hp ea	yes	12 400 hp Bab. & W. 2 600 hp Babk. & W.	yes	Worthington Comp. Duplex	25 tons	creek and 3 deep wells	1 steel 4ftx120ft brick 10ftx180ft	Marion 31.5, Alexandria 11 5 Muncie 18, Broad Ripple 59 Noblesville 42, Tipton 25 Kokmo 42, Logspt 61, Peru 59 Fairmount 22.5, Elwood 15 Daleville 7, Ingalls 13 Lawrence 24.5 1 Portable Sub Station	2 250 kw in each 1 16 kw Booster Store Battery of 264 cells, 168 kw capacity 1 250 kw in ea 1 8 kw Booster S. Bat. 264 cls, 84 kw cap 1 250 kw	4 175 kw in ea 4 in ea 3 87½ kw	yes yes	none none
13	Cincinnati, Lawrenceburg & Aurora Street R. R. Co.	No AC	No AC	2 Simple Hamilton Corliss belted 28inx48in, 725 hp ea	No AC	none	Continental Filtr Stilwell B Heatr.	4 Heine 250 hp ea	none	4 Snow	none	Ohio river	steel 6ftx126ft	No AC	No AC	No AC	No AC	No AC
14	Kokomo, Marion & Western Trac. Co.																	
15	Indianapolis & Eastern Trac. Co.	yes	yes	2 Comp. Condens. Russell D. C. 20inx35inx27in, 650 hp ea		L. D. & Gorden	Cochrane	4 Stirling 250 hp ea	none	L. D. & G.	none	creek	2 steel 4ftx40ft	Charlotte 13 Lewisville 27	1 300 kw in ea Stanley	oil cooled	yes	yes
16	Richmond St. & Interurban Ry. Co.	yes	yes	2 Buckeye Tandem belted 17½inx30½inx33in, 417 hp 1 Russell 20inx27in belted, 300 hp	1 motor set	2 Wheeler	Stilwel, Bierce	2 Edgemoor 375 hp ea 1 Stirling 375 hp	Roney		none	river	forced draft brick 5ftx115ft	Cambridge 14.2	2 150 kw Genl Elec	6 75 kw Genl Elec	yes	yes
17	Dayton & Western Trac. Co.	Ind.			none													
18	Hammond, Whiting & E. Chicago El. Ry.																	
19	Indianapolis, Columbus & Southern Trac. Co.	yes	yes	1 Simple non-Condens Buckeye D. C. 750 hp, also 1 Cr. Comp. Condens Buckeye D. C. 900 hp being installed 1 300 hp Westinghouse belted		not yet installed	Hoppe	Stirling 2 300 hp	none	4 Dean	none	river and wells	1 steel 5ftx150ft	Greenwood 20	1 300 kw Stanley	3 oil cooled	yes	yes
20	Chicago & South Shore Ry. Co.	No AC	No AC		1 steam 1 motor set	none	Cochrane	1 300 hp Rohan 2 150 hp	none	2	none	lake	1 steel 5ftx100ft	No AC	No AC	No AC	No AC	No AC
21	Muncie, Hartford & Ft. Wayne Ry. Co.	yes	yes	2 Cr. Comp. Condens. Cooper D. C. 22inx24inx42in, 750 hp ea	No AC two 45 hp	2 Wheeler	Cochrane	Stirling 3 300 hp ea	Jones Underfeed Am. Blower	Worthington 5 Duplex	30 tons	river	3 steel 4ftx76ft	Montpelier 17.2 Bluffton 30.7	2 200 kw Genl Elec 2 200 kw Genl Elec	6 75 kw 3 75 kw	yes yes	yes yes
22	Terre Haute Electric Co.	yes	yes	2 Fitchburg 24inx30in D. C. 500 hp 1 A. & Sims 400 hp, 1 Westg. 250 hp belted at Brazil, 100 hp Westghouse and one 150 hp McCune, belted	none	none	Industrial Purifi. Stilwell B Heater	7 Cahill 250 hp ea 2 Climax 500 hp ea	none	7 Duplex	15 tons	city supply and deep wel emergency	7 steel 3ft to 5ft D 60ft to 80ft high	Atherton 11.0	1 200 kw Westinghouse	2 125 kw oil cooled	yes	yes

The steam railroads resist all attempts of the traction lines to cross their tracks at grade. The former contend that the traction tracks should be overhead or under grade of the steam railroad. In an effort to relieve the situation the State Legislature approved an act in 1903 in relation to the crossings of the court to order the construction and assess the cost according to its judgment. The grade of the interurban track cannot be ordered heavier than 2 per cent by the court unless the company consents.

Some of the steam railroad companies appear willing to share

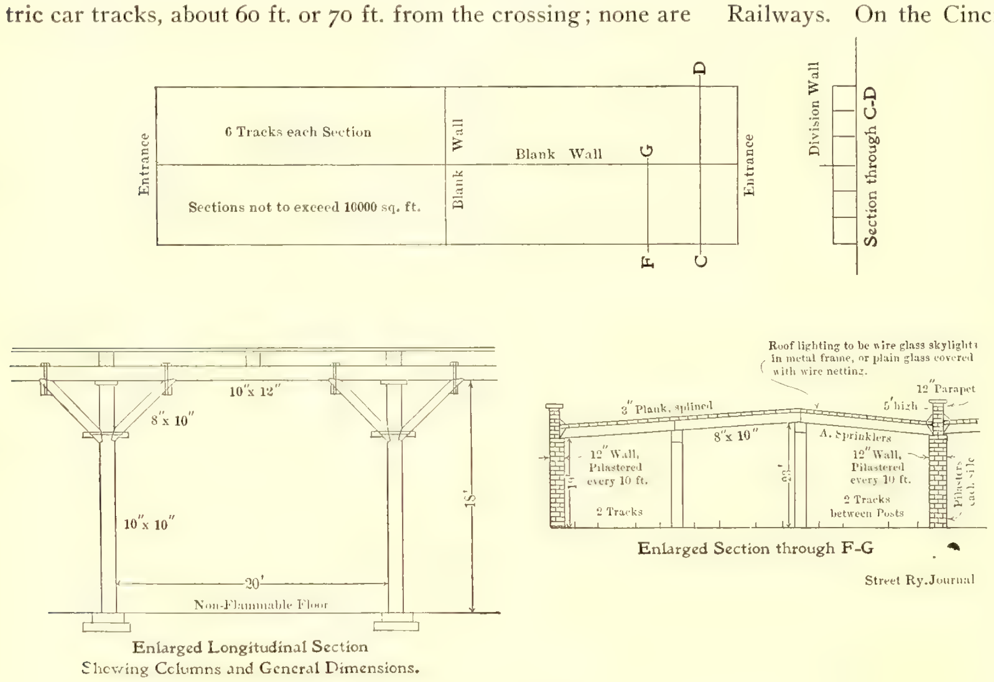
	WIRE									TRACK						
No.	High Tension	H. T. Transpsitn	Feed Copr.	Feed Taps	L. Arresters	Trolley	Telephone	Telephone Transposition	Rail.	Joints	Ties	Cross Bonds	Ballast	Cattle Guards
1	3 No 4 copr	none	300,000 cm entire length	1,000 ft	half mile	1-0000 G Elc grooved	2 No 10 galv iron	1,000 ft	70lb T rail; 1 ml 73lb Girder in Cville	4 bolt angle bars	white oak cedar	800 ft	9 in. gravel	wood
2	3 No 6 copr	none	000	half mile	half mile	2-00 Fig 8	2 No 12 galv iron	1,000 ft	60lb T rail	4 bolt angle bars	white and R. oak cedar	800 ft	6 in. gravel	wood
3	3 No 4 copr	none	0000	1,500 ft	1,500 ft	1-00	2 No 12 galv iron	ha'f mile	70lb T rail 2 ml 90lb T Evnsv.	Weber	oak	1100 ft	to be 6 in. stone	none
4	No AC	No AC	500,000 cm	1,000 ft	half mile	2-000 G Elec grooved	none	no telephone	75lb T rail; ½ ml of 90lb T r in Jeffsnv.	6 bolt angle bars	oak	800 ft	6 in. stone	vitrified clay
5	3 No 6 copr 3 No 4 copr	none none	0000	1,500 ft	half to four-fifths mile	2-00 Fig 8	2 No 12 galv iron	East End 500 ft West End 1,000 ft	56lb T e of Huntgn 60lb T w of Huntgn	6 bolt angle bars	oak	4 mi'es	6 in. gravel	steel east end none west end
6	3 No 4 copr	⅓ mile	0000 to 500,000 cm	half mile		1-00 W. End 2-00 E. End	2 No 12 galv iron	E. of P. Sta. 2,000 ft W. of P. Sta. 500 ft	60lb T	4 bo't angle bars	oak, cedar walnut	4 mi'es	6 in. gravel (east end less)	wood west end none east end
7	No AC	No AC	350,000 cm 500,000 cm	six miles	half mile	2-000 Fig 8	2 No 10 galv iron	1,000 ft	70lb T	6 bolt angle bars	oak chestnut	600 ft	6 in. gravel	vitrified clay
8	3 No 4 copr	1¼ mile	0000 entire length	one-fifth mile	one-fifth mile	2-00	2 No 12 galv iron	1,000 ft	70lb T	6 bolt angle bars	oak	¼ mile	6 in. gravel	none
9 10	No AC	No AC	0000 to 500,000 cm	one-fifth mile on S. B. & S. M. half mile on Ind. Ry.	one-fifth mile on S. B. & S. M. half mile on Ind. Ry.	1-00 circular	none	no telephone	70lb T	4 and 6 bolt angle bars	cedar on S. B. & S. M. oak on Ind. Ry.	1 mile	6 in. gravel	vitrified clay on S. B. & S. M. steel on Ind. Ry.
11	No AC	No AC	0000	half mile	half mile	1-00 Fig 8	2 No 12 copper	500 ft	60lb, T 72 Hight T in Warsaw	4 bolt angle bars	oak		6 in. gravel	
12	3 Nos 3, 4 and 5 copr	1 mile	00, 0000 300,000 cm 400,000 cm 500,000 cm 550,000 cm 600,000 cm	quarter mile	half mile	1-00 1-000	2 No 12 galv iron	1,600 ft	56lb T Mar to Sum 60lb T Sum to And 60lb T Alex to Elw 70lb T Mun to Ind 80lb T Ind to Koko 80lb T Tipn to Elw 80lb T Ko to P&Lo in cy 6 in 60 & 72lb T	4 bo't ang'e bars 6 bolt angle bars 6 bo't bars 4 bolt continuous joint on all 80 lb rail	oak	every 6 rail length	8 in. gravel	steel between And. and Mar.
13	No AC	No AC	300,000 cm	2,000 ft	2,000 ft	2-0000 circular	2 No 12 copper	1,000 ft	70lb T	4 bo't ang'e bars	oak of all kinds	1000 ft	6 in. gravel	none
14			500,000 cm	quarter mile	quarter mile	2.0000 circlr	2 No 10	1,000 ft	70lb T	6 bolt angle bars	Bu and W. oak	500 ft	to be 6 in. stone	none
15	3 No 4 copr	none	0000, 300,000 cm 400,000 cm	. half mile	half mile	2-00	ga!v iron		70lb T		oak and cedar	½ mi'e	6 in. gravel	
16	3 No 6 copr		0. 00, 0000 300,000 cm	500 ft	half mile	0, 00	2 No 12 copper	800 ft	60lb T Rich to Cent 66lb T Cent to Dub			none (to be 1000 ft)	6 in. gravel	
17			0000,			2-0 & 2-000			70lb T	6 bolt angle bars	oak		none now	none
18			300,000 cm						T		oak		6 in. gravel	none
19	3 alumin'm 3 No 4 copr	none	aluminum 300,000 cm	half mile	half mile	2-00	2 No 10 galv iron	1,000 ft	60lb T	4 bo't angle bars	oak and cedar	300 ft	6 in. gravel	wood
20	No AC	No AC	00 cop & alu-min'm 4/0 cop	quarter mile	half mile	1-00 Fig 8	none	no telephone	66lb Tr & 70lb Relay	Atlas and Weber joints	cedar	500 ft	6 in. fine sand	vitrified clay
21	3 alumin'm 3 No 4 copr	6 miles	0,0000 & alum 300,000 cm	half mile	quarter mile	2-00	2 No 10 galv iron	1,000 ft	40lb T r 95lb gir in Muncie and Bluff'n	6 bolt angle bars	oak and cedar	½ mi'e	6 in. gravel	wood
22	3 alumin'm 3 No 4 copr T H to Clin	½ mile	0000, 500000 cm & alu, 0000 cop	quarter mile	2,000 ft	2-00 Brazil 1-00 Clinton	2 No 10 galv iron Clinton 2 No 12 galv iron Brazil	¼ mile Clinton ½ mile Brazil	70lb T Har to Braz 60lb T Clin & Braz Lines	4 bolt bars Weber	oak	none	6 in. gravel	none

	BRIDGES							R. R. GRADE CROSSINGS						
Poles	Kind	Stresses	Private Right of Way	Parks	Interlockers	Derails	Over and Under Grade Crossings	No. in T'ns	trks No.	No. in cnty	trks No.	Avg Speed Miles per hour	Av. Rate of Fare per Mile	No.
cedar 32 & 35 ft painted	steel and steel-concrete arches	50 ton cars in trains trucks 22 ft centers	all, 50 ft wide	none	none	6	1 overgrade, steel 1 under highway (N of Indpls) timber	8	18	2	2	Indpl-Laf (63.8m) 21.14 Lim " 27.5	1.52 1.52	1
cedar 30 & 35 ft painted	steel and small wood stringer spans	35 ton cars in trains trucks 20 ft centers	mostly, 32 to 50 ft wide	Acton	none	none	2 undergrades, steel 1 overgrd, stl & timber			1	1	20.0	1.38	2
chestnut 30 & 35 ft	steel and wood stringer spans	50 ton cars in trains trucks 20 ft centers	mostly, 40 ft wide	none	1 to be inst'd at Prncton	none	none	3	4	1	1	21.18	1.60	3
cedar 30 & 40 ft painted	steel, mostly timber trestles		partly, 32 ft wide	Glenw'd nr N Alb		1	1 undergrade, steel	4	4	1	1	12.80	0.78	4
cedar 30 & 35 ft painted	steel, timber trestles	35 ton cars in trains trucks 20 ft centers	mostly, 50 ft	none	none	1	2 undergrade, steel	6	13	1	1	19.28	1.56	5
cedar 30 & 35 ft	stee', timber trest'es	25 to 50 ton cars	a'l, 50 ft W. of Peru in Hway E. of Peru	Boyd	none	2	none	4	5	3	5	18.11	1.74	6
cedar 30 ft painted	steel	4000 lb per lineal ft	all, 50 ft wide	none	none	none	none	5	13			15.27	1.79	7
cedar 35 ft partly painted	stee', (former steam R. R. spans	3000 lb per lineal ft	mostly, 50 ft wide	Bethany	none	1	1 undergrade, steel	6	18			20.00	2.00	8
cedar 35 ft	steel-concrete and timber	40 ton cars in trains for S. B. & S. M.	mostly, 50 ft wide partly, 50 ft wide	Osceola S Bend Elkhart	none	none	1 undergrade, concrete arch	3	9	1	1	So B and S M 18.86	1.36	9
										1	1	Indiana Ry 19.06	1.48	10
cedar 35 ft painted	none		generally in highway	Lake Winona	none	none	1 undergrade	1	1			9.00	2.23	11
Oregon pine & cedar 30, 35 & 40	steel-concrete arches on lines built since 1902 steel and timber trest'es prior to 1902.	Mun. to Ind. 30 tn cars in trains trks 30 ft ctrs except Wht riv at And for 40 ton cars. work since 1902 for 100 ton cars in trains truck centers 20 ft	mostly, 30 to 50 ft wide	none	1 at Carmel	6	3 overhead, steel 3 undergrd including 1 at Lognsprt (not in) 1 at Bunker Hill and 1 in Marion	33	35	4	5	Indpls-Mun (54m) 20.9 Lim " 27.0 Andsn-Mar (33m) 17.68 Alex-Tiptn (20.2) 23.30 Inds-Kok'm (50.1) 22.40 Lim " 24.93 Indpl-And (36m) 20.57 Lim " 25.41	1.57 1.85 1.36 1.49 1.60 1.87 1.67	12
cedar 30 ft	steel and timber trestles		generally in highway	none	none	none	1 overhead, steel	3	5	1	1	15.60	1.92	13
								Gauntlet track over bridge						
cedar 40 ft	steel trestles	no standard yet	all, 40 ft wide	none	none	none	none	1	1			12.67	1.58	14
cedar 35 ft	steel	35 to 45 ton cars in trains	⅔ of line on Hway, ⅓ private	Spg Lake	none		1 underhighway, wood	4	7	1	1	Indps-Dbln (52m) 18.35 lim Ind-Rch (69m) 24.94 (Over Rys Nos 15 & 16)	1.44 1.88	15
chestnut 30 & 35 ft	steel, timber	35 ton cars in trains	mostly	none	none	1	2 undergrd, 1 concrete arch, other steel	2	2			Rchm-Dblin (17m) 17.00	2.06	16
cedar 30 ft	steel	40 ton cars in trains	partly	none	none	none	1 overhead, steel					19.38	1.67	17
cedar 30 ft	steel		all in highways	none	none	none	none	12	35	5	10	HtoR 10.64, HtoW 8.48	1.70	18
cedar 30 & 35 ft	wood, steel		half of line in Hway half of line private	none	none	none	none	5	8	1	2	18.44	1.57	19
cedar 30 & 35 ft	wood, steel		mostly	Pine Lake	none	none	none	5	10	1	1	18.00	1.48	20
cedar 30 & 35 ft	wood, steel and concrete arches	3000 lb per lin. ft & concent'ed load of 40 t cars	all, 50 ft wide	Eaton	2 bf or cabn interlock'rs	2	1 undergrade, steel 1 overgrade, steel	3	4	6	7	21.10	1.80	21
cypress 35 ft on Brazil line and cedar 35 ft on Clinton line	wood, steel		Brazil line on highway mostly, Clinton line priv'te	none	none	none	1 undgrade, stl, Brazil 1 overgr'de, stl, Clintn	5 3	7 13	4	4	T H to Hmy (19m) 14.25 T H to Cltn (15m) 15.00	1.05 1.67	22

street railroads. This act authorized, in substance, the right to maintain a crossing at grade, but with a proviso that the traction company must install and maintain within six months after putting down the crossing a full interlocking works, with derails on both the electric and steam tracks. Either party has the right to request the Circuit or Supreme Court to order an overhead or under-grade crossing, full power being vested in the expense of these structures, but in the opinion of the author it would expedite matters and promote more of these constructions if the subject could be referred to a State Railroad Commission. At present no such body is provided for in Indiana, but it is quite likely one will be created in the near future.

Grade crossings with steam railroad tracks are frequent.

The interurban railways of the State cross the steam railroads at no less than 151 crossings and on 277 tracks; or an average of one grade crossing with two tracks every 5 miles; of these 116 crossings, with 232 tracks, are in cities or towns, and thirty-five crossings, with forty-five tracks, are in the country. In addition, there is a gauntlet track operated by the Cincinnati, Lawrenceburg & Aurora Electric Railway on the single-track bridge of the Big Four Railroad over the White Water River; each has an individual track, one overlapping the other for a distance of probably 1000 ft. A block signal is installed at the bridge, with a constant attendant operating it. In the State there are fifteen undergrade crossings, and nine overgrade, of the steam railroads, and two undergrade of highways. There are twenty crossings that have hand-operating derails, which are thrown by the traction car conductor. There is only one full interlocking station now in operation, but an agreement has been entered into for one more. There are two half or cabin interlockers installed. This device, as the name implies, is a compromise between an ordinary hand-operating switch derail and a full tower interlocker operated by a regular attendant. Ordinary switch derails are placed in the electric car tracks, about 60 ft. or 70 ft. from the crossing; none are



MILL FORM OF CAR HOUSE CONSTRUCTION

in the steam railroad track, but semaphore signals are located on the latter about 500 ft. either way from the crossing; both are operated by levers located in a small cabin near the crossing. Normally the derails are open, and it is necessary for the conductor to enter the cabin and throw a lever, which sets semaphores against the steam trains. If a train is within 2000 ft. of the crossing the lever cannot be thrown, as a track circuit locks it. After throwing this lever the conductor throws another lever which closes the derail. In the operation of these levers the cabin door is locked, and the conductor cannot get out until after the car has passed over the derail, and the levers are returned to their normal position. It is barely possible that the trolley wheel might jump off the trolley wire while the conductor is locked in the cabin. This is an extreme view, yet it is worth consideration.

There is one hand-operating derail in the State, attached to which is a 1500-ft. or 1800-ft. track circuit either way from the crossing on the steam railroad, which locks the lever or switch-throw in case a train is within the distance mentioned, so that the electric car cannot proceed until the train has passed out of this section. The electric current for this circuit is supplied from the traction feed wires.

The speed of the lines that are over 20 miles in length varies between 18 m. p. h. and 27½ m. p. h. Those lines which have slower speeds are for the most part located in highways or have many railroad crossings to contend with. The highest speed development is on the Indianapolis & Northwestern limited service between Indianapolis and Lafayette. The distance of 68 8-10 miles from the terminus in the center of one city to that in the other is traveled at an average speed of 27½ m. p. h., including all stops. Special cars frequently make this distance in 2 hours and 18 minutes, or an average speed of 30 m. p. h. This is fast time when it is remembered that the route embraces 4 miles of track in the streets of Indianapolis, and 2 miles in each of the cities of Lebanon, Frankfort and Lafayette. The next highest speed is attained on the Indianapolis-Muncie division of the Union Traction, where the distance of 54 miles between termini is covered by the limited cars at an average speed of 27 m. p. h.

The average rate of fare on all the lines is 1.62 cents per mile. A few of the roads sell 1000-mile books for 1¼ cents per mile, while some sell round-trip tickets at a slight reduction.

Automatic block-signal systems are installed on the Indianapolis & Northwestern and the Fort Wayne & Southwestern Railways. On the Cincinnati, Lawrenceburg & Aurora Railway a manual block is in operation. Electric stop crossing signals are placed at stopping points on the Indianapolis & Northwestern. To signal a car to stop the person raises a small lever attached to a special post located nearby.

REDUCING THE FIRE RISKS ON CAR HOUSES

The article published in the STREET RAILWAY JOURNAL for May 21, on "Electric Railway Car Houses—Construction and Hazards," has excited considerable interest in the subject of the best method of reducing the fire risk on this class of structure. In reply to several requests for further information as to the class of building recommended by the underwriters, the accompanying diagram is presented, not as an ideal structure from a fire resisting view, but as one which is much more desirable than many of those now in use. It is the intention of those interested in this work not to increase the cost of such structures, but to furnish at a lessened cost a structure better adapted to the purposes for which it is used. There is little doubt that a fire resistive form of structure made, for instance, with brick walls, cement or terra-cotta roof, with iron work thoroughly protected, as specified in the recent meeting of the National Fire Protective Association, would be of a slower-burning type, though up to the present time the cost of such a structure has prohibited its general adoption.

In certain ways the construction illustrated in the diagram herewith seems antiquated. It has been argued that in recommending it the fire underwriters are going back to the old horse-car days, when nearly, if not quite, the same form of building was in vogue. This is true to some extent, but not true when one considers that many, if not most of the old horse-car barns were two stories in height, and under no circumstances do the underwriters recommend a two-story car house, even of mill construction. When a company finds it necessary to build a car house over one story in height the proposition is an entirely different one, and will require special treatment.

The advantages claimed for the mill type of building illus-

trated is that it presents the least ignitable projections to a fire, admits of no concealed spaces, and all parts are readily accessible to a stream of water in the event of a fire. The heavy timbers and posting, it is claimed, will stand longer than any other type of construction approximating the same cost, and the roof will not fall in until it is entirely consumed. This latter circumstance will afford a chance of rescuing a few cars from the burning section, or at least holding the fire in check until the cars in an adjoining section can be run out to a point of safety.

Several car houses in the neighborhood of New York are being built after the design illustrated.

THE MEDICAL DEPARTMENT OF THE SAN BERNARDINO VALLEY TRACTION COMPANY

The San Bernardino (Cal.) Traction Company has established a medical department, consisting of three resident surgeons, for examining applicants, attending employees and for assistance in case of accidents. In the case of new employees it is the duty of the chief surgeon and his assistants, each in his own district, to examine the applicant and to issue certificates of health, upon written application, signed by any of the company's department heads, superintendents or foremen having charge of the employment of men. These certificates of health are issued in triplicate, upon forms provided. The examining physician retains one, sends one copy to the person having ordered the examination, and the third copy to the chief surgeon with his monthly report. No applicant, whether male or female, is employed in any department of the company's service without this examination. After the examination, if the certificate issued by the examining physician show that the applicant is "up to standard," he may be employed by the person ordering his examination. If not "up to standard," the head of the department must be consulted before the applicant is to be received into the employ of the company. Department heads employ applicants who are not "up to standard" only for weighty reasons, and conference with the office in such cases is required.

Another duty of the chief surgeon and his assistants is to give all employees all the medical attention that may be necessary by reason of injuries or any form of illness except as follows: (1) Venereal diseases, (2) acute alcoholism, and (3) such infectious diseases as small-pox, plague, cholera, etc., which the company is prevented by law from attending.

Treatment is rendered to employees, whether their injuries or illness are caused by reason of the company's work or not. In ordinary cases this attention consists of exactly such service, including simple medicines (but not prescriptions), dressing, drugs, etc., as is customary for the family physician or surgeon to give in a visit or office call. In such cases, where it is possible, employees are obliged to go to the office of the nearest regular company physician, not the emergency surgeon, except in cases of accident. When this is not possible the physician will go to them. In serious cases the directions of the physician or surgeon in charge as to whether or not the patient shall go to the hospital must be followed. The employee refusing hospital service, when offered him, forfeits the benefits of the medical department. In cases where major operative interference will be necessary, the patient may, upon order of the chief surgeon, be brought to Redlands. In such cases the service includes hospital, nursing, drugs, medical or surgical attention and dressing, it being specially understood that such care and attention is to be limited in all cases to twenty-one days, except by special order of the chief surgeon.

In case of accident to outsiders the chief surgeon, or his nearest assistant surgeon, must always be called, in order that he may offer such medical or surgical relief as is imperative, and that he may ascertain the extent of the injuries sustained. When accidents occur to employees or outsiders, those who have charge of reporting them to the general manager are instructed to consult with the company's local physician, and use his aid in properly filling out such reports as pertain to the injury, extent of injury, probable period of disability, etc.

In order to maintain this medical department the company contributes liberally, and each employee, from the presiding officer down, is required to contribute $1 per month or fraction of a month.

To assist in the prompt service of the department the company has published a map showing the location of the offices of the different physicians of the company, also the following order to employees:

ORDER TO MOTORMEN AND CONDUCTORS
(All Divisions)

A car carrying a physician and showing a Red Cross banner across the front dashboard, will have the right of way over the entire system. If you see this car approaching, you will get off the main line on the nearest switch and remain there until the car has passed you.

JOHN H. FISHER,
Acting General Manager.

AN IMPORTANT APPLICATION OF THE POSITIVE AUXILIARY CAR-LIGHTING SYSTEM

The demand for a system of positive lighting for electric cars, which will furnish lighting current when a trolley pole leaves the wire or the propulsion current supply is interrupted, is evidenced in the recent adoption of such a system by the Lackawanna & Wyoming Valley Railroad Company, the high-speed third-rail electric railway operating between Scranton and Wilkesbarre, Pa. This company has installed twelve auxiliary car lighting equipments of the automatic type, supplied by the Kinsman Electric & Railway Supply Company, of New York, for use upon its trains, partially to light cars at night when the current supply is interrupted. The disagreeable feature of the loss of light at night, due to such current interruption from any cause, as burning out of a fuse, opening of the circuit breaker, etc., has proved a serious inconvenience to passengers upon all electric railways, and should be avoided as far as possible.

The Kinsman system of auxiliary lighting has been described heretofore in these columns. It consists of an equipment for providing lighting current for the car from a small storage battery, which will be operative normally only when the propulsion current supplied to the car is interrupted. The passage of the propulsion current through the regular lighting system of the car is arranged to normally pass a charging current to the storage batteries for the auxiliary system, and, by means of an automatic switch, to keep the auxiliary lighting system cut out; whenever the propulsion current is interrupted, however, the automatic switch releases and throws the auxiliary lighting circuit onto the storage batteries, leaving them connected in and burning until the propulsion current again flows.

The system is convenient and economical, as only a very small battery is required in each car. Upon the Lackawanna & Wyoming Valley Railroad each car is equipped with a storage battery of six cells, each of 5-ampere-hours capacity; the batteries are enclosed in a box for convenience, occupying very little room and weighing only 60 lbs. in all. The arrangement of the auxiliary lighting circuit is such as to provide one lamp in the headlight and four lamps distributed through the car, two inside and two upon the platforms.

Several of the Kinsman equipments were recently shipped to the first electric railway company in Lima, Peru, which was described on page 851 of our June 4 issue. Here the conditions of operation are such that it is very dangerous for the passengers of a car to be without light at any time at night.

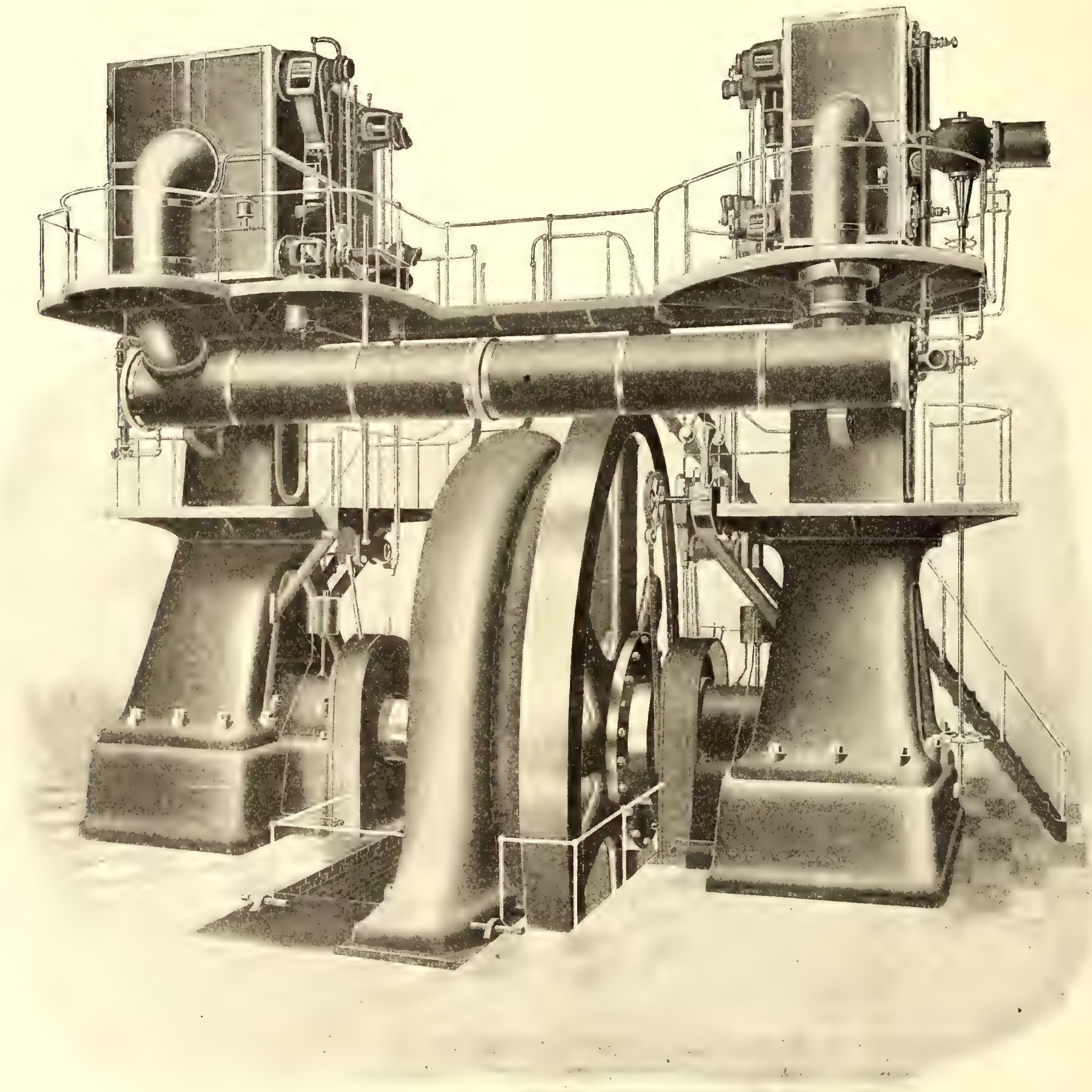
NEW HAMILTON-CORLISS VERTICAL CROSS COMPOUND ENGINE

The Hooven, Owens, Rentschler Company, of Hamilton, Ohio, has entered the field for vertical engines by bringing out a new vertical Corliss engine. This engine is of entirely new design, and is said to include all the features that the company's long experience has found to be the best.

The company has built a 2500-hp unit of this type, which will be exhibited at the Louisiana Purchase Exposition, direct connected to a 1500-kw alternator, manufactured by the National Electric Company, of Milwaukee, Wis. This alternator was described in the STREET RAILWAY JOURNAL of May 7.

The cylinder sizes of the Exposition engine are: High-pressure cylinder, 34 ins. diameter; low-pressure cylinder, 68 ins. diameter; stroke, 54 ins.; speed, 83 r. p. m.; main bearings, 25 ins. diameter by 42 ins. long; shaft in wheel and generator, 30 ins. diameter; crank pin, 11 ins. diameter by 11 ins. long; wheel, 22 ft. diameter; weight, 120,000 lbs.

The cylinders are made of close-grained charcoal iron, as hard as is practical to machine them. The exhaust chambers are separated from the cylinder walls by an air space. The arrangement is such that there is a 2-in. space between the cylinder walls and lagging for non-conducting covering. They are lagged with sheet-steel with bright polished angle-steel. The valves are located in the barrels to avoid the inconvenience of having to disconnect the valve gear when the heads are removed. The valves, however, have been placed in such a manner as to reduce the clearance to about the same as if they were placed in the heads by bringing the exhaust valves partly within the cylinder walls, although at no time do the valves enter the space swept by the piston, while the piston is allowed to sweep past the ports. The arrangement is different on the steam valve side. The ports on this side are so arranged that the incoming steam strikes the piston squarely on the end, thus preventing any side shock or pounding common to the vertical type of engine. Both steam and exhaust valves are double ported and have a very short travel. The valves are cored and made as light as possible.



REAR VIEW OF CROSS-COMPOUND VERTICAL ENGINE

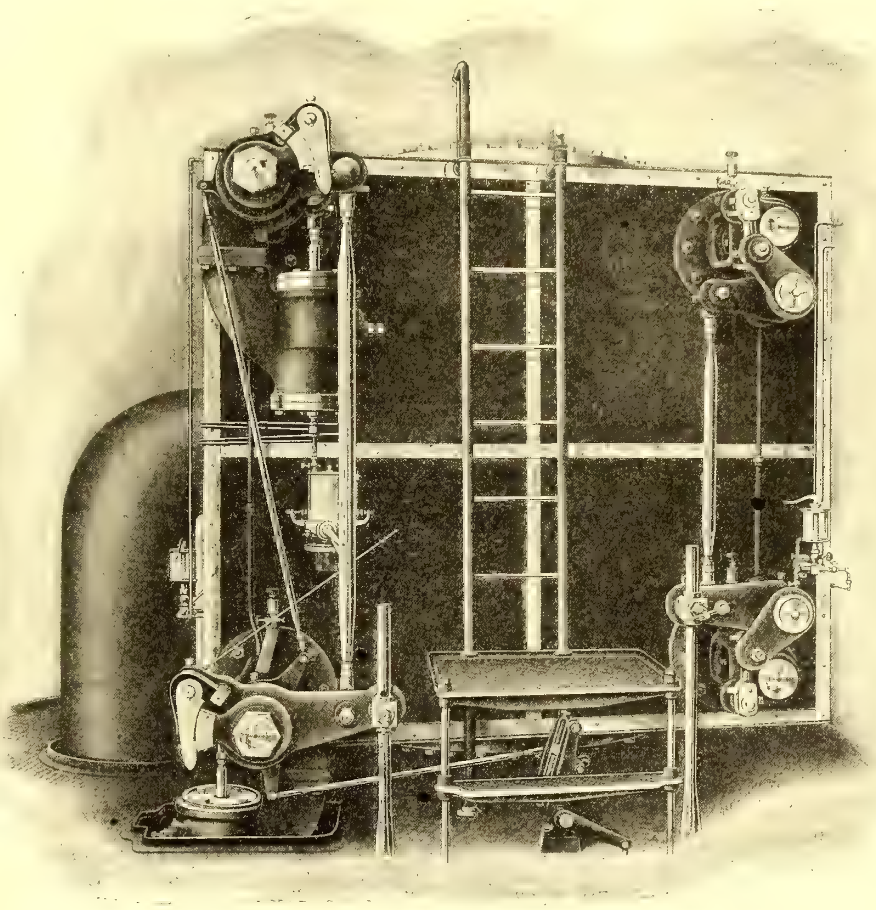
The bed-plate is of the box-section type, deep, massive and strongly webbed, with liberal bearing surface on the foundation. It is cast in one piece, and is carried around the crank at full height, forming a deep crank pit to retain oil. This base has easy lines and well rounded corners. The main bearing portion is bored and faced to receive the bottom box, which is of

the shell-type, and so arranged that it can be removed by raising the shaft enough to remove the weight from the box. This box is arranged for water circulation.

The wheel is made in eight segments, a section of the rim and one arm to each segment. These segments are carefully planed and fitted at the joints, and are bolted to the hub with turned steel bolts, holes being reamed for a driving fit. The rim is clamped together with steel arrow-headed links, which are shrunk in place. The hub is in two separate discs forced upon the shaft. These discs are drilled, reamed, and are bolted to the arms with turned steel bolts.

The "A" frame is cast in two pieces, strongly webbed, and is planed and fitted together and bolted with reamed fitting turned steel bolts. Its lower portion is of the box, or rectangular section, which gradually changes to a circular section as it reaches the top, giving very pleasing, but very strong lines. The openings on the sides are especially designed to receive oil shields which entirely enclose this part of the engine. The guide barrel is circular in form, slightly flattened on the sides where the openings come, which are also designed for perfect fitting oil shields and doors. This portion of the frame is also strongly webbed. The guides are separated from the walls of the barrel by an air space, and are bored from a common center. The barrel is faced at both ends at the same setting, which ensures perfect alignment. The pistons are cored and made as light as consistent with the proper factor of safety. They have a follower ring and one sectional ring, which is pressed out by spiral springs held in place by T-headed brass bolts. The pistons are forced on a taper and locked with a jamb nut and keeper. The cross-head is of steel, with cast-iron slippers, lined with best phosphor babbitt, peined in, bored and scraped to fit. Each slipper has a wedge adjustment which is entirely independent, hence the position of the slipper is not changed by its movement. The slippers are fastened to the cross-head by several steel bolts, thus relieving the wedge bolts of any extra strain, and are so arranged that they can be easily removed. Their construction is such that it is impossible for them to get adrift. Piston rods are fastened to cross-head by thread, jamb nut and keeper. The connecting rod is of the solid end pattern, and is five and one-half cranks long, with wedge adjustment at either end, so arranged that in taking them up the length of the rod and clearance spaces remain constant. The boxes are of bronze, babbitted, peined, bored and scraped to fit.

The valve gear differs somewhat from the company's regular type. The steam and exhaust valves are actuated by separate eccentrics, direct, without wrist plates. The necessary motion is obtained by the use of levers and links on each bonnet separately, thus greatly reducing the strains. The dash pots are hung from the bonnets and are close to the cylinder, making a very compact and self-contained arrangement. They are of the manufacturer's new noiseless pattern, with the weight of the moving parts greatly decreased, and are adapted for much higher speeds than usual. Both steam and exhaust cam rods have efficient unhooking devices, so that the valve gear can be worked by hand to facilitate starting and warming up. The valves are double ported, with very short travel, and, hence, have very little wear. The dash-pot levers are placed on the valve stems within the opening of the bonnet, and, therefore, are well supported on both sides to reduce wear. The releasing gear hooks and latch block trip plates have eight reversible wearing edges. All valve-gear connections are made to run as nearly noiseless as possible. The links have bronze connections with key adjustments. The governor is of the high-speed, center-weighted, fly-ball type, with motor and micrometer attachment for changing speed from switchboard to regulate for throwing in parallel. It is placed on the first gallery platform, and is easily accessible. Both cylinders are under control of the governor, hence the work is properly divided to suit the load. The range of cut-off is from zero to three-quarter stroke.



VALVE GEAR, LOW-PRESSURE CYLINDER

The intermediate rocker arm supports for eccentric rods are of the box section, strongly bolted to the guide barrel, and are reinforced by braces from the "A" frame.

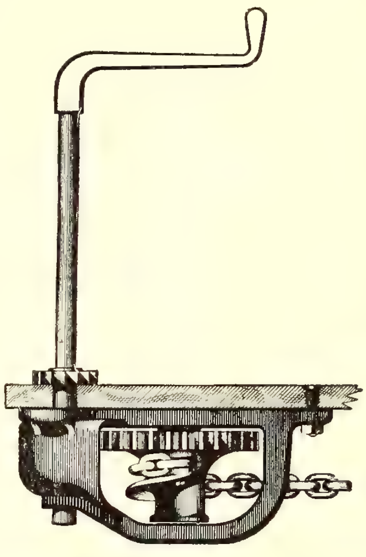
The main bearings are lubricated by a continuous stream of oil, furnished by an oil pump driven from the eccentric. The oil is pumped from a tank, located beneath the floor, to two receivers, which are located over each main bearing cap. From there it flows by gravity to all parts of the journal. The bottom box of these journals is cored out and arranged for water circulation. The eccentrics, cross-head slippers, cross-head and crank pins are oiled from a gravity feed system by multiple sight-feed tanks located on the upper part of the engine. The cross-head slippers have wipers on the bottom end, which dip into reservoirs at the bottom end of stroke, insuring perfect lubrication of the guides. All the valve gears, rocker arms, etc., are lubricated by grease cups. The engine is thoroughly furnished with oil guards and shields to prevent oil from being thrown on the floor. The eccentrics are entirely

enclosed to prevent oil creeping along the shaft and coming in contact with the wheel and generator.

These engines will be made in sizes from 16 ins. x 32 ins. x 36 ins. to 48 ins. x 96 ins. x 60 ins., and will be adapted for all medium speeds, and any desired steam pressure, belted or direct connected. The company also manufactures horizontal Corliss engines in single cylinders, compound-triple expansion types for low-pressure duty and moderate speeds.

AN IMPROVED HAND BRAKE

Although the spindle brake is still extensively used, it has only been retained because many railway companies felt that they could not afford to equip their cars with costly power brakes. Many attempts have, therefore been made to design a hand brake which, while low in first cost, could be used satisfactorily on heavy high-speed cars.


IMPROVED HAND BRAKE

The National Brake Company (Incorporated), of Buffalo, N. Y., believes that it has solved this problem in designing its "Peacock" brake, which is illustrated in the accompanying cut. Although on the market but a very short period, it is already in use on several of the principal Canadian electric railways, and has also been given some thorough tests by the International Railway Company, of Buffalo, N. Y. The result of these tests was so satisfactory as to warrant the consideration of this brake for general adoption on the company's heaviest cars.

The brake is adapted to any kind of car, from the single truck to the heaviest and fastest suburban type. It is durably constructed, has few parts, and is easily operated and applied, because the drum works on roller bearings. The speed obtained in taking up the slack chain and the great power gained when applying the brake are very valuable features. The spiral drum, with its eccentrically-geared cam construction, not only accomplishes these objects but extends sufficiently to provide for the taking up of any surplus chain caused by the car house men neglecting to keep the brakes properly adjusted. This last feature overcomes the only objection ever raised to the company's "National" brake, and its later type should, therefore, prove a very efficient hand brake for the most arduous service.

ACCIDENT INSURANCE IN ST. LOUIS

The employees of the St. Louis Transit Company will hereafter be protected by accident insurance, the cost of which will be borne partly by the employees and partly by the company. The plan of this fund became effective June 1; it was proposed by the company and adopted by the Missouri Street Railway Union, of which every motorman and conductor in the employ of the company is a member. Payment of compulsory dues of 50 cents a month to the union have ceased. In their place the men are given the privilege of voluntarily contributing a similar amount to the accident fund, but only those who do make such contribution are entitled to the benefits of the fund. In order to further the movement the company has agreed to contribute to the fund a sum equal to one-half of that paid in by the men. In addition to this the company will furnish free medical attendance in case of sickness or accident, and free legal advice should such be desired by a member of the fund who is in good standing. The union, however, will cease to pay benefits of $5 a week to members who are disabled either by accident or sickness. The administration of the fund will be left to the executive board of the union, but the company will be the custodian of the fund, and the company's auditor will keep the accounts. The executive board of the union will meet within ten days and decide upon what basis benefits shall be allowed.

The new arrangement was outlined to the employees in a circular issued by the company. According to this circular, which is signed by Robert McCulloch, vice-president and general manager of the company, no expense will attend the conduct of the union's affairs. Moreover, the circular says:

"If the officials of the Missouri Union devote time to the performance of duties, the company will pay for this time, making it plain that every cent contributed, together with an equal amount from the company, shall constitute a substantial relief fund for accidents, and if the condition of the treasury comes to justify it the scope of the benefits will be enlarged."

Because of the arrangement by which the company will audit and be the custodian of the accident fund and pay the officers of the union for the time actually devoted to union duties, most of the salaried officers of the union will be discontinued, the general president and others serving voluntarily. A secretary, however, will be paid. The auditing of the accident fund accounts by the company will relieve the union of a burden, for, heretofore, the auditing committee of the labor organization checked up the accounts every month, receiving compensation for its labor. There is also some talk among the members of the union of discontinuing the maintenance of general offices at the corner of Park Avenue and Eighteenth Street.

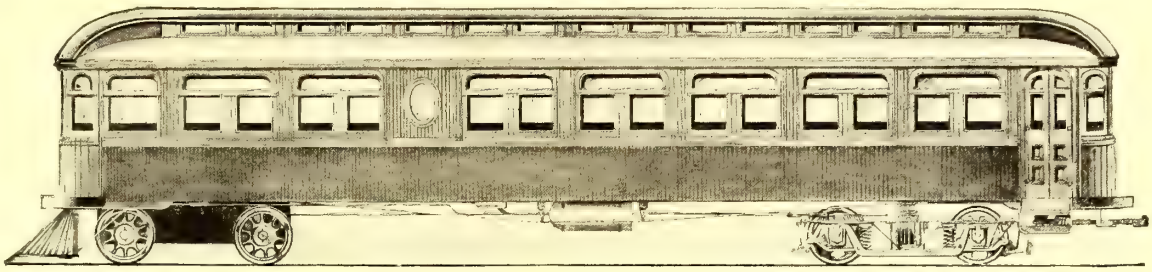
Though the sick benefit of $5 a week, which was paid wholly by the union, will be discontinued, the organization may continue the funeral benefit.

DEALING WITH THE ROWDY IN BROOKLYN

The question of how to suppress the street car rowdy is one that about this time occupies the attention of most managers operating lines to pleasure resorts. Last year several schemes were tried in different parts of the country for protecting passengers from insult and assault at the hands of the ruffian. In one city the company had the police meet its suburban cars at the city limits and take offenders into custody. This, so far as is known, proved fairly effective. In Brooklyn, where the hoodlums became particularly numerous and abusive, the citizens organized for protection, and in a number of instances did effective work, particularly at the beaches. This year, however, the Brooklyn Rapid Transit Company has essayed to grapple with the problem itself, and has decided on the "bouncer" as the most efficient means to the end. Accordingly, it has organized a force of seventy-five special policemen, some of whom will be uniformed. These men will be on duty during the rush hours, and all day during Saturdays, Sundays and holidays, when the pleasure traffic is heaviest. The "bouncers" are to travel in pairs, and when in civilian's dress will, so one report says, protest vigorously as citizens if any passenger conducts himself so as to disturb the public peace. If remonstrance proves futile, then the "bouncers" will do all their name implies. The end sought will be the peace of the majority of the passengers, and only in exceptional cases will arrests be made.

THE PROUTY-PIERCE GASOLINE MOTOR CARS

One of the companies that has been making substantial progress in the direction of a successful gasoline interurban car, is the Prouty-Pierce Locomotive Manufacturing Company, of Kansas City, Kan. There are many places where traffic will not warrant the investment in a complete electric equipment of a railway. It was thought that if a practical gasoline motor car, or locomotive, could be evolved it might make practicable the construction of railways in territories where neither steam nor electric traction have yet entirely filled the demand. The Prouty locomotives were first designed for contractors, logging and industrial railways. Such locomotives having been in successful use for some time, the company decided to enter a wider field with them, and adapt them for use either pulling interurban coaches as trailers, or placing them directly on one truck of an interurban car.



DOUBLE-TRUCK GASOLINE MOTOR CAR

Fig. 1 shows a combination passenger car such as it is proposed to equip with the gasoline motor, and Fig. 2 shows a passenger locomotive, similar to the switching locomotives now being built by the company. It is proposed to substitute in place of the ordinary truck at one end of the car a gasoline locomotive, allowing the locomotive to stand up into the car body through an opening in the car floor. This part of the car body would be closed off from the passenger compartment, and might be used for packages.

The gasoline locomotive is made very heavy, so as to adapt it to the roughest work and give good traction. The gasoline engine in this locomotive runs continuously one way. The form of clutch used on a locomotive of this kind is of the greatest importance, since a large amount of power must be transmitted from a constantly-running gasoline engine for the acceleration of a car or train.

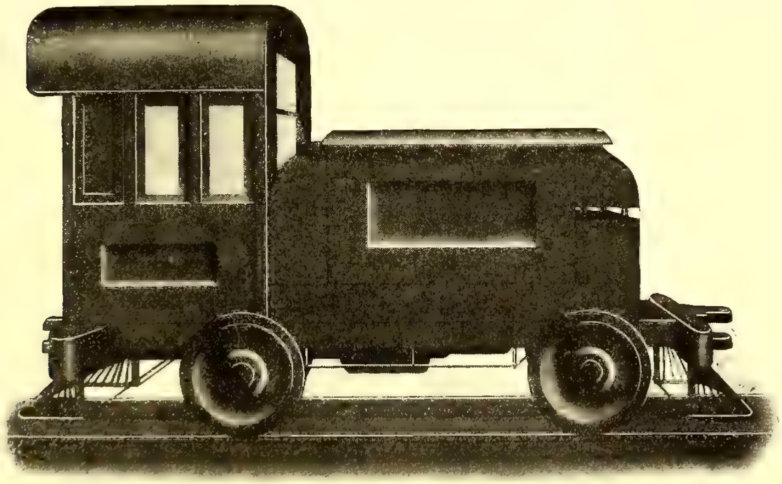


FIG. 2. GASOLINE LOCOMOTIVE

The power transmission on this locomotive is accomplished by what is called the "Prouty impinging reversible clutch." This clutch operates on a principle which was first employed by Mr. Prouty on his street car brake, which the readers of the Street Railway Journal will recall as having been tried in Chicago several years ago. In this clutch the faces of the friction discs are forced together by a tapered roller, which is forced between the bevelled edges of one friction and another disc which is free to revolve. These tapered wheels operate the friction clutch by impingment, and not by thrust. The clutch is arranged so that the car is started and stopped smoothly, and is run in either direction. By reversing the clutch an effective brake is put on the motion of the locomotive.

The friction faces are lubricated with oil mixed with graphite. These faces are parallel surfaces well lubricated, and, as mentioned before, are forced together by the wedging action of the taper wheel mentioned. All the parts of the clutch, gearing and pinions are made of the best crucible steel, perfectly turned and cut.

Two speeds are provided for by means of gearing. Intermediate speeds must be obtained by varying the speed of the engine. The low-speed gear is used for starting and on grades. The general construction of the locomotive frame is peculiar, one axle is rigid with the frame of the locomotive. The other rocks on its center, causing all wheels to bear uniformly on the rail.

The gasoline engine is of the 4-cycle type. It is mounted vertically. One cylinder only is used. A very heavy balance wheel is provided. The valves are of large diameter, with slight lift. The exhaust valve is opened by a cam and the air intake valve by the vacuum. No carburetter or gasoline vaporizer is used in the intake pipe. Instead of this the gasoline is mechanically measured for each stroke, and is injected into the intake air with great force as the air is being drawn into the cylinder by the down stroke of the piston. This causes it to be vaporized, and also permits a low grade of gasoline to be used. The gasoline is carried on the truck in a tank with wheels over ½ in. in thickness, the tank being made heavy, since saving in weight is not an object. The gasoline moves only by mechanical action when the engine is running, and not by gravity, which tends to increased safety. The discharge of the gasoline into the air intake is controlled by an automatic governor. This governor keeps constant speed, so long as it is not touched, but it can be controlled by a lever within easy reach of the motorman, to increase or decrease the speed of the engine. The measuring and regulation of the gasoline being entirely mechanical, sudden changes in the weather have no perceptible effect on the working of the engine, and when once the adjustments are made, it is claimed that the adjustments need not be touched for months. The gasoline vapor is ignited by an electric jump spark. The engine is water jacketed, and the cooling water is rapidly circulated by a centrifugal pump, driven by the engines. Considerable interest has been manifested by some electric railway, and also some steam railroad men, in the development of gasoline motor cars for branch lines and extensions, where operation by steam or electricity is not profitable.

In a long editorial on the question of the "end-seat hog," the "Hartford Times" recently advanced the wonderful theory that the ordinance introduced in the Council of New York to restrain the hog "is all for the benefit of the trolley company."

FINANCIAL INTELLIGENCE

WALL STREET, June 15, 1904.

The Money Market

The only important development in the money market of the week is the sharp decline in sterling exchange. It is notable that this has occurred in face of the lowest money quotations of the year in New York City, and in face of unmistakable assurance that these very easy conditions are going to continue. The one conclusion possible to draw from the week's exchange movement is that both Paris and London have all the gold they are likely to need, and that they will draw no more from America this season. This inference is, of course, strongly supported by the decline in the price of gold in the London market, and by the violent advance in the sterling rate at Paris. With gold exports no longer probable, the only thing that might conceivably have caused a firmer money market during the next two months, has been removed. Not until the accustomed drain of currency to the harvest territory begins need any change in existing conditions be looked for. The banks continue to add heavily to their already bountiful stores; last Saturday's statement showing a further increase in specie and legal tender holdings of $6,400,000, and an increase in surplus reserve of $3,800,000. The gain in cash is derived chiefly from the unemployed funds of the interior cities, but part of it is new gold transferred across continent. The surplus item now stands at the high point of the year; it is $35,562,000, compared with $9,477,000 a year ago, and $13,302,000 two years ago. In view of the fact that money has again become unprofitable to lend, we may expect to see the institutions outside the Clearing-House retire from the market and shift the lending function upon the member banks. Saturday's increase of $5,528,000 in loans undoubtedly reflected the beginnings of the process. Call money on the Stock Exchange renews at 1 and 1¼ per cent. Sixty-day rates have fallen to 1¾, ninety days to 2, and six months money to 3 per cent.

The Stock Market

A moderate advance in prices, with rather more activity in the trading, has occurred on the Stock Exchange this week. It has been based chiefly on speculative conditions, or, to put the case more specifically, upon the discovery that the market at the recent low level was very thoroughly sold out. A large short interest has been built up without any corresponding increase in the supply of real stock for sale, and these speculative sellers have been forced to bid up prices in order to cover their contracts. The rise has, perhaps, been helped by better crop reports, specially by the enormous acreage and high condition estimated for cotton. The government figures issued last Friday showed a somewhat reduced area of spring wheat, and a rather lower percentage as compared with a year ago. They also showed a small gain for the winter wheat crop during the month of May. There was scarcely anything in this exhibit to stimulate buying of stocks. With the cessation of gold exports and the rapid accumulation of bank reserves the investment demand for bonds has quickened considerably. Some rather striking advances have occurred in this quarter during the week, and this specially has assisted the growth of more cheerful feeling in the stock market. Railroad earnings reported for the month so far have shown up better than in some time past. The Republican victory in Oregon gave a more cheerful aspect to the political outlook. But all these outside matters would have been of insignificant importance in themselves had they not fallen upon a market sold to a standstill. It is the opinion among the majority of Wall Street observers that a rather better market is in store for the immediate future, but that there is little likelihood of any considerable advance or any very active speculation.

The city tractions have borne their full share in the week's improvement. A rather bullish feeling is discernible on Metropolitan, in speculative quarters which have lately acquired a considerable reputation for being right on the market. Philadelphia has sent a good many buying orders in the stock. The contention is now made that if the dividend were reduced from 7 to 5 per cent, the market would treat it as "bad news" over-discounted, and the price of the stock would advance to at least 120. Manhattan has been unusually active, selling "ex" the quarterly dividend of 1½ per cent and easily recovering it. The fact that the Interborough Company was able to pay a dividend to its stockholders out of Manhattan's surplus earnings, has served to draw investment attention more powerfully than ever to the merits of the elevated property. There is some talk that the stock may be listed on the London Exchange. Brooklyn Rapid Transit has been heavily bought by speculators impressed with the remarkable advance in the various bond issues of the company. Brooklyn Union Elevated 5s, Nassau Electric 4s and Kings County Elevated 4s have all enjoyed a very sharp raise on heavy dealings, while the new B. R. T. 4s have also been extremely strong. The investment position of the road is generally acknowledged to have become much more attractive since the recent changes in management.

Philadelphia

Without any noticeable developments, the traction list in Philadelphia has joined moderately in the general improvement of the week. Union Traction rose to 50 "ex" the dividend of ¾ per cent, which made its equivalent 50¾. This is the high record of the season. Philadelphia Traction was also conspicuously strong, gaining a half-point from 95⅞ to 96⅜. On the other hand, Philadelphia Electric and the Rapid Transit shares were weak. In the case of the first-named, there was a story of a rival company about to be formed which, however, did not receive a great deal of credence. The stock dropped from 6¼ to 5¾ and then hardened a trifle to 5 15-16. Rapid Transit declined from 12¼ to 11½ on the sale of 800 shares, but subsequently rallied to 12. Dealings in Philadelphia Company common were featureless, the stock selling at 38¾ and later easing at 38⅜. The preferred went at 44⅛ and 44. American Railways rose from 43 to 43½ and then receded to 43⅛, at which figure 100 shares changed hands.

Chicago

Dealings in the Chicago tractions have fallen off considerably, and prices in some instances have suffered by a clearer recognition that the recent court decision by no means ends the interminable question of the franchise extension. After 100 shares of City Railway had sold at 178 the bid was lowered so sharply that the offer of a small lot brought only 175. There were no sales at all of Union Traction shares. Three hundred West Chicago changed hands on the way up from 45 to 47 and back to 46. One hundred North Chicago sold at 80, 200 at 78, 120 at 78½ and a fractional lot at 79. In contrast to the uncertainty reflected in the market for the surface road securities, the shares of the elevated lines were very strong. Metropolitan common rose as high as 21¾, reacted to 21 and rallied to 21½. Five hundred of the preferred sold on a scale from 54 to 57. Three hundred Northwestern common were dealt in between 17 and 17⅝, and 200 of the preferred at an advance from 44½ to 47½. There was no explanation for this sudden exhibition of strength beyond the fact, which has been understood in inside quarters, that it was speculative conditions rather than poor company earnings which led to the recent low prices in these elevated securities. South Side was also stronger, recovering from 89½ to 90½, on the announcement that, providing the company's stockholders approve of the bond issue plan, $8,000,000 of the 4½ per cent bonds have already been placed through various bankers in New York and Chicago. Lake Street was firmer, getting up from 3 to 3½.

Other Traction Securities

Another very sharp advance in Boston Elevated is the feature of the week's Boston dealings. The stock rose from 143 to 147½, on a fairly large volume of sales, 500 shares changing hands between 144¼ and 146, and 300 between 146 and 147½. Appreciation of the growing investment value of the property, backed up by some active investment buying, is what the advance has chiefly reflected. Massachusetts Electric issues have been dull, the common stock unusually so, a few hundred shares between 18⅝ and 19¼ being the extent of the trading. The preferred has sold at 70. West End common went at 91, and the preferred was notably strong at an advance from 111 to 112. On the Baltimore Exchange the United Railway securities have again been under some pressure, the income bonds falling from 45 to 44⅝, while the stock dropped to 5¾, after 500 shares had sold at 6. The general 4s were firmer than the others, rallying from 89¾ to 90¼. Other Baltimore transactions comprised Baltimore Traction 5s at 112½, City & Suburban (Washington) 5s at 98½, Atlanta Consolidated 5s at 106½, City & Suburban (Baltimore) 5s at 112½, Toledo Traction 5s at 101⅞ and 102, Rochester Railway 5s at 109, North

Baltimore Traction 5s at 116 to 116½, Baltimore City Passenger 4½s at 101, and Knoxville Traction 5s at 101¾. On the New York curb the main incident of the week has been the rise in Interborough Rapid Transit from 111½ to 119¾, at which figure it sold on Monday. About 5000 shares have changed hands on the advance. The movement is associated with the active operations in Manhattan Elevated on the Stock Exchange, and is partly ascribed to a better appreciation of the remarkable earnings situation of the property, and partly to the preparations for listing the securities in London. Three hundred St. Louis Transit sold at 13⅞ and 14. Washington Railway & Electric was strong, 800 shares of the common stock selling at an advance from 15 to 16, and the 4 per cent bonds rising from 77½ to 78¼. Nassau Electric 4s on heavy dealings gained 2⅝ points, from 80¼ to 82⅞.

There was a strong demand for Cincinnati Street Railway in Cincinnati last week. The stock has been selling around 139 for several weeks past, but the sudden demand advanced it to 144 during the week. Sales aggregated about 1300 shares. Cincinnati, Newport & Covington preferred was quite active at 85½, and the common sold at 29½ for two lots. The first 5 per cent bonds of this company brought 109½ for $28,000 worth. There was considerable demand for Cincinnati, Dayton & Toledo stock, but little was offered for sale; the price advanced from 20 to 22 on two sales. Northern Ohio Traction 5s sold at 99 for $7,000 worth. Detroit United was comparatively inactive, two small lots selling at 61.

In Cleveland there was a strong demand for Cincinnati, Dayton & Toledo stock. Cincinnati people have been doing the buying, due to the report that the property is about to become affiliated with the strong interests that control the Cincinnati city lines. One Cincinnati house is said to have bought 5000 shares at private sale in Cleveland. Sales were made at from 21 to 23¾, but the holders seemed unwilling to let it go at these figures. Syracuse Rapid Transit sold at 24 for a round lot, one point below previous mark. Aurora, Elgin & Chicago 5s sold at 75 for $5,000 worth.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid	
	June 7	June 14
American Railways	*43	43
Aurora, Elgin & Chicago	a13½	a14
Boston Elevated	142¾	147
Brooklyn Rapid Transit	47	48⅝
Chicago City	170	175
Chicago Union Traction (common)	a6¾	5¼
Chicago Union Traction (preferred)	28	a30
Cleveland Electric	71¼	70½
Consolidated Traction of New Jersey	65	66
Consolidated Traction of New Jersey 5s	105	105¼
Detroit United	60⅞	61
Interborough Rapid Transit	111¾	118¼
Lake Shore Electric (preferred)	a40	a30
Lake Street Elevated	3	3¼
Manhattan Railway	144	*148⅜
Massachusetts Electric Cos. (common)	18¼	18¼
Massachusetts Electric Cos. (preferred)	*70	70
Metropolitan Elevated, Chicago (common)	21	20½
Metropolitan Elevated, Chicago (preferred)	52¾	56
Metropolitan Street	110⅝	114½
Metropolitan Securities	75	80
New Orleans Railways (common)	8¼	9
New Orleans Railways (preferred)	26¼	27½
New Orleans Railways, 4½s	74	—
North American	81	84
Northern Ohio Traction & Light	12	13
Philadelphia Company (common)	38⅜	38¼
Philadelphia Rapid Transit	12¼	12
Philadelphia Traction	95¾	96¼
St. Louis (common)	13¼	13½
South Side Elevated (Chicago)	89	91½
Third Avenue	116	120½
Twin City, Minneapolis (common)	93¾	93½
Union Traction (Philadelphia)	50	50
United Railways, St. Louis (preferred)	57	57
West End (common)	90	90½
West End (preferred)	111	111

a Asked.

Iron and Steel

Reports from the iron and steel trade are still by no means encouraging. Consumption of foundry iron is on the decline and concessions in prices are looked for. The outlook is not good for business in steel rails, beyond the summer months, for which period the mills seem to be pretty well supplied with orders. Trade in structural material is very slow and disappointing. Quotations are as follows: Bessemer pig iron $12.85, Bessemer steel $23, steel rails $28.

Metals.

Quotations for the leading metals are as follows: Copper 12¾ cents, tin 27¼ cents, lead 4¼ cents, and spelter 4 15-16 cents.

REPORT OF THE LISBON ELECTRIC TRAMWAYS

The report of the Lisbon Electric Tramways for 1903 was presented at a meeting of the company held June 9 at London. The report shows that after charging off interest and sinking fund on the debentures of the "Companhia Carris de Ferro de Lisboa," there is a net profit to the sum of Rs.516,904,264, which in sterling, gives the sum of £91,803-4-7, which is carried forward to the credit of the London profit and loss account; and after payment of interest on debentures, and other charges, besides London office expenses and directors' remuneration, there remains a balance of £59,814-13-4, which, added to the balance of £6,080-12-10, brought forward from last year, gives an available balance of £65,895-6-2. Out of this amount, the arrears of preference dividend accumulated during construction to Dec. 31, 1902, amounting to £12,000, have been paid, and also the dividend of 6 per cent for the year of 1903, amounting to £25,533-3-8. The directors have also transferred the sum of £20,000 to depreciation reserve account, leaving the sum of £8,362-2-6 to be carried forward to the next year's account.

The business of the company continues steadily to expand, as is shown by the receipts for the year under review, which will be seen to amount to Rs.1,115,722,067, sterling equivalent, £198,133-12-10, as against Rs.966,547,142, sterling equivalent, £166,283-19-4, in 1902, being an increase of Rs.149,174,925, sterling equivalent, £31,-849-13-6.

There has been expended during the year on construction the sum of £19,667-18-5, which includes the cost of an additional unit to the power house.

PACIFIC ELECTRIC TO HANDLE FREIGHT

Much interest has developed lately in Los Angeles over the announcement that the Pacific Electric Railway Company is making preparations to handle freight. Already considerable freight business is done by certain interurban lines. Now the Pacific Electric Railway Company proposes to enter the field systematically, and has established a regularly appointed traffic department. To the position of traffic manager Joseph McMillan, heretofore chief clerk to General Manager Schindler, has been promoted. The duties of the new position will come naturally to Mr. McMillan, for he was district passenger agent of the Southern Pacific in Texas before he was brought to Los Angeles by Epes Randolph, when the latter was general manager of the Pacific Electric Railway Company.

"Our passenger business has grown so rapidly that we need one man at the head of that department," said General Manager Schindler to a representative of the Street Railway Journal. "In connection with our passenger business we are handling considerable freight, which is turned over to us by the steam roads. Eventually we shall do much business in this direction, but it is simply to be a natural development. Without any ado about the matter, we are simply preparing ourselves to take care of all the business that comes our way."

The report that the company has placed a large order for freight cars to be used between Los Angeles and Long Beach, Whittier and Glendale, is denied. Undoubtedly the report originated in the fact that thirty-two new passenger coaches have been ordered for the heavy summer travel to the beaches.

Mr. McMillan says that any freight cars the company may use will be built in its own shops in Los Angeles.

The National Electrical Contractors' Association will hold its fourth annual convention Sept. 14, 15 and 16, 1904. A special convention train will leave the Grand Central Station, New York City, Saturday, Sept. 10, at one o'clock, p. m., for St. Louis, Mo. Communications relating to trains and rooms should be addresssed to Alexander Henderson, Master of Transportation, 527 West Thirty-fourth Street, or Milton C. Roach, General Eastern Passenger Agent, 1216 Broadway, New York City.

TROUBLE OVER APPRAISEMENTS UNDER NEW OHIO LAW

State Auditor Jones, of Ohio, is having trouble in regard to the distribution among the various counties of the appraisements of interurban lines. Under the Bruce bill, which was passed in the recent State Legislature, through the efforts of the Ohio Interurban Railway Association, power houses, terminals and other valuable buildings are distributed over the entire line instead of being taxed in the county in which they are located. In urging the passage of this measure the interurban roads argued that a power station or sub-station was as much a necessary part of the track or rolling stock as the car or rails. Some of the counties which heretofore have had all the taxes derived from power stations or similar buildings are talking of bringing suit to have the Bruce law declared unconstitutional.

FINANCIAL REPORT OF RECEIVERS OF CHICAGO UNION TRACTION COMPANY

The receivers of the Chicago Union Traction Company have issued the following report:

INCOME ACCOUNT, WEST CHICAGO STREET RAILROAD COMPANY

(Six months ended Feb. 29, 1904.)

Car earnings—		
Passengers	$2,622,951	
Chartered cars	333	
Mail	11,631	$2,634,915
Miscellaneous earnings—		
Advertising	11,250	
Rents	3,313	
Sale of power	2,441	
Miscellaneous	54	17,058
Gross from operation		$2,651,974
OPERATING EXPENSES		
General—		
Salaries	$34,943	
Damages	194,813	
Legal expenses	48,434	
Insurance	10,714	
Various general expenses	45,248	$334,152
Maintenance way and structures		149,153
Maintenance equipment		226,435
Transportation—		
Operation of power plant	$288,962	
Operation of cables	121,272	
Operation of cars, all expenses	787,899	1,198,124
Total operating expenses		$1,907,865
Net earnings from operation		744,108
Miscellaneous income—		
Interest on deposits	$150	
Income from securities owned	4,046	
Rent of leased lines	5,000	
Miscellaneous	10,246	19,443
Gross income less operating expenses		$763,554
Deductions from income. Taxes accrued—		
Real and personal property	$37,478	
Capital stock	23,793	
Car licenses, etc.	22,679	
Interest accrued—		
On funded debt	302,410	
On real estate mortgages	4,599	
On floating debt	31,742	
Rent, leased lines, accrued	260,982	
Other deductions	154	683,840
Net income		$79,711
Reserve for depreciation	$339,213	
Proportion of deficit Chicago Consolidated Traction Company	132,685	471,899
Deficit		$392,188

INCOME ACCOUNT, NORTH CHICAGO STREET RAILROAD COMPANY

(Six months ended Feb. 29, 1904.)

Car earnings—		
Passengers	$1,477,387	
Chartered cars	228	
Mail	3,742	$1,481,357
Advertising, rents, sale of power, etc.		17,845
Total income		$1,499,203

DISBURSEMENTS

General expenses	$159,490	
Maintenance way and structures	109,622	
Maintenance equipment	142,260	
Transportation, operation of power plant	178,557	
Operation of cables	69,266	
Operation of cars, all expenses	431,251	
Total disbursements		$1,090,449
Net from operation		$408,753
Miscellaneous income—		
Interest on deposits	$81	
Income from securities owned	2,312	
Rent of leased lines	.....	
Miscellaneous income	9,071	11,465
Gross income, less operating expenses		$420,218
Deductions from income—		
Taxes accrued—real and personal property	$44,741	
Capital stock	26,744	
Car licenses, etc.	11,773	
Interest on funded debt accrued	115,590	
Interest on real estate mortgages accrued	450	
Interest on floating debt accrued	70,513	
Rent, leased lines accrued	103,735	
Other deductions	83	373,631
Net income		$46,587
Reserve for depreciation	$163,008	
Proportion deficit of the Chicago Consolidated Traction Company	74,939	237,948
Deficit		$191,360

CHICAGO CONSOLIDATED TRACTION COMPANY—INCOME ACCOUNT

(Six months ended Feb. 29, 1904.)

Car earnings—		
Passengers	$640,175	
Chartered cars	306	
Mail	2,160	$642,642
Miscellaneous earnings—		
Advertising	2,100	
Sale of power	633	
Other miscellaneous	329	3,063
Gross from operation		$645,706
OPERATING EXPENSES.		
General—		
Salaries	$7,665	
Damages	47,327	
Legal expenses	4,326	
Insurance	1,778	
Various general expenses	4,845	65,942
Maintenance way and structures		70,547
Maintenance equipment		49,527
Transportation—		
Operation power plant	$130,111	
Operation of cars	246,298	376,410
Total operating expenses		$562,427
Net earnings from operation		$83,278
Miscellaneous income—		
Interest on deposits	$219	
Income from securities owned	135	
Other miscellaneous	39,893	40,248
Gross income, less operating expenses		$123,527
Deductions from income. Taxes accrued—		
Real and personal property	*$10,450	
On earnings	1,166	
Car licenses, etc.	3,702	
Interest on funded debt, accrued	292,915	
Interest on floating debt, accrued	4,068	
Rent, leased lines, accrued	39,750	331,151
Total deficit		$207,624
Distribution of deficit among guarantors—		
North Chicago Street Railroad Company, gross income	$74,939	
West Chicago Street Railroad Company, gross income	132,685	207,624

* Credit.

The percentage of gross income consumed by operating expenses has grown in the past four years as follows:

	Year June 30, 1900	Six months, 1904
West Chicago	50.1	71.9
North Chicago	46.9	72.7

For North and West Chicago combined, year ending:

	Per cent
June 30, 1899	49.3
June 30, 1900	50.3
June 30, 1901	54.0
June 30, 1902	58.4

FRANCHISE CONDITIONS IN LONDON

Testimony given before the Royal Commission on London Traffic, June 3, by J. Clifton Robinson, managing director of the London United Electric Tramways, indicates the restrictive conditions of tramway promotion in England, by which the local borough authorities compete with each other as to the amount which the tramway company must pay to pass through their boundaries. Thus the London United Electric Tramways, whose system all lies within what is geographically the confines of London, is obliged to negotiate with some thirty different public bodies. Their exactions since 1898 for street widenings and improvements—being "the price of local authorities' assents"—amounted to £745,500, apart from the capitalization of numerous wayleaves, which amounted to a further £241,000. This was equivalent to over £20,000 per mile of tramway, irrespective of construction and equipment. For the extensions which the company proposed to make this year—but which it dropped owing to the extortionate prices placed by the local authorities on their assents—the company was asked to carry out public improvements costing £642,630, in addition to certain widening works, involving an expenditure of £217,932. In Brentford, one small district where the company asked for permission to build ¾ of a mile of track, the requirements of the Urban District Council represented an outlay at the rate of £608,000 per mile. Altogether, the proposed new tramways which the London United had to abandon, owing to the action of the various local authorities, represented a total of about 60 miles.

The Royal Commission is a body appointed by Parliament to consider the advisability of establishing an impartial tribunal which would deal with all questions relating to London traffic, and this proposal was advocated by Mr. Robinson.

REPORT OF NEW YORK CITY RAILWAY COMPANY

A consolidated statement follows of the earnings and expenses of the Interurban Street Railway Company (present name, New York City Railway Company), for the year ending Dec. 31, 1903, including the Metropolitan and Third Avenue systems, but excluding the Central Crosstown Railroad Company, the property of which was not leased to the Metropolitan Company until April 1, 1904:

Gross receipts	$21,221,519
Operating expenses	10,990,602
Net earnings	$10,230,917
Other income	1,373,793
Total income	$11,604,710
Deduction from income	8,191,106
Surplus available for rental payable under Metropolitan lease	$3,413,604

The following is a condensed general balance sheet of the Interurban Street Railway Company (present name, New York City Railway Company), as of Dec. 31, 1903:

ASSETS

Cost of road and equipment and stocks and bonds of other companies	$14,223,634
Third Avenue Railroad Company, profit and loss, as of June 30, 1903	227,670
Supplies on hand	266,801
Cash on hand	265,966
Cash on deposit to pay coupons and rentals	233,972
Prepaid insurance	40,500
Open accounts	11,401,370
Profit and loss (deficiency)	68,092
	$26,728,004

LIABILITIES

Capital stock, common		$7,921,200
Stock and notes due Met. Sec Co. under sub		10,754,800
Loans and bills payable		273,956
Interest on funded debt, due and accrued		34,583
Other interest due and accrued		11,083
Taxes, accrued		557,129
Rentals, due and accrued		1,883,507
Employees' deposits		13,809
Coupons due, not presented		2,645
Due for wages		69,193
Audited vouchers		534,414
Open accounts: Met. St. Ry. Co., on account of $23,000,000 payable under lease	$4,052,000	
Sundry accounts	85,106	4,137,107
Reserve for controlled companies as of June 30, 1903		534,578
		$26,728,004

The following is a condensed general balance sheet of the Metropolitan Street Railway Company, as of Dec. 31, 1903:

ASSETS

Franchise and property	$53,789,705
Construction	1,619,166
Construction to be distributed	64,838
Investments	10,889,714
Bills receivable	799,836
Due from Interurban Street Railway Co., under contract, payable as and when required by the Metropolitan Street Railway Co. for construction purposes	4,052,000
Material and supplies	663,439
Morton Trust Co. (Belt bond redemption account)	6,000
Cash	18,641
Open account, undistributed items, etc	61,420
Bond sale account	100,000
Advances to companies leased and controlled for construction and equipment	23,976,806
Due from companies and individuals	200,741
Total	$96,242,306

LIABILITIES

Capital stock	$51,997,400
Scrip outstanding	2,600
Funded debt	37,030,000
Due to companies and individuals	897,224
Due for material and supplies	532,336
Real estate mortgages	950,000
Bills payable	100,000
Bonds due and unpaid	6,000
Profit and loss (surplus)	4,726,746
Total	$96,242,306

The following is a condensed general balance sheet of the Third Avenue Railroad Company as of Dec. 31, 1903:

ASSETS

Cost of roads and equipment	$43,211,373
Other permanent investments	100,000
Bills receivable, representing advances to controlled companies	10,996,883
Advances to controlled companies, not included under bills receivable	4,333,170
Supplies on hand	154,862
Due by companies and individuals on open accounts other than traffic	25,978
Cash on hand	39,708
Cash on deposit to pay coupons	829,375
Open accounts	48,385
Prepaid insurance	7,305
	$59,747,041

LIABILITIES

Capital stock, common	$15,995,800
Funded debt	40,000,000
Loans and bills payable	1,175,000
Other interest, due and accrued	9,197
Coupons due, not presented	829,375
Due for wages	8,641
Employees' deposits	1,197
Due companies and individuals on open account	1,579,907
Taxes accrued	118,825
Profits and loss (surplus)	29,100
	$59,747,041

ANNUAL OUTING OF THE NEW ENGLAND STREET RAILWAY CLUB

The annual outing of the New England Street Railway Club will occur on June 21, and a most attractive programme has been prepared. Members will leave Boston at the North Station at 8:50 a. m. for Lynn, where electric cars will be taken to the Salem Willows. Here a ball game will take place between two selected nines representing, respectively, the railway men and the supply men. Those who do not care about witnessing the ball game can make the trip by boat to Baker's Island. At 2 p. m. a shore dinner will be given at Chase's and the party is scheduled to reach Boston on the return trip at 7 p. m. The charge for tickets is $1.50 each, and members are allowed to ask friends.

IMPROVEMENTS AT MANSFIELD, OHIO

The Mansfield Railway, Light & Power Company, of Mansfield, Ohio, operating city lines in Mansfield, and an interurban line from Mansfield to Shelby, is making some important improvements to its system. About 3 miles of city track are being relaid and rebuilt with 7-in. T-rail, and considerable special work is being put in. Heretofore the engines in the main power station have been run non-condensing, but a large condenser plant is now being installed. City water is used, and as it was found desirable to use the condensing water over and over again, a cooling tower, 32 ft. x 21½ ft., having 4000 sq. ft. of cooling surface, is being installed. Water enters at the top and falls in sprays, passing over numerous rows of tile. Radiation is aided by two large motor-driven fans. The new condenser is of the Wheeler surface type of sufficient size to take care of the present 1500-hp of engines and contemplated increased capacity. The entire outfit was installed by the Stillwell-Bierce & Smith-Vaile Company, of Dayton. The Railway & Light Company has just secured a ten-year contract to furnish city lighting and is installing in its main station suitable transformers, oil switches and switchboards to take care of 250 arc lights, to be operated under the series alternating system.

The company recently experienced on its Mansfield-Shelby line a strong demand for freight service. Not caring to go to the expense of buying a freight car until the service proved profitable, the company decided to utilize a large double-truck open car that had been found impractical for interurban service. The seats were taken out and a sheathing of matched siding was placed horizontally on the side posts, and then another sheathing outside of this was placed vertically. Large double doors were cut in the sides and made to slide in grooves on the outside. The car was fitted with four 35-hp motors, also air brakes, and is doing excellent service. Two round trips per day are made between Mansfield and Shelby, and a rate of 7 cents per cwt. is made on practically all goods for the 12 miles, with a minimum charge of no less than 25 cents for a package. The company carries a large number of trunks for traveling men, as the road forms part of the only direct route between Mansfield and Cleveland.

INTERNATIONAL ELECTRICAL CONGRESS

The acceptances of membership in the International Electrical Congress, which will be held Sept. 12-17, in St. Louis, number 1702, and over 160 specially invited papers are promised, in all. One thousand certificates of membership have been issued to those who have become members by sending in their subscription, and about 100 more certificates are about to be issued.

Efforts are being made to secure the manuscripts of as many of the 160 papers as possible, by July 1, in order to have them printed in advance and distributed among the congress members at St. Louis. Thus far, six papers have been delivered, and many more are promised by that date.

The programmes scheduled for Sections D and E, which cover electric power transmission and electric lighting and distribution, are here given. A similar programme for Section F, which is that on electric railways, will appear in an early issue.

All communications concerning the congress should be addressed to the general secretary, Dr. A. E. Kennelly, Harvard University, Cambridge, Mass.

SECTION D

Electric Power Transmission. Chairman, Mr. Charles F. Scott; secretary, Dr. Louis Bell.

Sig. E. Bignami, "Electrical Transmission Plants in Switzerland."

H. M. Hobart, "Conditions Conducive to Economy in Motor Design."

Mons. Maurice Leblanc, "Transmission of Alternating Currents Over Lines Possessing Capacity."

Prof. G. Mengarini, "Utilization of Hydraulic Powers in Italy."

Prof. F. G. Baum, "High-Potential Long-Distance Transmission and Control."

P. O. Blackwell, "The Tower-System of Line Construction."

H. W. Buck, "The Use of Aluminum as an Electrical Conductor."

V. G. Converse, "High-Tension Insulators."

M. H. Gerry, Jr., "Line Construction and Insulation for High Tensions."

L. M. Hancock, "Bay Counties Transmission System."

R. L. Hayward, "Some Practical Experiences in the Operation of Many Power Houses in Parallel."

J. F. Kelly and A. C. Bunker, "Long-Distance Power Transmission."

P. M. Lincoln, "Transmission and Distribution Problems Peculiar to the Single-Phase Railway System."

R. D. Mershon, "The Maximum Distance to Which Power Can Be Economically Transmitted."

P. N. Nunn, "Pioneer Work of the Telluride Power Company."

J. S. Peck, "The High Tension Transformer in Long-Distance Power Transmission."

Dr. F. A. C. Perrine, "American Practice in High Tension." N. E. L. A. paper.

Dr. C. P. Steinmetz, "Theory of Single-Phase Motors." A. I. E. E. paper.

SECTION E

Electric Light and Distribution. Chairman, J. W. Lieb, Jr.; secretary, Gano S. Dunn.

Prof. André Blondel, "Impregnated Arc-Light Carbons."

Herr Max Déri, "Single-Phase Motors."

Herr E. de Fodor, "Rates for Electricity Supply."

Sig. Ing. E. Jona, "Insulating Materials in High-Tension Cables."

Prof. W. Kubler, "Upon a Means for Compensating the Series Connection of Induction Motors."

Herr Karl Roderbourg, "Storage Batteries."

Sig. Ing. Guido Semenza, "Commercial Limits of Electric Transmission, with Special Reference to Lighting Service."

Dr. G. Stern, "The Superiority of the Alternating Current for Distribution in Large Cities."

Dr. W. Wedding, "Measurements of the Energy of Light and Heat Radiation from Electric Light Sources."

Arthur Wright, "Recent Improvement in Electrolytic Meters."

Prof. S. P. Thompson, subject to be announced.

B. A. Behrend, "The Testing of Alternating-Current Generators."

George Eastman, "Protection and Control of Large High-Tension Distribution Systems." N. E. L. A. paper.

W. C. L. Eglin, "Rotary Converters and Motor Generators in Connection with the Transformation of High-Tension Alternating current to Low Tension Street Current." Assn. Ed. Illg. Cos. paper.

W. L. R. Emmet, "The Effect of Steam Turbines on Central Station Practice."

Louis A. Ferguson, "Underground Electrical Construction." Assn. Ed. Illg. Cos. paper.

Gerhard Gottling, "Storage Batteries as an Adjunct to Central Station Equipment." Assn. Ed. Illg. Cos. paper.

G. Ross Green, "American Meter Practice." N. E. L. A. paper.

Caryl D. Haskins, "Metering Efficiency on Customers' Premises."

Francis Hodgkinson, "Steam Turbines."

John W. Howell, "Incandescent Lamps."

Philip Torchio, "Distributing Systems from the Standpoint of Theory and Practice."

W. F. White, "The Selection of a Distributing System for a Large City."

NEW YORK CENTRAL MAY FIGHT TROLLEYS

It is reported that the New York Central management, after long and careful consideration of the conditions which prevail, has finally decided to meet the competition of the trolley roads which parallel its lines, by providing for frequent fast service between local stations, and equipping some of its line with electricity. A. E. Brainard, the representative of the Central's passenger department, located at Albany, is quoted as having stated that George H. Daniels, the general passenger agent, has been making a study of electric line competition for a long time, and has worked out a schedule of prices and service, which "it is thought will change some the quarterly reports of the trolley lines."

AMENDING THE LOUISIANA "JIM CROW" LAW

A bill has just been introduced in the Louisiana State Legislature, known as "House Bill No. 87," providing for separate cars for the races in lieu of the wire screens now in use on street railways in the State. During the last session of this assembly the "Wilson 'Jim Crow' Law" was enacted, causing much inconvenience and expense to street railway companies and some little annoyance to the public, but after a few weeks the law enforced itself and things have been moving smoothly. The passage of such a bill as proposed by Mr. Seeber affecting towns of 25,000 or more inhabitants, will virtually be effective only in New Orleans and Shreveport, and will prove a great inconvenience, as local conditions hardly justify the use of trailers as suggested. Moreover, the public of New Orleans has grown accustomed to the "Wilson Law."

THE INTERNATIONAL ENGINEERING CONGRESS

This congress, which will be conducted under the auspices of the American Society of Civil Engineers, will be held at St. Louis Oct. 3-8, or the week previous to the meeting of the American Street Railway Association. The papers to be presented are by engineering authorities from all parts of the world, and cover thirty-eight different subjects; among them are several which bear directly upon electric railway work. Among the latter are the following:

Three papers on "Underground Railways," by William Barclay Parsons, chief engineer, Rapid Transit Commission, New York City; Basil Mott and David Hay, Central London and City & South London Railways, England; and M. Biette, adjoint d l'Ingenieur en Chef du Chemin de fer Metropolitan de Paris, France.

Two papers on "The Substitution of Electricity for Steam as a Motive Power," by James G. White, New York City, and Alexander Siemens, London, England.

Two papers on "Steam Turbines," by Francis Hodgkinson, Pittsburg, Pa., and M. Rateau, Professeur a l'Ecole des Mines, France.

One paper on "Electrical Power Generating Stations and Transmission," by L. B. Stillwell, New York City.

STEAM AND ELECTRIC STATISTICS FROM MASSACHUSETTS

In a recent issue, the "Boston Financial News" publishes the following statistics of the steam and electric roads of that State for the year ending Sept. 30, 1903. The steam statistics include earnings, etc., not only in Massachusetts, but in all of the States operated in, so for this reason the comparison is unfair to the electric lines, which, with few exceptions, transact practically all of their business in the State. But, inasmuch as the steam roads do not differentiate between the business originating in the various States operated in, the reports must be taken as a whole.

The statistics are as follows:

	Steam Roads	Electric Roads	Total
Gross earnings	$93,325,932	$25,540,811	$118,866,743
Operating expenses	67,774,864	17,519,367	85,294,211
Net earnings	25,551,068	8,021,444	33,572,512
Percentage of operating expenses to gross	72.62	68.59	
Gross earnings per mile of track	$19,020	$10,124	
Net earnings per mile of track	5,207	3,180	
Passengers carried	123,162,793	504,662,243	627,825,036

The following figures are also given for the electric roads only:

	1903		1893	
	Gross	Net	Gross	Net
Per car mile, cents	23.76	7.46	30.28	9.23
Per passenger carried, cents	5.06	1.59	5.04	1.54

NEW PUBLICATIONS

Up-to-date New York Air Brake Catechism. By Robert H. Blackall, author of Westinghouse Air Brake Catechism. Published by Norman W. Henley Publishing Company, 132 Nassau Street, New York, 250 pages. Illustrated. Cloth, Price $1.25.

This book is intended to fill the demand which has been created by the increasing use of the New York air brake, for a complete description of the parts of the apparatus employed to be presented clearly and concisely in a single volume. This is the only complete treatise that has been issued on the New York air brake and signaling apparatus, and was written with the idea of furnishing information, not only for those who are interested in handling the brake, but for those as well who have to do with the installation and maintenance of it. A detailed description is presented of the plain and quick-action triple valves, the duplex pump, pump governor, brake and retaining valves, signal valves and other features of the New Yoik equipment. Detailed information is also presented bearing on the peculiarities and troubles met in the care of the New York apparatus, together with their remedies, which will be of particular value to those using this system. An important feature of this book is the clear and instructive drawings presented, illustrative of the various portions of the apparatus. The book is carefully indexed for ready reference to any desired information.

Ready Reference Tables, Volume 1, Conversion Factors. By Carl Hering. Published by John Wiley & Sons, New York; 195 pages, full morocco. Price, $2.50.

The present is one of several volumes in preparation by the author and contains all the principal units used in engineering practice, and in commerce, with their definitions, logarithms, and constants used for converting them to other dimensions or measurements of the same character. Approximate conversion values have also been added so as to reduce the calculations to the simplest possible, and are so selected that the result will be correct within 2 per cent. A great many unusual, foreign and obsolete units are given, as well as a great many compound units with equivalents in other measure. A condensed list occupying three pages appears inside the first cover. To those who have much computation to do, especially the conversion between English and metric measures, the book will be most useful.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

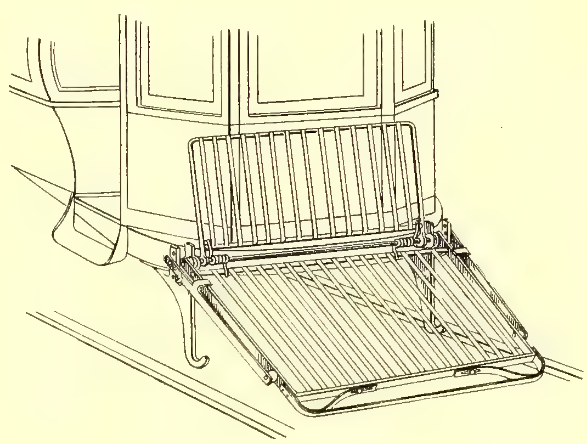
UNITED STATES PATENTS ISSUED JUNE 7, 1904

761,637. Trolley Guard; Linwood B. Aikens, Rockledge, Fla. App. filed March 24, 1904. At each side of the trolley wheel is eccentrically mounted a roller which is adapted, when the wire leaves the wheel and falls upon it, to rotate and lift the wire to a position where it will fall into the groove of the wheel.

761,687. Safety Attachment for Cars; Benjamin Lev, Cleveland, Ohio. App. filed Oct. 17, 1902. Means whereby when an obstruction is engaged and picked up by the fender, it will drop at the rear and rise in front, to thereby form a cradle.

761,692. Car Brake; William C. Mitchell and Mark Cummings, Trafford Park, England. App. filed Oct. 13, 1903. Means whereby the brake-blocks are applied with substantially equal pressure to the wheels on each side of the car, even though different amounts of wear have occurred, and it is necessary to move the brake-blocks on one side through a greater distance than those on the other side of the car when applying the brakes.

761,736. Passenger Traffic Handling Apparatus; Walter Wellman, Washington, D. C. App. filed Nov. 14, 1903. The train is provided with special entrance and exit cars thereby facilitating loading and unloading thereof.



PATENT NO. 761,687.

761,737. Railway Car; Walter Wellman, Washington, D. C. App. filed March 19, 1904. The seats are arranged upon a raised platform extending longitudinally of the car.

761,785. Car Seat; David Rait, Jr., Larchmont Manor, N. Y. App. filed Nov. 17, 1903. The seats are adapted to be folded against the side of the car to thereby provide greater standing room.

761,848. Trolley Signal; Charles H. Morse, Cambridge, Mass. App. filed June 27, 1901. Details.

761,928. Means for Contacting Electrical Conductors; Frederick G. Walker, Cleveland, Ohio. App. filed Aug. 12, 1903. Two trolley wheels mounted at an angle with their rims together thereby forming a single groove for the wire.

762,191. Means for Changing the Tracks of Tramways or Railways Having Movable Rails; Ottaviano Pacini, Pistoja, Italy. App. filed July 24, 1903. A switch, a box, a rail movable therein, wings on each side of the rail, and sheets fixed to the box under

which the wings are adapted to slide, the rail and sheets having their upper surfaces flush.

762,219. Combined Cash-Register, Ticket Register, and Bell Ticket Punch; Paul Whiting, East Las Vegas, Territory of New Mexico. App. filed June 10, 1903. Details of construction.

PERSONAL MENTION

MR. CHARLES T. YERKES was a passenger on the Kaiser Wilhelm II., which sailed Tuesday, June 14, from New York for Bremen.

MR. JOHN R. KREIDER, of Lancaster, Pa., has been made superintendent of the newly opened York Furnace Electric Railway, operating in York Furnace, Pa.

MR. RICHARD McCULLOCH, son of Captain Robert McCulloch, general manager of the St. Louis Transit Company, has assumed the duties of assistant general manager of the company.

MR. JOHN POWERS, of Sterling, Ill., has been appointed general superintendent of the Sterling, Dixon & Eastern Electric Railway Company. He is a man of fifteen years' street railway experience.

MR. WALTER B. MAHONY, associated with Emerson McMillin & Company since 1900, will form a connection on July 1 with Hodenpyl, Walbridge & Company, bankers, of 7 Wall Street, New York City, who control and operate gas, electric light and street railway properties.

MR. H. H. VREELAND, president of the New York City Railway Company, will address the Steam Railroad Master Mechanics' Association in Saratoga next week, on the importance of the mechanical and motive power departments of the steam roads familiarizing themselves with the principles and practical operation of electric apparatus. Mr. Vreeland's talk on this subject will be given on June 22.

MR. A. L. NEEREAMER has been appointed traffic manager of the Columbus, Delaware & Marion Electric Railway, of Columbus, Ohio, in charge of traffic and transportation, with offices at Columbus. The offices of general passenger and freight agent and superintendent have been abolished.

MR. A. G. DAVIDS, formerly superintendent of the Chester Traction Company, of Chester, Pa., has returned to Chester after an absence of two years as superintendent of the Auburn City Railway, of Auburn, N. Y., to become superintendent of the southeastern line of the Chester Traction Company.

MR. A. D. BOWEN, assistant president of the Petaluma & Santa Rosa Electric Railway Company, has withdrawn from that position, although he will retain his interest in the company. The detail work heretofore handled by Mr. Bowen will hereafter be attended to by Mr. E. L. Van der Naillen, the resident engineer of the new railway.

MR. DAVID YOUNG, JR., son of the former general manager of the North Jersey Street Railway Company, now part of the Public Service Corporation, of New Jersey, was married quite recently to Miss Daisy Wadsworth, of Newark, N. J. Mr. Young formerly was connected with the North Jersey Company, but now has an important position with the United Railroads of San Francisco.

MR. G. J. PAUL, for some time general manager of the People's Light & Railway Company, of Streator, Ill., has been confined to his home with a severe illness for some weeks. He was to have succeeded Mr. Godfrey Morgan as superintendent of the Youngstown & Sharon Railway, of Youngstown, Ohio, on May 1, but was unable to assume his new duties, and it is still uncertain when he will be on duty.

MR. J. R. RICHARDS has been appointed roadmaster of the Rochester Railway Company, of Rochester, N. Y. This is a new position. Mr. Thomas G. Hicks is at present superintendent of tracks, and Mr. Richards will work in conjunction with Mr. Hicks. Mr. Richards comes from Buffalo, where he has been for the past three years roadmaster for the International Railway Company. Previous to 1900 he was employed in a similar capacity by the Milwaukee Electric Railway & Light Company.

MR. S. S. FOLWELL, manager of the street railway department of G. D. Peters & Company, London, was in New York this week winding up a visit of some two months in this country. Mr. Folwell states that the business outlook on the other side of the Atlantic is good. G. D. Peters & Company have just secured the contracts from the Underground Electric Roads of London, Ltd., for the car seats and blinds for the 420 new electric cars which will shortly be used in the District Underground Railway. The seats are of the "Hale & Kilburn" type.

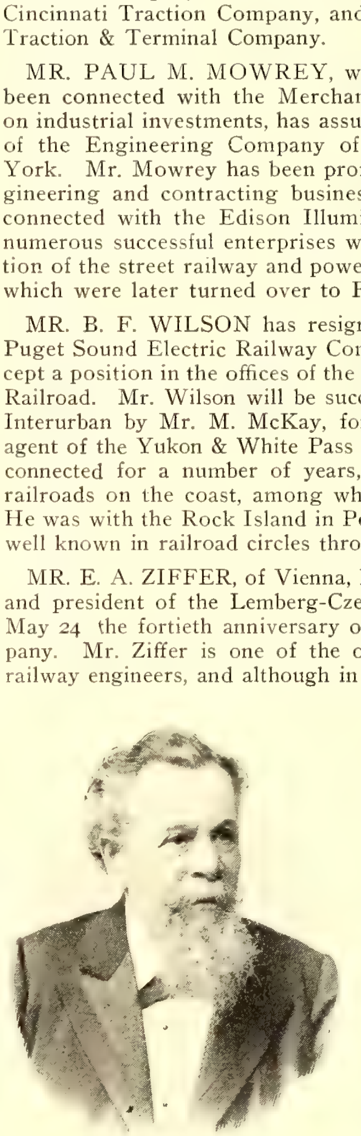
DAMON-DILLER.—Announcement is made of the marriage on Wednesday, June 8, of Miss Harriet Diller, daughter of Mr. and Mrs. Henry B. Diller, of Chicago, to Mr. George Alfred Damon. Mr. Damon is managing engineer of the Arnold Electric Power Station Company, of Chicago, and is one of the most promising and popular of the younger electrical engineers of that city. It is not considered good form to congratulate the bride on such occasions, but those acquainted with Mr. Damon feel that this rule should be set aside in this case, on account of the sterling qualities of the groom.

MR. GEORGE F. McCULLOCH has resigned as president and general manager of the Indiana Union Traction Company, of Indianapòlis, Ind., to devote himself exclusively to his newspaper enterprises, he having recently purchased and consolidated the "Indianapolis Journal" and the "Indianapolis Star." Mr. McCulloch is a member of the electric railway test commission that will conduct the test at the Exposition. His successor in the Traction Company is Mr. W. Kesley Schoepf, president of the Cincinnati Traction Company, and a directoı of the Indianapolis Traction & Terminal Company.

MR. PAUL M. MOWREY, who for the last three years has been connected with the Merchants' Trust Company as adviser on industrial investments, has assumed the office of vice-president of the Engineering Company of America, 74 Broadway, New York. Mr. Mowrey has been prominently identified with the engineering and contracting business sinse 1888, when he became connected with the Edison Illuminating Company. Among his numerous successful enterprises was the purchase and consolidation of the street railway and power companies of Richmond, Va., which were later turned over to Frank Jay Gould.

MR. B. F. WILSON has resigned as commercial agent of the Puget Sound Electric Railway Company, of Tacoma, Wash., to accept a position in the offices of the Kansas City, Fort Scott & Gulf Railroad. Mr. Wilson will be succeeded in the local offices of the Interurban by Mr. M. McKay, formerly assistant general freight agent of the Yukon & White Pass Railroad. Mr. McKay was also connected for a number of years, it is understood, with various railroads on the coast, among which was the Rock Island road. He was with the Rock Island in Portland for a long period, and is well known in railroad circles throughout the West.

MR. E. A. ZIFFER, of Vienna, M. A. S. C. E., M. I. C. E., etc., and president of the Lemberg-Czernowitz Railway, celebrated on May 24 the fortieth anniversary of his connection with that company. Mr. Ziffer is one of the oldest and best-known Austrian railway engineers, and although in his seventy-second year, he still enjoys enviable health and strength, and attends to his numerous duties with undiminished activity. He was born in 1833, and in 1852 had already completed his studies at the Vienna Polytechnic, studied architecture at the Vienna Art Academy, and had seen active service in the uprising of 1848. After working on a number of other railways, he became, in 1864, chief engineer of construction work on the Lemberg-Czernowitz-Jassy Railway, traffic manager in 1866, and technical director in 1868. Until May, 1875, he was the technical advisor of the board of managing directors, in that year becoming a member of the board. He has been its president since 1893. Mr. Ziffer on several occasions has ben decorated with medals and crosses of high Austrian orders, and is also an honorary citizen of the cities of Czernowitz and Janow. He enjoys a high reputation in steam and electric railway circles, and has contributed a number of articles to the Street Railway Journal on street railway practice in Europe. He has been for a number of years one of the members of the executive committee of the Internationale Strassenbahn und Kleinbahn Verein (International Street Railway & Light Railway Association) which this year will hold its annual convention in Vienna during the early art of September. In 1893 he founded the Verein für die Förderung des Local und Strassenbahnwesens, the Austrian Street Railway Association, and has been for a number of years its president. Mr. Ziffer has always been an enthusiast in all matters relating to railway work, and both of his sons are prominent railway officials in the employ of the Austrian Government.



E. A. ZIFFER

Street Railway Journal

Vol. XXIII. NEW YORK, SATURDAY, JUNE 25, 1904 No. 26.

Published Every Saturday by the

McGRAW PUBLISHING COMPANY

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago. Monadnock Block.

Philadelphia: 929 Chestnut Street.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York."—Lieber's Code used.

ST. LOUIS HEADQUARTERS:

Section 1, Electricity Building, Louisiana Purchase Exposition.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues) .... $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy) .... $6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues) postage prepaid: 25 shillings. 25 marks. 31 francs.

Single copies, first issue of each month, 40 cents; other issues, 15 cents.

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

The End-Seat Problem Again

The battleground of public discussion is ever being revisited by the ghosts of old themes which refuse to lie decently in their graves. Just now the end-seat problem is receiving more than its deserved share of attention in some of our Eastern cities, and the columns of the daily papers wax heavy with the strife of the pens of "Constant Reader" and "Pro Bono Publico." Fortunately, the street railway manager is not seriously mixed up in this peppery fray, but now and then a verbal club, thrown by some over-excited participant, misses its aim and flies too near the official head for comfort, instead of killing the ghost of this ancient subject, as it is rightfully bound to do.

We believe that this end-seat question is no more to be settled by street railway managers than is the holder of an end seat in a theater to be obliged to move inward by the playhouse authorities when a late comer rolls majestically down the aisle. No one ever was called an "end-seat hog" for retaining his place at a concert or a play, as far as we are aware, and, to point out still another instance where lateness pays its own penalty, we have yet to learn of a case where the first arrivals in a barber shop were objurgated with opprobrious epithets by their less fortunate followers. Nor are we aware of any code of bargain counter ethics which is violated by the solidity with which the fair patrons of the department store maintain their vantage points against the onward rush of their less punctual sisters.

On the other hand, there is no denying that the more general practice of courtesy in street railway travel would result in some amelioration of rush-hour conditions, or that the exhibition of additional politeness on the part of passengers in their relations with each other and with employees would lubricate the machinery of transportation to a noteworthy degree. Rapid transit in cities, however, can never be made an Alphonse and Gaston affair as long as people persist in all going home at once, unless somebody is willing to remain down-town over night. As for the end-seat question, there are often cases where a passenger is going to leave the car so soon that it would be a serious inconvenience for him to move away from the end, only to climb over the laps and feet of subsequent comers when his near-at-hand destination arrives. It is certainly a mark of much courtesy to give up the end seat to all comers, but the passenger who retains his place can scarcely be classed among the villains of modern society, and in no event is it fair to blame the street railway company, which is as powerless to leave out the end seat, and thus solve the problem of courtesy, as is the steam railroad to omit the last car in its train as a safeguard against rear-end collisions.

Light in Repair Shops

We have frequently called attention to various points, not to be lost sight of, in the design of repair shops for electric railways. Not the least of these is the question of good light. Nothing can take the place of plenty of daylight. A realization of this fact has caused the majority of electric railway companies to do away with night work as far as possible in the inspection and repair of motor equipments. Night inspection is necessary, of course, but any great amount of repair work carried on at night is sure to result in financial loss, because it could be done so much more cheaply in the day time. No matter how perfectly a shop may be equipped it cannot be called a commercial success unless there is plenty of daylight in all places where work must be done. This, however, does not apply to pits, which are necessarily dark and which must have artificial illumination. It is seldom that pits properly equipped with electric lights are seen. For general lighting of the pit, lights placed under each rail in recesses, where they will not

be liable to injury, are best. For use around the motors and trucks portable hand lamps are a necessity. The use of some kind of a shade on these portable hand lamps is also most useful. A cheap tin shade, which will shield the workman's eyes from the direct glare of the lamp while he is working in a close place, will enable him to see very much better than he otherwise could. It is almost never that one sees pit lights equipped with something of this kind, however. A shade could be made to take the place of the regular protecting cage now used around such lights, and would considerably increase their efficiency by preventing the workman from blinding himself with the glare of the unshielded lamp. Anyone who has worked in a close place with an uncovered incandescent light, and who has tried the results with and without shading, knows that this is true.

Cast-Welded Rail Joints

One of the things which it is to be hoped the track men will take up at the next convention is an exchange of experiences regarding rail-joints. It goes without saying that this is one of the most important subjects connected with track work, and yet, at the present time, practice is in a decidedly uncertain state regarding it. The cast-welded joint apparently does not have the popularity which it once enjoyed, yet we are inclined to think that if it has really lost any of its popularity it is on account of mistakes that have been made in the application of cast-welded joints. There are certain objections which must hold against any track-welded joint, namely, the difficulties of removing or renewing short pieces of rail or of repairing broken joints. While these are real objections, they become of small importance if we start in the first place with good welded joints and track constructed in such a way that repairs and alterations are not likely to be necessary during the life of the rail. Cast-welding appears to have suffered considerably from the over zeal of its friends in the years that it was first introduced. Frequently track that had been operated over for a year or two with angle-bar joints had the angle-bars removed and the joints cast-welded in what would now be considered a rather slipshod manner. The joints were frequently poured with iron so cold that there was no melting of the rail base, and, consequently, there was no real union between the cast-welded joint and the rail. Further than this, a rail with angle-bar joints, if operated over for a year or two, is almost sure to become a little low at the ends, even if not low enough to cause rough riding, and if the joints are then cast-welded the low joints cause the hammering of the rail ends, even if there is no mechanical motion in the joint itself. This continues until the car wheels hammer a large depression at the joint. Another cause of dissatisfaction with cast-welding has been the annealing of the steel of the rail head by the heat of the iron in the joint. This, it is claimed, has softened the rail at the joint sufficiently so that it becomes rolled out by the car wheels more than the balance of the rail, with the result that the joint in time becomes low. It is a question whether many low cast-welded joints, thought to be due to annealing, were not really caused by the fact that the joints were low to begin with. However that may be, it is evident that all the objections that have been mentioned to the cast-welded joint as a joint, are objections which could be overcome by proper construction. The cast-welded joint does not necessarily have to be brought up to such a height that it will anneal the head of the rail. One manager we know of simply welds the base of the rail and two-thirds the web. To ensure a true weld between a cast-iron and steel rail it is only necessary to have the iron hot enough at the time of pouring, and to make the mould of a shape which will give a great body of metal around the base of the rail. Any kind of rail construction must be attended to carefully, and cast-welding is no exception to the rule. There is no place where lack of care in construction gives more disastrous results than in joint construction, no matter what the form of the joint.

We have not intended, in what we have just said, to pose as the champions of cast-welded rail-joints to the exclusion of all other types, but merely to call attention to the fact that many of the common objections to this class of joint are not valid. Electrically-welded joints, the joints welded with thermit, and many other modern rail-joints, including angle-bar joints, have also been used with equal success, but, as said before, all require attention to details during construction, and it is not likely that a joint will ever be invented which will not require such care. A good, thorough exchange of experiences on these subjects by track men would be worth millions of dollars to the electric railways of this and other countries during the next five years.

Concerning Speed

In the past few years a great deal of money has been spent by electric railways to secure higher speeds than were customary in the earlier days of trolley transportation. Cars for both interurban and city service have been supplied with heavy four-motor equipments; gear ratios for cross-country running have decreased in numerical value, while 600-volt sub-stations and reinforced feeder copper have done their part in permitting faster schedules, no less than improvements in roadbed and track.

One of the fundamentals of rapid transit between any two points is high speed. This is everywhere recognized, but when we have said it we have only told half the story. The question is opened in its broadest aspect when we realize that two different kinds of speed—maximum and average—enter the problem.

High maximum speed has an irresistible fascination to the rebuilders of old roads as well as to the promoter of new lines. One of the first questions asked about a new suburban or interurban route is, "How fast will the cars run?" The advertisements of projected lines seldom fail to lay great stress upon the high maximum speed which it is proposed to make between the objective points, calling attention to the expensive equipment and the private right of way, as evidence of the company's efforts to provide real rapid transit for its patrons.

There are other considerations, however, which affect the running time quite as much when operation begins, as does the attainment of 35, 40 or 50 m. p. h. on favored sections of the private right of way. These are the limitations of speed in suburban and city portions of the route; the delays due to an imperfectly maintained time-table, undue restrictions as to speed in village streets, etc. The importance of high maximum speed shrinks considerably when 50 per cent have to be added to the running time between the outskirts of two cities on account of slow-downs within the city limits themselves met in completing the schedule. While it is essential that time lost in cities be made up outside, the best operating practice strikes at the root of the difficulty and attempts to avoid delays in town by running through the wider and less congested streets, keeping clear of the tracks carrying heavy local traffic, and, if necessary, establishing an interurban terminal at some point a little off the main arteries of travel. People are generally

willing to go some distance out of their way to take a steam train at the railroad station, because of the great gain in time which they secure when fairly under way. The same thing should hold good with the electric interurban line. At all events, it should be borne in mind by managers of existing properties and the designers of new systems that high maximum speed costs money; that a high average speed, well sustained, is less expensive and just about as effective in maintaining a fast schedule, and that before extremely high running is capitalized by heavy investments in plant and rolling stock, it is a good plan to determine the limitations of the terminal portions of the route and do one's best to overcome them to an extent that will hold up the average speed to a point which will ensure a running time that will not destroy the effect of the speed made outside the cities.

The Master Car Builders and the Electrified Steam Road

Mr. Vreeland's address before the Master Car Builders' Association, on June 22, reprinted elsewhere in this issue, presents a new view of the results which will follow any extensive substitution of electricity for steam power by steam railroad companies. The electrification of steam roads has frequently been discussed in its relation to traffic, but Mr. Vreeland approaches the subject from a novel and entirely different standpoint, and, in view of his long experience and success in both classes of railroading, his remarks are of more than the usual interest. In brief, he points out that a change of this kind would mean almost a complete revolution in the repair shop methods of the steam road. Every other change which has occurred in the history of steam railroading has been more in the nature of a transition from pre-existing methods. The rolling stock and the motive power apparatus have been changed and improved, but in every case the two portions of the equipment have remained independent of each other, and have been housed and maintained apart. This condition has existed not only since the origin of steam railroading, but through the ages of its predecessors, as far back as prehistoric times, when the first primitive savage constructed the original two-wheeled cart.

The electric motor car, in which the motive apparatus is practically inseparable from the vehicle, constitutes a radical departure, and one which must vitally affect the repair shop force and maintenance methods of the steam railroad company. While certain divisions of labor are possible, and indeed necessary in every large shop, the motors and the vehicle can no longer be considered or treated as separate entities. New problems of wiring, lighting, heating and fire protection, as well as those of motor suspension and motor repair, must now be considered in the vehicle with which the steam railroad car builder is familiar, and for whose design and care he is responsible. Much of his old experience is applicable to the new conditions, but there are added to it many other things which have had no part in steam railroad work and with which he must become acquainted properly to render that service to his company which the altered conditions require.

As Mr. Vreeland pointed out, this is a case which is up to the employee himself. There is not the same opportunity of making up failures in corporation service as in collegiate life. The student who fails to pass an examination has an opportunity of working off his condition, but a corporation expects its employees to be experts in the work which it requires of them, and if deficient they must give way to men who understand the duties of their position.

Three years ago we took occasion to comment upon the general lack of interest which steam railroad men, as individuals and as associations, were taking in electric railway subjects. Three or four years previously, or about the time that the electrical equipment of the suburban division of the Illinois Central Railroad was being discussed by the officials of that company, and after the introduction of electric locomotives in the Baltimore & Ohio belt line service, the conditions were different. A number of papers were presented on electric railway topics before different steam railroad associations, and there was considerable discussion of electrical methods of construction and operation. The electrical equipment of a number of the New Jersey suburban lines was also seriously considered at this time, as was possibly the equipment of lines extending out of other cities. Following the decision against electrification by the Illinois Central and the other roads mentioned, the subject was practically dropped from steam railroad consideration, as far as outward evidence went, until it came up in an acute form in connection with the developments in the neighborhood of New York. That these same officials realize the importance of the subject is shown by the paper on the standardization of third-rail location, discussed by the Master Car Builders at their annual meeting, and also reproduced in this issue, as well as by the invitation extended to Mr. Vreeland, as a practical electric railway and steam railroad operator, to address the association.

The transition from the light 16-ft. electric car of twelve years ago to the heavy 60-ft. interurban electric coach of to-day, has come so gradually that electric railway men proper have almost insensibly passed from one stage of the development to the next, and it is almost impossible to state any definite date when the street railway passed into the electric railway. Nevertheless, the interurban rolling stock of to-day differs only slightly in general construction from the steam railroad coach, and interurban practice, as a whole, bears a much closer resemblance to that which would obtain on an electrified steam railroad than to that of the 16-ft. single-truck car era. For this reason the interurban electric railway engineer of to-day is, by education, eminently fitted for the larger, if not more responsible, duties of supervising the electrical equipment of trunk lines; and it is a noteworthy fact that all of the large electric railway work up to the present day has been undertaken by engineers who have served their apprenticeship on the street railway. We do not mean to decry the steam railroad engineer, but he must realize that if he wishes to take his part in the development which is sure to come on his own road he must be preparing himself for the emergency. In many respects he may possess advantages over the street railway engineer, but if he is lacking in the essential knowledge of the machinery which he is to install, or which will be put in his charge, he may be worse than useless. The technical schools are turning out annually electrical engineers by the hundred, most of whom understand electrical matters thoroughly, but who know little or nothing of railway operation. They could not immediately be put in a responsible position on a converted steam line, but in many respects the appointment would be no more anomolous than the maintenance in his position of a steam railroad man who knew nothing of the electrical side of the subject. The time has passed when the possibilities of this new motive power in trunk line work can be ignored. The progressive steam railroad man owes it to himself, if not to his company, to become conversant with the electric railway situation, and if those who do not should fall by the wayside when electrical equipment is decided upon, they have only themselves to blame.

CONTROL SYSTEM, MOTORS AND SHOES OF THE BALTIMORE & OHIO LOCOMOTIVES

In view of the attention directed toward the heavy electric locomotive work proposed in the neighborhood of New York, some further particulars about the equipment of the latest type of Baltimore & Ohio locomotives will be of interest. These locomotives were described in the STREET RAILWAY JOURNAL for Aug. 22, 1903, but no details were given of the method of control other than that it was of the Sprague-General Electric type. The control is technically known as type-M, Form C, with C-15 controllers, and is designed for use with four motors. Each unit contains forty-four contactors, which are placed in

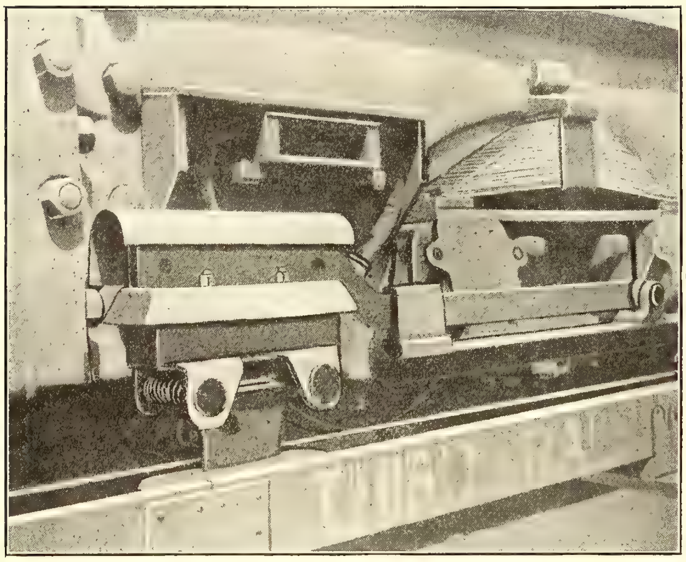


FIG. 2.—COLLECTING SHOE AND SUPPORTING BAR

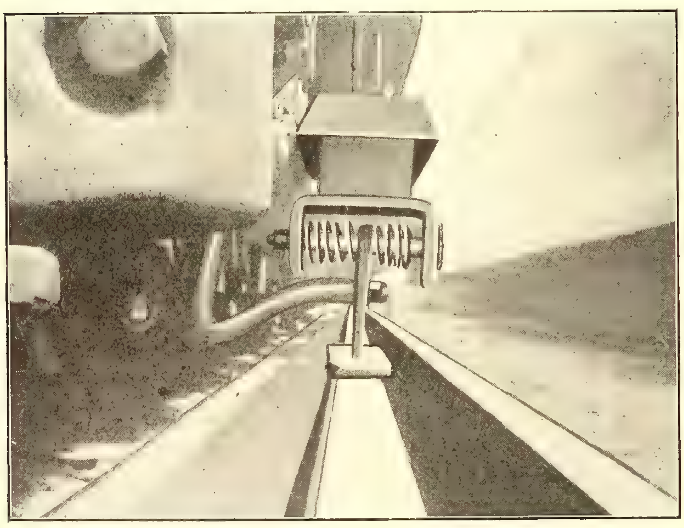


FIG. 3.—END VIEW OF COLLECTING SHOE

cabinets in the cab. Below the contactors in somewhat larger cabinets are placed the resistances which are utilized on the various speed notches. While the contactors are of the same type as those that will be used on the Interborough cars in New York City, and described in the STREET RAILWAY JOURNAL for March 14, 1903, the trade name being "D. B. 41 A-1," their number and arrangement differs materially.

Consulting the diagram shown in Fig. 1, it will be noted that thirty-eight of the contactors tap to a common bus-bar. The first four contactors are in multiple, and connect this bus-bar with the shoe. The succeeding contactors in sets of two or more in multiple according to the currents required, connect this bus-bar to another bar from which power is distributed by contactors Nos. 39, 40, 41, 42, 43 and 44. These latter contactors control the series multiple connections of the motors. The direction of the motors is controlled by two reversers, one for each pair of motors. The motors themselves are arranged to be cut out in pairs with a suitable cut-out. The locomotives are operated in pairs, as illustrated in the issue of Aug. 22, and eighteen train wires are used in connecting the units in each pair together.

Each unit is equipped with four motors, having a rated horsepower of 200 each. The maximum current capacity of each motor is 275 amps., and the operating voltage is 625. This gives a maximum capacity of the unit of 1100 amps., or for the pair of units, in which form they are commonly used, of 2200 amps. With this current at 625 volts, the two units will exert a drawbar pull of about 65,000 lbs.

The motors are known as the G. E. 65-B, one turn, and weigh without pinions or gear case 4900 lbs. They were built especially for the Baltimore & Ohio locomotives, and are geared to the axles at a ratio of about 4.26 to 1, the exact teeth ratio being 81 to 19. The motors are designed for a maximum speed of

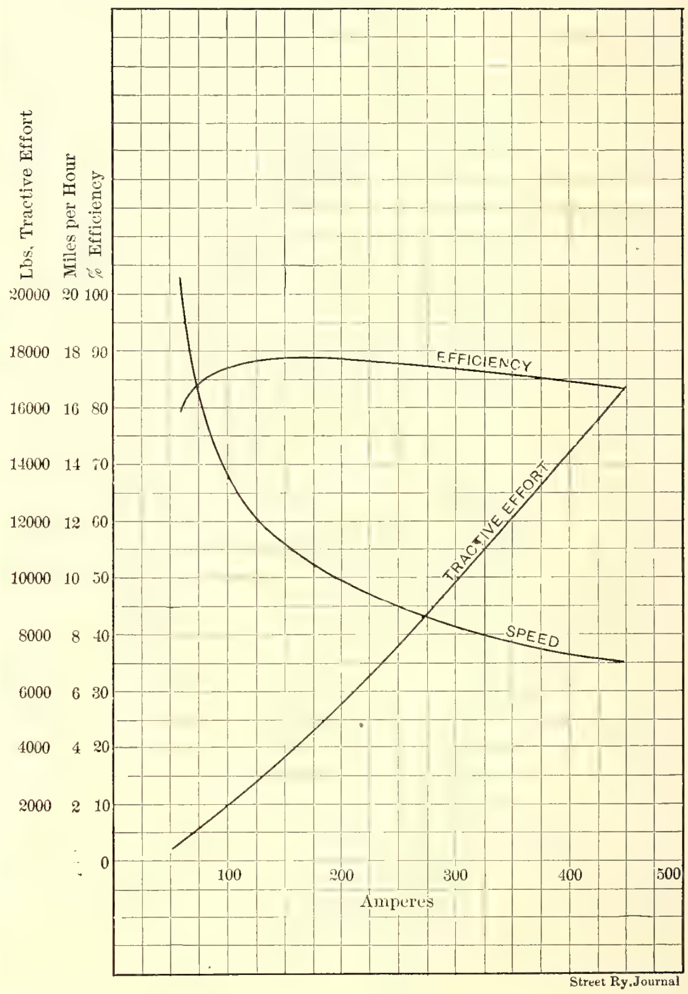


FIG. 4.—CHARACTERISTIC CURVES OF G. E. 65-B MOTOR, ONE-TURN ARMATURE, 42-IN WHEELS, GEAR RATIO 81:19

about 24 m. p. h. The performance curves of these motors, shown in Fig. 4, are quite interesting. The efficiency touches 89 per cent at about one-half load, and at full load exceeds 87 per cent, and at 415 amps., which is nearly 60 per cent overload, the efficiency is 83 per cent. The speed of the motor at full load is somewhat less than 9 m. p. h.

The current is supplied to the locomotive by means of four shoes, two of which are usually in contact with the rail at a time. These shoes are of an unusual type, having been constructed upon the same heavy lines as have been the previous shoes of this road described in the STREET RAILWAY JOURNAL for March 14, 1903. The shoe itself bears on the rail with a pressure exceeding 125 lbs. As the shoe itself has to work in a slot in some places, it is provided with a long neck for that purpose, and is free to move laterally within certain limits,

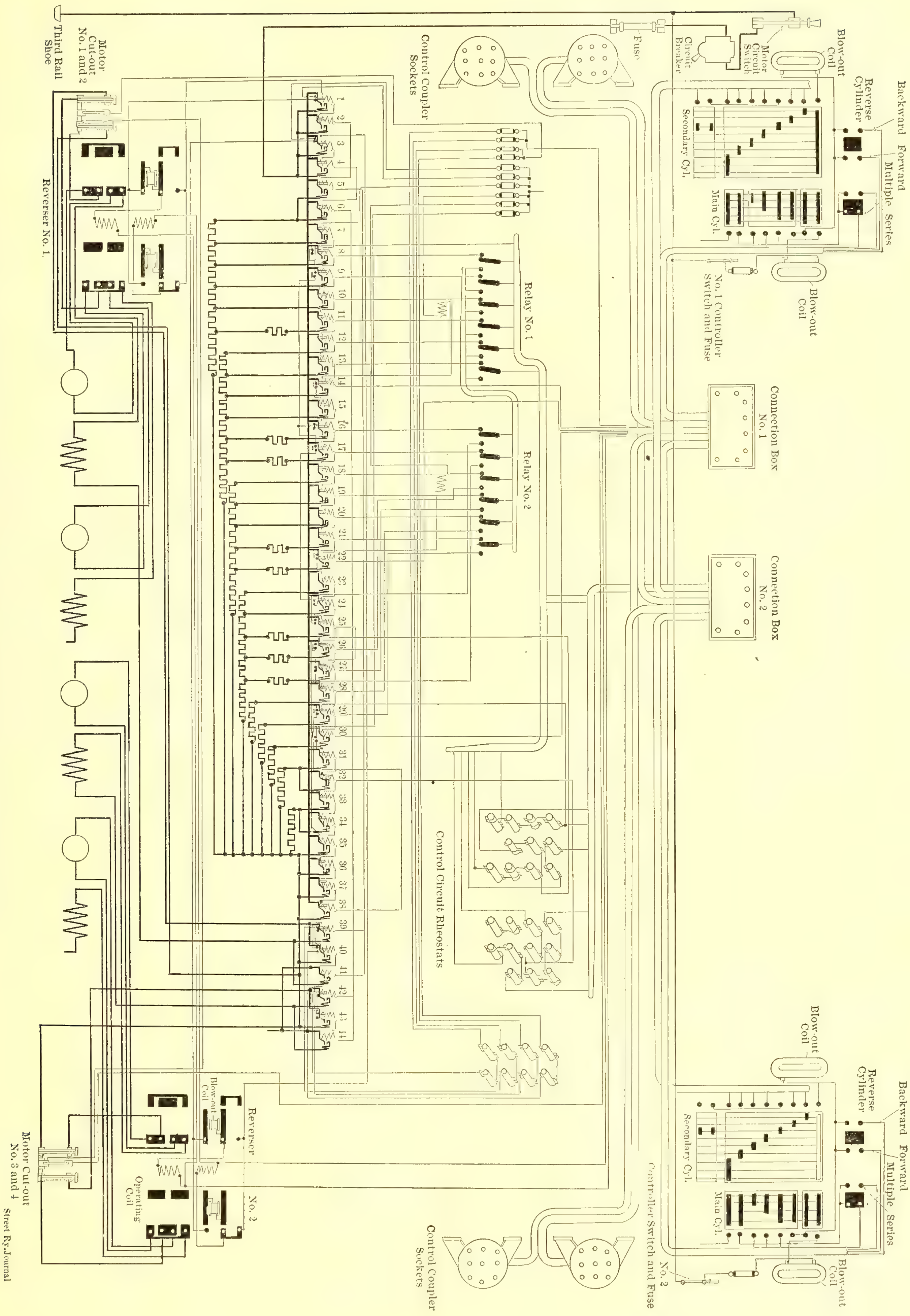


FIG. 1.—CONNECTIONS OF TYPE M, FORM C CONTROL WITH C-15 CONTROLLERS AND FOUR MOTORS

being restored to a central position by springs. The shoe is fastened to a carrying plate, and insulated therefrom by fibre pieces and bushings. This carrying plate slides on rods parallel to the axle of the locomotive. These rods are mounted in a frame which is belted to a hardwood block, affording further insulation. On the top of this block an angle-iron is bolted, which is secured to the shoe-bar and insulated therefrom by fibre sheets and washers. This triple insulation has been found necessary because of the severe exposure to weather, and the very serious character of short circuits which would result from its failure. The whole shoe is suspended from the end of a rectangular bar pivoted at the distant end and free to slide up and down in a slotted piece. This construction will be better understood by consulting Fig. 2, which shows the shoe and its supporting bar. Fig. 3 shows an end view of the shoe, the cable connections and the springs controlling its lateral position. It will be noted that hoods are fastened over the insulating portions of the shoe to shed water.

The shoe circuit is protected by a fuse, of the Case type, immediately above it. This is a fuse copper strip with its carrying capacity in the center weakened by means of a reduction of its section by a large hole in the center. The locomotive frame is constructed of four very heavy castings bolted together and forming a rigid rectangle. The frame is suspended from the axle by very heavy leaf springs. The motors are suspended by bearings on the axle and by nose suspension at the free extremity. In the cab above, which is of very liberal dimensions, are arranged eight cabinets, the upper four containing the contactors, the lower four containing the resistances. In a central position on the cab and about 4 ft. from each end are located the reversing switches in cabinets. In either corner of the cab is located an air reservoir, and in the exact middle is the motor-driven air compressor. On the side walls near the door are the circuit breakers, cutting out the motors, and either end is equipped with a controller station. The controller station comprises a C-15 controller, which gives a set of series notches on one revolution of the handle, and on returning the handle to zero, and depressing a button in the top, it will give an equal number of parallel notches. The controller station also comprises a hand switch for the contactor circuit, lighting switches for the cab, a switch for controlling an electro-pneumatic sander, a switch controlling the electric circuit of the motor compressor, the electro-pneumatic control of the air for the motor compressor, hand manipulation for the sander, Westinghouse air brake lever, bell and whistle cord. In front of the controller is mounted an ammeter, which indicates the full current taken by the locomotive, and which, for the present, is limited by the Baltimore & Ohio management to 2000 amps. Fig. 5, the interior view of the locomotive, shows, to some extent, the arrangements described in the foregoing, while a general view of its appearance can be obtained by consulting Fig. 6, which shows a view of the exterior of one of the units. These units are now used in pairs to handle the freight traffic through the Belt Line tunnel. They are, of course, of slower speed than those that will probably be employed for the passenger traffic in and about New York City, and are of somewhat less power. There is no doubt, however, that they have the greatest draw-bar pull of any electric locomotive now in existence.

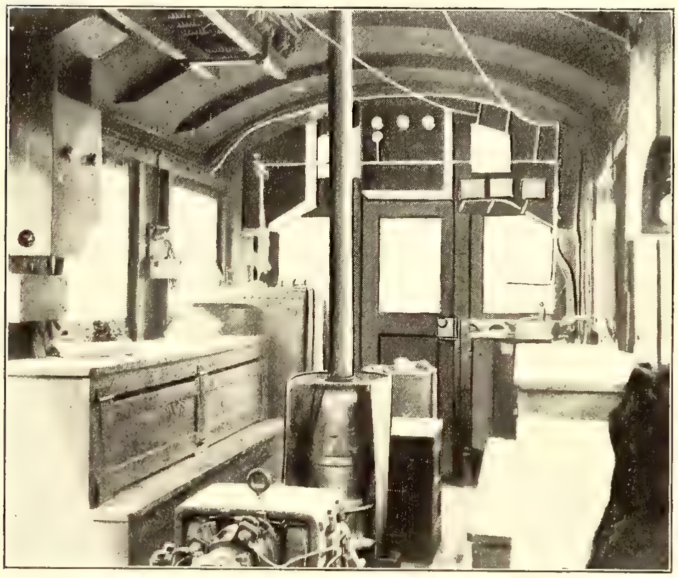


FIG. 5.—INTERIOR ARRANGEMENTS OF BALTIMORE & OHIO ELECTRIC LOCOMOTIVE

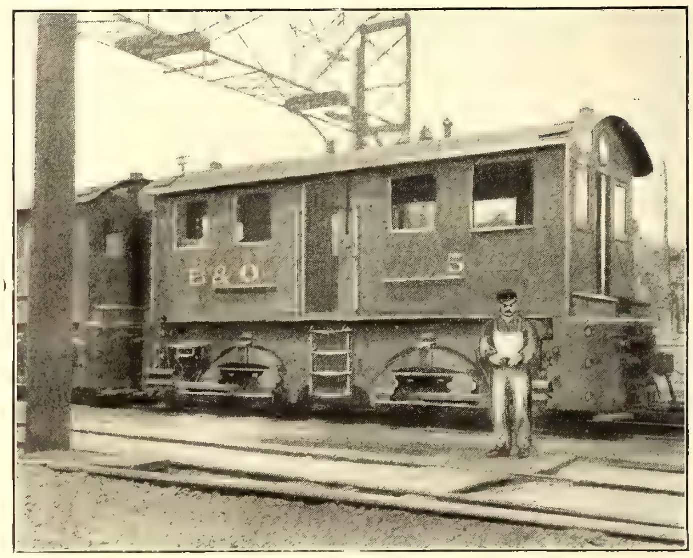


FIG. 6.—EXTERIOR OF BALTIMORE & OHIO ELECTRIC LOCOMOTIVE

IMPROVEMENTS IN DUBUQUE, IA.

The Union Electric Company, which operates the Dubuque electric railway and lighting systems, is planning a number of important extensions this year, which, when completed, will involve an outlay of in the neighborhood of $500,000. The plan for rebuilding and improving this system has been under consideration for the last three years, but has been delayed pending the consolidation of the electrical properties in the city. Certain portions of the railway have, however, been rebuilt during this time, including the overhead system, and the rolling stock has been practically replaced. The changes at present proposed involve the construction of a new power station and car house and the reconstruction of track.

The power station will be 36 ft. x 114 ft. deep, and will be entirely of brick, stone, steel and cement. The steam equipment will consist of six boilers of 400 hp each, normal rating, and five steam turbo-units of 500 kw each, with the necessary equivalent of rotary converters for the use of direct current on the railway system. The turbo-units will be of the Curtis type, will occupy a floor space of 8 ft. sq., and will have a height of 2 ft. 2 ins. The boilers will be of the Babcock & Wilcox make, and will supply steam at 200 lbs. pressure. The steam will be superheated at 150 degs. The stack, which is of steel, will be 200 ft. high, with a diameter of 11 ft. The car house will be 108 ft. x 240 ft., and will contain the offices of the company, repair shops, etc.

The track is being relaid with 72-lb. 60-ft. rails. The L. E. Myers Construction Company has the contract for both the track work and the car house, while Witherspoon & Engler have the contract for the power station building. The work is being carried on under the direction of L. D. Mathes, general manager of the company.

AN IMPORTANT APPLICATION OF THE STORAGE AIR-BRAKE SYSTEM AT NEWARK, N. J.

Increasing favor for the storage system of air braking for street railway cars is attested in its adoption by the railway department of the Public Service Corporation, of New Jersey, for the cars of its Montclair, Orange and West Orange lines running out of Newark. The necessity for power braking upon these lines had for some time been felt on account of the exacting requirements of the service, as well as the size of the company's heavy double-truck cars, and in considering the problem, D. F. Carver, chief engineer of the street railway department, made a careful and thorough study of modern systems of power braking for street cars.

The uniformly good results of the storage air system which is used upon the street railway systems at both Detroit, Mich., and St. Louis, Mo., induced a careful examination of its many desirable features for street railway service. The favorable experiences with the storage system in these cities led to a decision that for the peculiar conditions met in city car service, it offers many advantages over the independent system of using a motor-driven compressor upon each car—the usual method of air braking for street cars. This view was taken particularly on account of the smaller investment required for the equipment of the system, although the greater economy in the maintenance and operation of a few large stationary compressor plants, as compared with that of the motor-driven compressors upon the various cars, was also considered an important factor. The fact that the experience of the roads in the two above-mentioned cities was to find the storage-system car more reliable and less likely to fail on the road than an individual compressor-system car, was of great weight in influencing the adoption of the storage system at Newark.

The above-mentioned car lines operating out of Newark, which are being equipped, operate on high-speed schedules through territories having heavy grades to contend with, so that the system of power braking requires to be both powerful and reliable for cars of the weight used, which conditions will thus afford an excellent test of the system. The cars being equipped are of the twelve-bench open type, weighing 33,000 lbs. without passengers, and are 40 ft. 8 ins. in length over bumpers.

The system to be provided involves the application to each car of storage air tanks to hold the compressed air supply at high pressure (300 lbs. a square inch), from which the service air supply will be delivered to the brake reservoir through a reducing valve for obtaining the desired working pressure. The rest of the brake equipment will be of a standard form, as used in connection with the usual systems of air braking, the engineer's valve being of the "straight-air" type. A compressor plant, consisting of two belt-driven two-stage air compressors, operated by electric motors through belting and line shafting, will be located at the car depots of each of the three above-mentioned lines, the intention being to charge the high-pressure tanks of each car with compressed air at least once during each round trip as the car passes the depot. The usual hand brakes are, of course, retained so that in case of failure of the air brake system no delay will occur to a car.

THE CAR EQUIPMENT

The details of a standard application of this braking equipment to a car are shown in the plan in Fig. 1. The storage tanks are located at either side of the middle of the car, with the service reservoir and brake cylinder between them, the piping connections for the operation of the system being clearly shown in the drawing. A charging line extends across the car, connecting with each storage tank, and also through the reducing valve to the service reservoir; this line is provided at both ends with one solid-head coupling of the air-brake hose type, for charging connections. The hose couplings are conveniently located at the sides of the car beneath the sills for ease of connection with the charging hose located in the street boxes opposite the car depots.

In charging these storage tanks at the car depots, compressed air enters at high pressure through a check valve in the charging line, and thence through a ground stop-cock to the storage reservoirs. The storage tanks are to be 18 ins. x 78 ins., and the service reservoirs each 12 ins. x 42 ins. in size.

By means of the reducing valve, between the high-pressure line and the service reservoir, an air pressure of 50 lbs. is

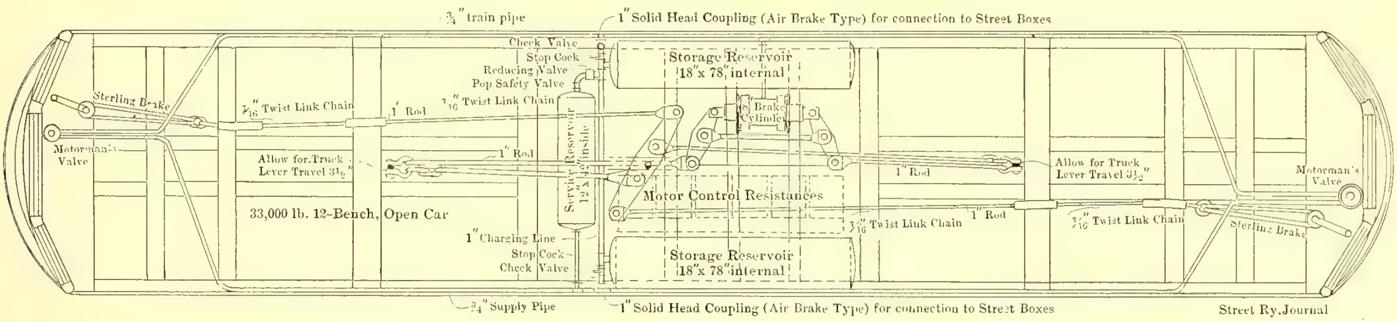


FIG. 1.—PLAN OF THE STANDARD CAR EQUIPMENT FOR THE STORAGE AIR-BRAKE SYSTEM, SHOWING ARRANGEMENT OF RESERVOIR AND PIPING

maintained in the service reservoir at all times as long as sufficient pressure remains in the storage tanks to deliver through the reducing valve. From the service reservoirs connection is made to a ¾-in. air supply pipe at one side of the car, which leads to the motorman's control valves at either end of the car. The "train," or service, pipe leads from the motorman's valves at either platform back along the other side of the car to the cross connection leading over to the brake cylinder an 8-in. double-end jam cylinder, as shown in drawing. The piping is quite simple, and is so arranged as to be easy of access for examination and repairs at any time.

In addition to the above, each car is equipped with two pressure gages, one duplex and the other single, upon each platform, for use of the motorman. The duplex gage indicates the pressure both in the high-pressure storage system and in the service reservoir, thus acting as a valuable check upon the efficiency of the reducing valve; the single gage indicates the pressure acting in the jam cylinder when braking, a valuable adjunct for the motorman in careful and effective braking. A pop safety valve is applied to the service reservoir, and set to blow at 90 lbs. for protection to the low-pressure system in case of failure of the reducing valve. The piping used for the high-pressure will be double-extra strength welded wrought-iron, with double extra strength fittings; that under the service pressure (50 lbs.) will be the standard welded wrought-iron pipe. The high-pressure system will be tested to 600 lbs. by hydraulic pressure, while the low-pressure system, including the jam cylinder, must withstand a pressure of 90 lbs.

THE COMPRESSOR STATION EQUIPMENT

As mentioned above, at the car houses of each of the three lines being equipped for storage air braking, will be located an

air compressor plant for supplying the high-pressure compressed air to the cars as they pass. This arrangement of the charging stations at the car houses, where the cars must stop always in passing, is thought to possess great advantages over the use of one large plant located in a central—probably downtown—point, where stops for charging would cause inevitable delays. In this way each car may easily be charged with air while the conductor is making his usual stop at the depot office.

In Fig. 2 is shown the standard arrangement of apparatus and also details of the storage and cooling tanks at one of the compressor stations. The equipment of each station will consist of two belt-driven air compressors, each with a capacity of compressing 100 cu. ft. per minute, two Westinghouse type-56 railway motors, with line shafting and belt connections for driving, and three cooling storage tanks connected in series for delivering air to the cars. Pipe connections are provided for delivering air to the cars passing the depots by means of street boxes, embedded in the surface of the street alongside of each track passing the depot, from which openings hose may be run to the charging coupling on the car; also three similar hose

be very effective in providing an excellent opportunity for the air to cool, and practically rendering the use of mechanical cooling apparatus unnecessary.

It will, furthermore, be noticed in the detail elevation view of the three reservoirs that the air leaves each tank from a point midway down its side, and delivers through a long sweeping bend to the top of the next one, this arrangement being made to provide for free expansion and contraction, due to temperature changes. The left-hand reservoir is provided with a lever and ball safety valve, connected to the delivery-pipe fitting, as shown, and also a pressure gage will be connected to them.

These storage tanks are mounted in an unusual manner, being set vertically with their lower portions projecting into basement of the building, as shown. This arrangement is economical of space, and also provides a convenience of access to all parts. The details of the stands upon which they are supported, as well as the piping, drainage and other connections, are shown in the detail elevation of these reservoirs in Fig. 2.

Fig. 4 shows the details of the iron street boxes which are to be used for enclosing and protecting the hose connections for

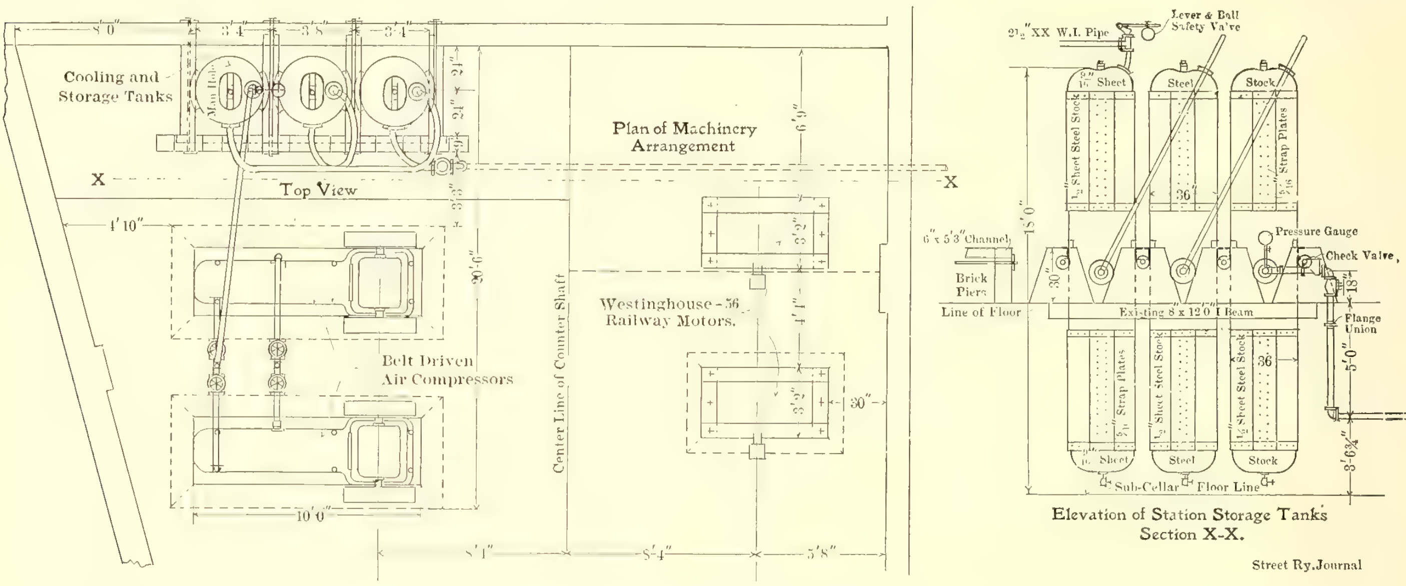


FIG. 2.—PLAN OF THE COMPRESSOR PLANT TO BE INSTALLED AT THE MONTCLAIR CAR DEPOT, SHOWING ALSO DETAILS OF THE STORAGE AND COOLING TANKS

coupling connections are to be provided in each depot for charging the storage tanks while "in the house."

The air compressors are of the two-stage type, with intercooler, the details of one of which compressors are shown in Fig. 3. These compressors are of usual construction, having the intercooler elevated over the cylinders, as shown. They are very carefully provided with cylinder jackets for the cooling of cylinder surfaces; cooling water is passed first through the high-pressure cylinder, flowing thence to the intercooler and out through the low-pressure cylinder, as indicated in the drawing. These compressors are arranged to operate at 100 r. p. m., and will deliver air at a pressure of 325 lbs.; their capacity is rated at 100 cu. ft. per minute at the pressure of 325 lbs. a square inch. Each will be equipped with a pressure gage and two high-pressure safety valves, set to blow at 325 lbs., upon the intercooler. They will be belt-driven from the countershaft located between them and the motors; friction clutches are provided upon the pulleys on the countershaft, so that either motor may drive, or be cut out, and likewise either compressor may be operated at will.

The storage reservoirs at the compressor stations are located adjacent to the compressors, as shown in Fig. 2, and are piped up in series, the air passing from the compressor first into the one at the left, from that one to the middle tank, and thence to the third tank, before passing out to the delivery connections in the street. This general arrangement of the three in series will

charging the car storage tanks, when not in use. These boxes are only 8 ins. wide by 42 ins. long, thus requiring very little space in the street, and are arranged so that the cover, when closed, comes flush with the street level. The cover is of ⅜-in. iron plate, very heavily braced to provide freedom from injury. This box is, as shown, of sufficient size to contain 5 ft. of the flexible air hose by which connection is made to the charging coupling upon the cars, besides the necessary cut-out cocks for shutting off the supply.

DESIGN OF THE SYSTEM

Careful attention and study was devoted to the design of the essential features of the storage system by Mr. Carver. Owing to the high pressure dealt with, and the method of handling the two pressures, the principal features of the work of designing the system may be of interest.

In considering the size of the storage tanks which it would be necessary to use upon the cars for carrying the high-pressure compressed air supply, a study was made of the maximum number of applications of brakes which ordinarily would be made in the operation of any car. The service upon the three car lines which are being equipped with this braking system is very similar, so that provision for maximum possible conditions upon any one of the lines would be ample for any of the other lines. It was found that the maximum number of brake applications for a full round trip could not very well be greater than 300, and that an average for maximum service

conditions would be about 280; this number is much higher than will normally be expected, but it provides for the extreme conditions of "rush-hour" service with numerous stops.

Further study of ordinary air braking practice under street railway conditions indicated that the average consumption of compressed air per 40-lb. application would be but slightly over 1 cu. ft. per application, an average being assumed at 1.2 cu. ft. per application. Thus it may be seen that the total maximum consumption of air, assuming 280 applications using 1.2 cu. ft. each, will be 336 cu. ft. of free air. This quantity must be supplied from the storage tanks.

As above stated, the storage tanks used upon the cars are to be 18 ins. in diameter and 78 ins. long, the combined volume of the two reservoirs per car being 21.95 cu. ft. These two tanks have a total capacity, at 300 lbs. compressed-air pressure, of 439 cu. ft. of free air. But as the air passes from the storage tanks into the service reservoir only at pressures from 300 lbs. down to 50 lbs., there is available in the storage tanks for braking purposes an amount of air corresponding to that volume at 250 lbs. pressure, or (21.95 cu. ft. volume × 16.66 atmospheres) = 368 cu. ft. of free air, which may be seen to be ample for the total of 280 applications. Dividing this capacity by the amount of 1.2 cu. ft. of free air assumed to be required in the brake cylinder per application, it will be seen that over 300 applications are available, so that a fairly large margin of excess is provided.

In calculating the storage tanks for use upon the cars for strength, a large factor of safety was thought desirable, and they are to be built of ⅜-in. steel stock of an ultimate tensile

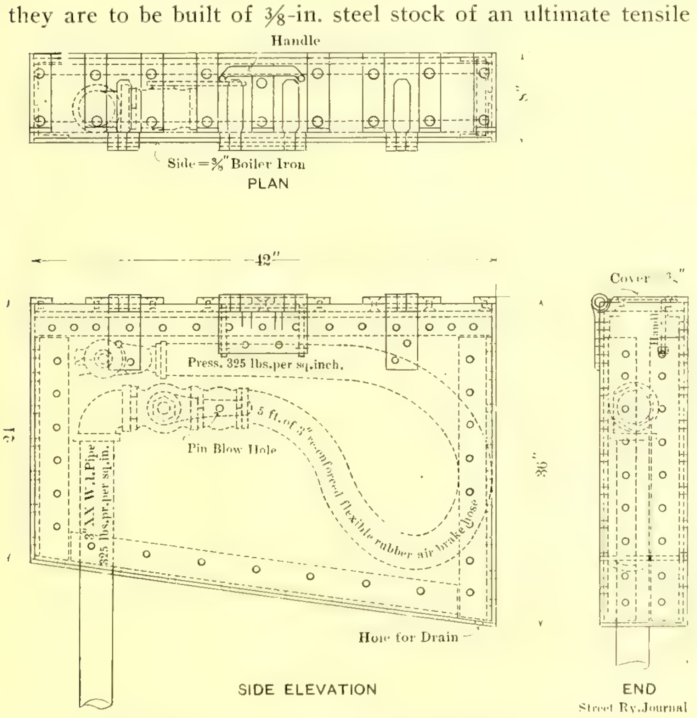


FIG. 4.—DETAILS OF THE SPECIAL STREET BOX TO BE USED ALONGSIDE OF TRACKS IN THE STREET TO RECEIVE AND PROTECT AIR DELIVERY HOSE

strength of 60,000 lbs. per square inch. As may easily be figured, this will provide an ample margin of safety; the working strain due to longitudinal stress was found by the formula,

$$\frac{\text{radius} \times \text{pressure per square inch}}{\text{thickness}}$$

to be 7200 lbs. per square inch, while the strain due to transverse stress was found by formula,

$$\frac{\text{diameter} \times \text{pressure per square inch}}{4 \times \text{thickness}}$$

to be 3600 lbs. per square inch, the combined effect of these two stresses thus amounting to 10,800 lbs. From this it may be observed that the factor of safety amounts to nearly 6.

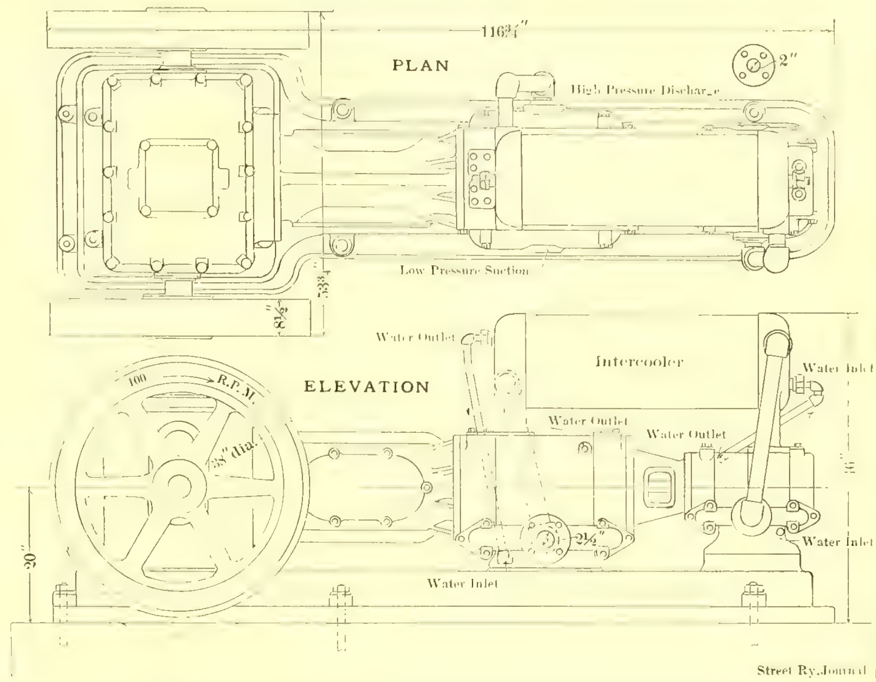


FIG. 3.—THE TYPE OF BELT-DRIVEN, TWO-STAGE INTERCOOLED AIR-COMPRESSORS TO BE USED IN THE COMPRESSOR PLANTS

In calculating the amount of air to be used in charging passing cars, and thus the required capacity of the air compressors and station storage tanks, it was assumed that the minimum possible headway upon which cars would ever be expected to operate would be 2 minutes; inasmuch as the average headway upon these lines is about 5 minutes, it may be seen that this assumption provides for the most extreme conditions of service. If cars pass the compressor station once in 2 minutes, it is evident that, with the 368 ft. required per car to raise the storage tank pressure from 50 lbs. to 300 lbs., it will be necessary for the compressors to supply compressed air at the rate of 184 cu. ft. of free air per minute. Thus it may be seen that the provision of two compressors, as above referred to, each capable of furnishing 100 cu. ft. of free air per minute, will amply provide for this service, and it is more than probable that one will be easily able to take care of the work under ordinary conditions of service.

The compressor station storage tanks are each 36 ins. in diameter and 18 ft. long, as indicated in Fig. 2. Each of these tanks embrace a volume of 127.2 cu. ft., the three having a total of 381.6 cu. ft. The combined capacity of the three tanks at the pressure of 300 lbs., is 7784.6 cu. ft. of free air; but for facilitating the charging of the car storage tanks, the compressors are to be operated at 325 lbs. pressure per square inch, which will give a larger reservoir capacity than at the 300-lb. pressure. The amount of free air which they will contain at 325 lbs. pressure is 8433.4 cu. ft., so that it may be seen that an additional reservoir capacity of 648.8 cu. ft. is provided above the capacity at 300 lbs., by the 25 lbs. of excess pressure. This provides a liberal reserve over the amount contained at the car reservoir delivery pressure, and makes the compressor station capable, in addition to giving the cars complete charges when running on schedule headway, of cleaning up a three-car blockade at the rate of one car per minute without reducing the station reservoir below 300 lbs.; that is, three cars may be

charged within a period of 3 minutes without reducing the pressure in the station tanks below 300 lbs.

The station reservoirs are built of ½-in. steel stock, of 60,000 lbs. ultimate tensile strength. The heads are convex, in one piece, and are forged from 9-16-in. steel stock. These tanks have one longitudinal and two circumferential seams, and are tested to 600 lbs. hydraulic pressure. The longitudinal joints are triple-riveted double butt-strap joints, with a rivet pitch of 3⅛ ins., bringing twenty-four rivets in a space of 25 ins., while the circumferential seams are double-riveted lap joints, with similar rivet pitch. The rivets used are all ⅞-in. rivets, the load which will be imposed upon those of the longitudinal seam being 5686 lbs., double shear, and that upon those of the circumferential seams being 4250 lbs., single shear. By similar formulæ, as used for the car reservoirs, it may be seen that the working longitudinal stress is 11,375 lbs., and the transverse working stress 5685 lbs. per square inch. The sum of these is 17,060 lbs., thus making the factor of safety nearly 4.

The National Electric Company, of Milwaukee, Wis., furnished and erected all the station and car equipment; Oliver P. Scaife & Company, of Pittsburg, Pa., made the car storage tanks, and the Niles Boiler Works, of Niles, Ohio, furnished the station storage tanks.

EXHIBIT ON THE PENNSYLVANIA RAILROAD TUNNEL AND TERMINAL

The Pennsylvania Railroad Company has spent a large amount of money upon its exhibit in the Transportation Building at the Louisiana Purchase Exposition. This exhibit includes a locomotive testing plant, where it is intended to test a number of locomotives during the Exposition season. The things of most interest to the electric railway man, however, are the models showing the New York terminal of that company, and the tunnels under the Hudson and East Rivers. The most prominent thing in this part of the exhibit is a full-sized section of one of the single-track tunnels, two of which tunnels are being constructed under the Hudson River. This section, as exhibited, is shown in Fig. 1. It consists of a cast-iron shell lined with concrete. On each side of the track are terra-cotta ducts for electric wires. There is very little clearance above the top of the car roof in the tunnel, but in that space is located an overhead conductor, which, on the model, is a wide strip of steel supported by porcelain insulators from the concrete roof. There is also a third rail, the location of which beside the track can best be seen in Fig. 2. This third rail has its center 26½ ins. outside the gage line of the track, and its top 2¾ ins. above the track. It is protected by two planks, a 9-in. plank on top and a 6-in. plank at the side. The third rail is supported on vitrified clay insulators. The section of tunnel illustrated in Figs. 1 and 2 is that which is to be used in passing through the silt in the bottom of the river. The track in this section is supported on steel screw piles, which extend below the tunnel to solid rock. The top of one of these steel screw piles, which is under the middle of the track, can be seen in Fig. 1. An I-beam parallel with the ties rests on the screw pile, and this in turn supports longitudinal girders, upon which the ties rest. In Fig. 3 are shown models of sections of the tunnel. That at the right is a three-track tunnel, as constructed under the streets of New York City. In the middle are two single-track tunnels side by side, as constructed in solid rock, and at the left is a single-track tunnel as constructed through solid rock. Fig. 4 is from a photograph of the model

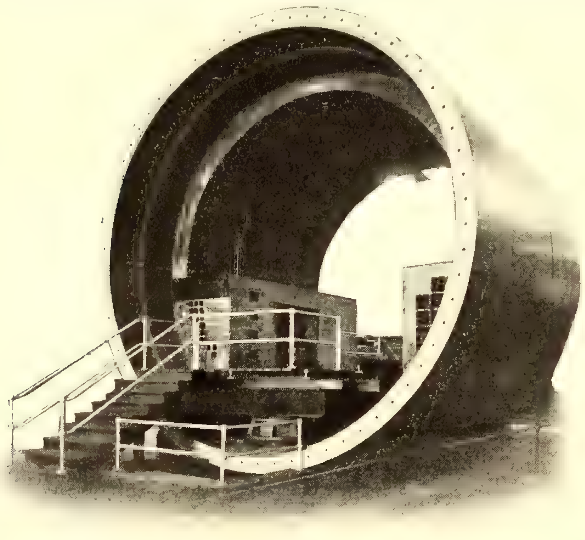


FIG. 1.—MODEL OF HUDSON RIVER TUNNEL

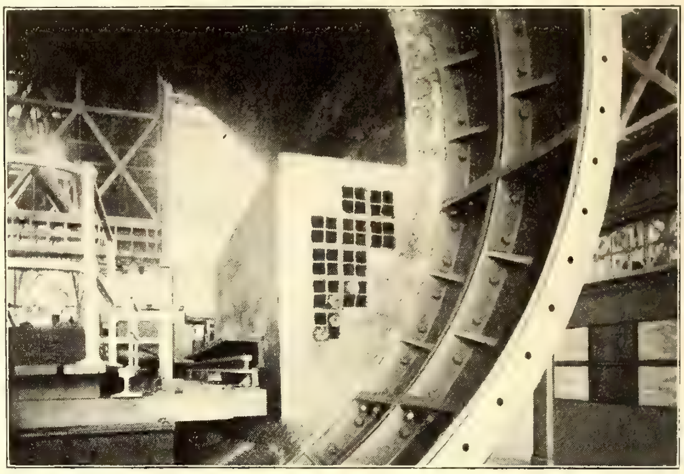


FIG. 2.—PORTION OF EXHIBIT, SHOWING METHOD OF PROTECTING THIRD RAIL

FIG. 3.—MODELS OF SECTIONS OF TUNNEL

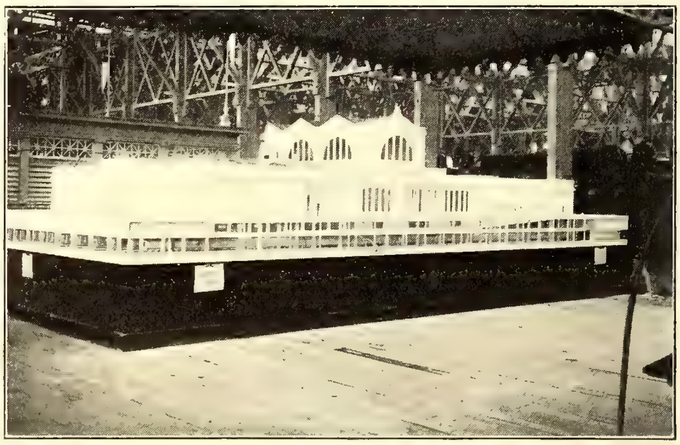


FIG. 4.—MODEL OF PENNSYLVANIA TERMINAL IN NEW YORK CITY

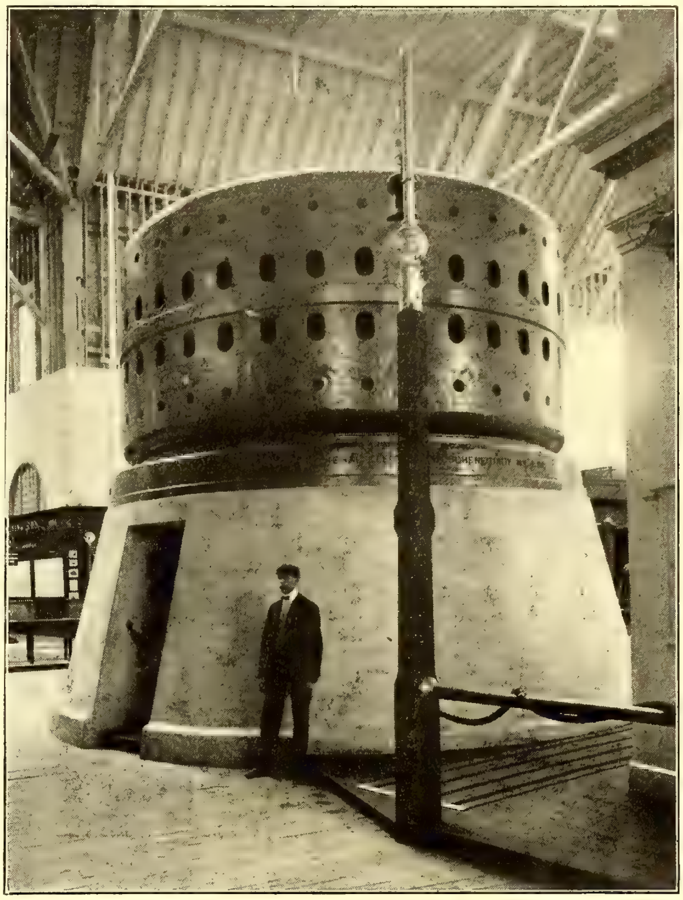
of the great Manhattan terminal which this company is to build between Seventh and Eighth Avenues, Thirty-Third and Thirty-First Streets, in Manhattan, New York City. This model shows the train shed at the bottom and floors above the train shed for depot purposes. On this model trains are shown as being coupled to one or two eight-wheeled electric locomotives, from which the natural inference is drawn that electrical locomotives connected together by the multiple-unit system will be employed with as many locomotives per train as may be necessary. Besides these models there is a model cross section of Manhattan Island, the river beds of the North and East Rivers, and the Long Island and New Jersey shores, showing the character of material through which the tunnel passes on its way from Hoboken to the terminal on Long Island.

THE GENERAL ELECTRIC EXHIBIT

The exhibit of the General Electric Company is, of course, very comprehensive, in fact so much so that it is impossible in a brief article, such as this must be, to do more than touch upon the latest apparatus shown. In the Machinery Building is a 2000-kw Curtis steam turbo-generator, giving 25-cycle, 6600-volt current. Along with the generator is an oil switch and switchboard, just as in a regular central station.

The principal exhibit of this company, which is in the Electricity Building, has, as a landmark, a model of the stationary armature of one of the 10,000-hp generators being built for the Canadian power house at Niagara Falls. The stationary armature model is shown mounted on a concrete foundation, just as in the actual installation. Inside the foundation is an office, where photographs of the General Electric Company's apparatus at Niagara Falls are shown. Five machines of this size are being installed in the Canadian power house at Niagara Falls.

Another one of the "biggest things" shown in this exhibit is a machine-operated oil switch for 60,000 volts. This switch has brick cells, 7½ ft. high, 2 ft. 7 ins. wide and 4½ ft. deep. The switching proper is done in a wooden cylinder filled with oil, the wooden cylinder being supported on high hardwood pins. The largest transformer at the Exposition (capacity 2333 kw) is shown together with two coils for such a transformer, one being partially completed and the other completed. They show the method of coil construction with flat copper strip and strips of insulating material between convolutions.



FULL SIZED MODEL OF 10,000-HP ARMATURE

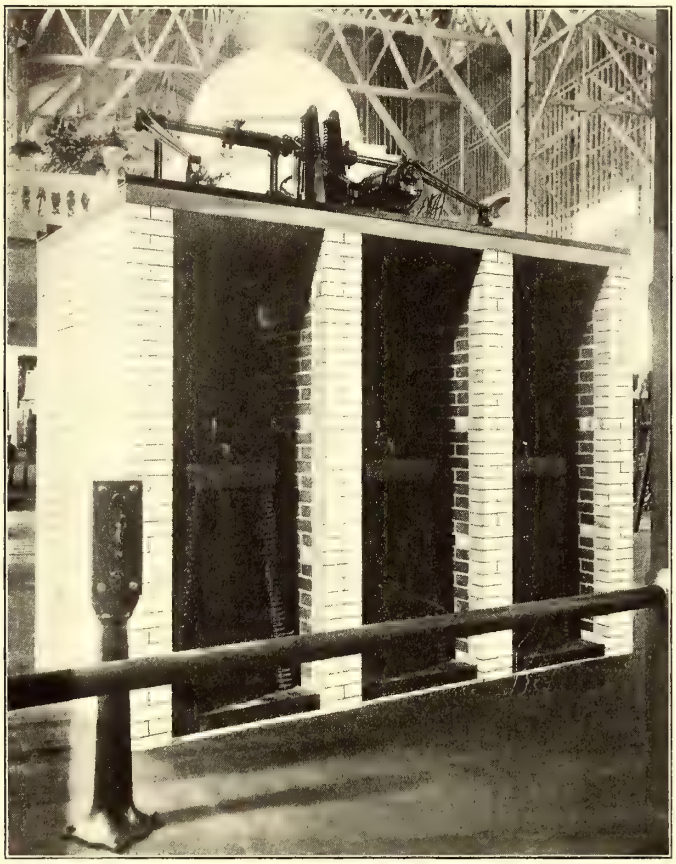
GENERAL VIEW OF EXHIBIT

A 250-kw air-cooled transformer is mounted over an air chamber, through which an extra volume of air is forced, to illustrate the principle of air-cooled transformers. Sections of transformer coils for 500-volt transformers are shown.

The part of this exhibit which will probably be of most interest to the technical electric railway man is the new Sprague-General Electric multiple-unit controller, as constructed for the Interborough Rapid Transit Company, of New York, with device for automatically regulating the rate of acceleration. This controller also has a new attachment to what is commonly called the "dead man's handle." It will be remembered that the dead man's handle, as heretofore constructed on the General Electric type-M train control system, simply acted upon the controller circuit whenever the handle was released by the motorman. On the new controller the dead man's handle, in addition to shutting off current by opening the controller circuit, also opens the train pipe of the automatic air brake, thereby making an emergency application of the brakes, should the motorman faint at his post, and so release the handle.

The automatic regulation of the rate of acceleration is accomplished in an ingenious way: The shaft, which is operated by

the controller handle, is geared to the controller-drum shaft. Connected with this gearing by a ratchet and pawl are other gear wheels operating a rapidly revolving soft-iron armature,



BRICK CELLS CONTAINING 60,000-VOLT SWITCHES

which revolves when the controller is advanced but not when it is being turned off. The motion of the controller drum can be

60,000-VOLT SWITCH

arrested at any point by the energizing of an electromagnet, which attracts this revolving armature. The upper part of the shaft, operated by the motorman's controller handle, is not rigidly connected to the lower part, which is geared to the controller drum shaft, but is connected by means of a long, spiral spring, which allows the motorman to turn his handle considerably in advance of the controller drum. Consequently, the motorman can simply turn his handle from "off" to "full on" position, and the controller drum will follow as far, and as rapidly, as the magnetic clutch will allow it to advance. The magnetic clutch is energized from a small relay placed in the reverser under the car. This relay is connected in series with the armature of one of the motors. When the current in an armature exceeds a predetermined amount for which the relay is set, it closes the circuit through the magnetic clutch in the controller, and this stops the movement of the controller drum until the current falls below that for which the relay is set,

PART OF THE GENERAL ELECTRIC EXHIBIT

which releases the clutch and allows the controller drum to advance. The automatic device can be thrown out of action if desired by opening the controller.

This controller is shown in connection with two G. E. 69 motors, mounted on a Hedley truck. A model car bottom has been placed at a convenient height for inspection, and the electric contactors of the General Electric train controller system are mounted under it. The new contactors now made with this train control system are much heavier than earlier forms, and are provided with an ingenious casing, which can be swung down to uncover the contactors even though they are mounted very near the ground, so that there is but little clearance under them. The car wiring is done in the latest approved manner according to the new underwriters' rules.

Another railway motor shown is the G. E. 70, such as furnished for the Intramural Railway of the Exposition, the Milwaukee Electric Railway & Light Company and others.

The railway controllers shown in addition to the train controllers are R. 70-a, K. 28-a, R. 17, R. 27 and C. 23-a.

The company exhibits also for the first time its new straight air brake equipment. The General Electric compressors are well known; the chief novelty lies in the motorman valve, which is notched for the guidance of the motorman somewhat similar to a controller.

NOTES ON THE STEAM TURBINE

BY H. F. SCHMIDT

In order that an engineer of a power plant may be able to operate the machinery in his charge economically, it is not simply necessary for him to know the general principles upon which the engines and other machinery are constructed. It is equally as important, if not more so, that he should understand the losses in the machines, and just how and why they occur, for if he does not understand their causes, he will not be able to do anything to prevent them, or rather to reduce them to a minimum.

That there are losses in the steam turbine is known to every engineer, but in general, his knowledge of them extends no farther than to know that all the available energy in the steam between the upper and lower limits of the working pressure is not realized as useful effect at the shaft. To a great extent this condition of affairs is not his fault, as little or no data have been given in any of the technical papers from which to gain this information. It so happens, however, that the losses in the turbine can be very easily determined and separated in parts, the only data necessary being the curve showing the total amount of steam used by the turbine per hour, the full-load capacity, number of revolutions per minute, steam pressure, vacuum, degree of superheat, and, if possible, the diameter of the wheels, number of buckets and guides in series, number of stages and the pressures in the different stage casings.

The following notes on the losses in a steam turbine are based on a study of the various curves, showing the results of tests made on steam turbines which have appeared in the papers from time to time, and especially an attempt to find out the reason that the total steam consumption curve for all turbines is, for all practical purposes, a straight line, as will be seen by examining the curves here shown. At first it is difficult to see the exact meaning which is attached to this fact, though after a little thought the following explanation will be evident.

First of all, and before discussing the different curves, it is necessary to consider just what happens inside the turbine, for at a glance the only thing apparent is the power actually available at the shaft which can be applied to do useful work. But in addition to this, a very considerable amount of work has been developed which has been lost in the friction of the whole of the machine while revolving in the vapor within the casings, in the windage of the rotating fields, and in the friction of the shaft in the bearings. Further, it will be evident that the steam lost by leakage, radiation from the first stage casings, any losses in the nozzles, loss by the velocity of the steam as it leaves the last row of buckets and friction of the steam in the buckets are all entirely different classes of losses from that of the friction of the discs revolving in the casings, for the latter remains constant at any load, while the first mentioned losses are, for all practical purposes, directly proportional to the load. Hence, it follows that the total, or combined internal and external efficiency of steam turbines remains very nearly constant. This will be further evident by a study of the curves. Let the full line in Fig. 1 be continued till it intersects the base line, then it will be evident that if the horse-power were reckoned from this intersection instead of at the point marked zero, the total steam consumption of the turbine would be exactly proportional to the total horse-power, and the total efficiency of the turbine would remain constant. What is here called the total horse-power will at once be recognized to be practically identical to the indicated horse-power in the case of reciprocating engine, and the power lost in revolving the bucket wheels will be found to correspond to the difference between the indicated and developed horse-power. The frictional resistance in the buckets and guides, the losses by spreading, leakage, etc., may then be considered to correspond to the losses by initial condensation, re-evaporation during exhaust, etc., in a reciprocating engine, while the energy carried away by the steam, due to its velocity as it leaves the last buckets, is almost identical to the loss due to too early an opening to exhaust and failure to expand down to the back pressure.

From what has been said of the losses in the turbine, it will be readily seen that none of the energy which is lost in final velocity of the steam, friction in the buckets, leakage and radiation has ever been transmitted to the moving blades. Therefore, the horse-power represented by the distance from the intersection of the steam consumption line with the base line and the point marked zero will be that which is necessary to revolve the bucket wheels and buckets in the casing. Now, from the results of experiment, it has been found that the weight of steam discharged per unit area of the nozzles is within 2 per cent or 3 per cent of the weight which should theoretically be discharged; hence, if the nozzle is properly constructed, the velocity of the jet will be also within 3 per cent of the ideal velocity , or, in other words, the energy lost in the nozzles will not be greater than 6 per cent.

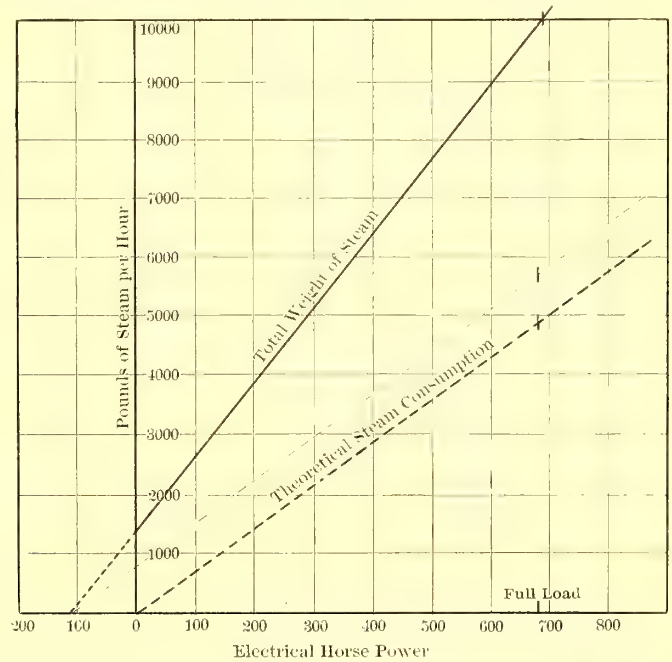


FIG. 1.—DIAGRAM SHOWING THEORETICAL AND ACTUAL STEAM CONSUMPTION OF A 500-KW TURBINE

The energy left in the steam as it leaves the last row of buckets can be calculated quite accurately when the dimensions of the wheels, number of rows of buckets in each stage, number of stages and number of revolutions are known.

From what has already been said it will be evident that if the nozzle losses, wheel losses, radiation and kinetic energy in the steam, due to its final velocity, be added together and subtracted from 100, the result would be the bucket losses in percentage. Referring to Fig. 1 the losses are found to be divided about as follows:

	Per Cent
Work available at the shaft	53.7
Lost in final velocity of steam	14.0
Lost in friction of wheels in chambers	6.2
Radiation	3.0
Loss in nozzles	6.0
Losses in buckets and leakage and spreading	14.8
Windage of generator, exciter and core losses	1.9
Operation of air pump and circulating pump	00.4
Total	100.0

The above account of the disposition of the total available enrgy is that shown by the test of the 500-kw Curtis turbine at the Newport station of the Old Colony Railway Company, and includes the generator losses as well as those of the tur-

bine, hence, if a correction is made for these losses the true performance of the turbine will be obtained, and are approximately:

	Per Cent
Work available at shaft	56.00
Loss in final velocity of steam	14.00
Friction of wheels in chambers	6.20
Nozzle losses	6.00
Losses in buckets and spreading and leakage	14.80
Radiation	3.00
Total	100.00

This shows a much better record for the turbine. A further examination of these figures indicates that there are two losses that might possibly be reduced by careful operation, namely, the bucket losses and that due to the friction of the wheels. The other losses are entirely beyond the control of the operator, and practically cannot be reduced by any change in the design. The losses in the buckets may be affected by changing the pressures in the different stages, and this may also lessen the frictional resistance of the discs, but this can only be determined by actual experiment.

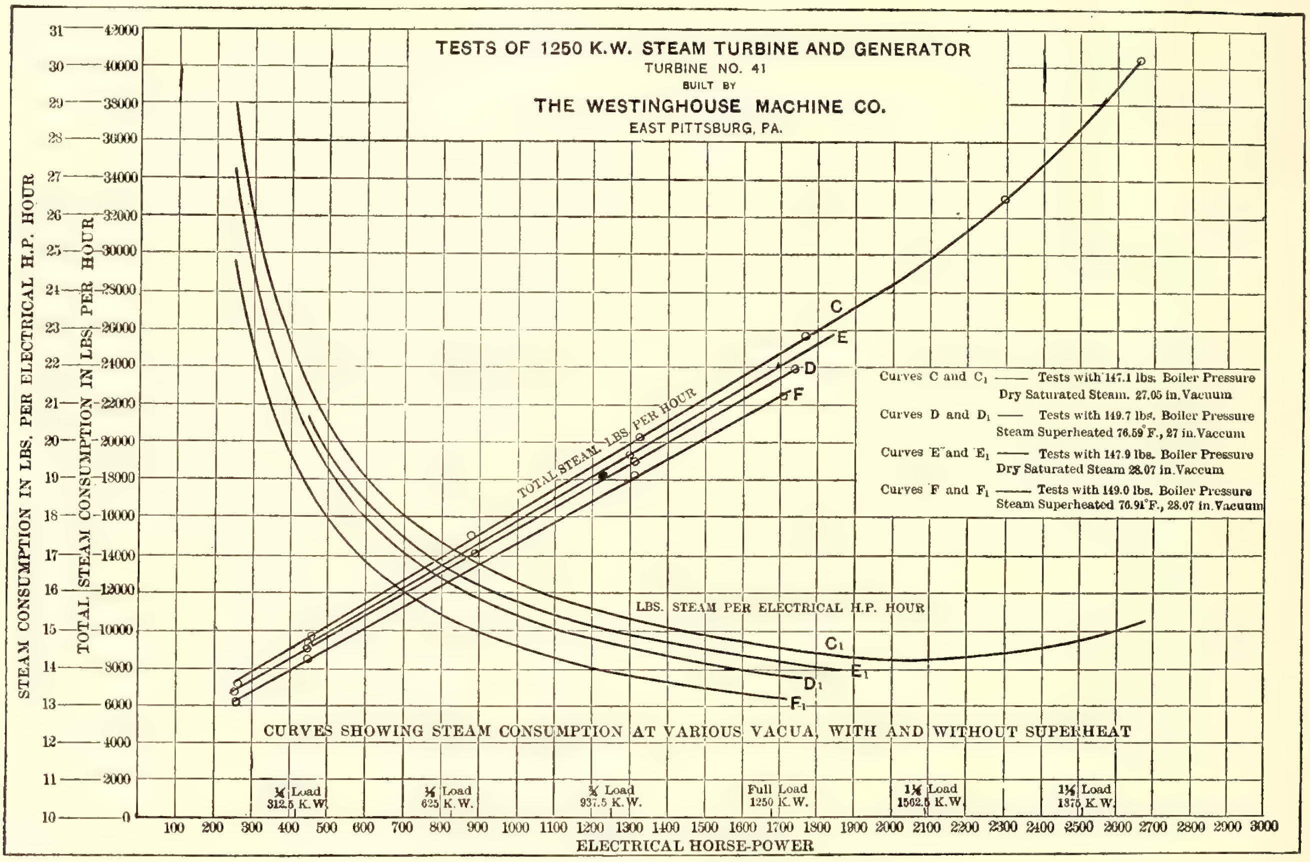


FIG. 2.—TESTS OF A 1250-KW STEAM TURBINE

Fig. 2 shows a set of curves giving the results of a test on one of the turbines of 1250 kw for lighting the New York subway, and of the Westinghouse-Parsons type. An analysis of the total steam consumption curve of this turbine shows the losses and distribution of the total available energy of the steam to be approximately as given below:

	Per Cent
Energy available at generator terminals	58.80
Friction of drum and buckets	10.30
Radiation	7.00
Loss by final velocity of steam (assumed)	12.00
Losses in buckets, friction and leakage	11.90
Total	100.00

Again, correcting this for the generator efficiency and crediting the turbine with the power that was required to operate the air pump, the result will be:

	Per Cent
Energy available at turbine shaft	62.80
Friction of drum and buckets	6.30
Radiation	7.00
Loss by final velocity of steam (assumed)	12.00
Losses in buckets and guides, friction and leakage	11.90
Total	100.00

The reason that the loss by final velocity of the steam is marked "assumed" is that in the Parsons type of turbine this loss cannot be even approximately calculated, and as it cannot be easily determined by experiment it was necessary to assume it. Consequently, whatever error has been made in this assumption will also be present in the bucket loss which is obtained by subtraction. It is probable, however, that this figure is not far from correct. If any considerable error has been made it is because the value given is too small, although that can hardly be, for a consideration of the design of the Parsons turbine will make it evident that the losses in the buckets must be comparatively large on account of the large clearance between the outer edges of the blades and the casing, which affords a very considerable area for the leakage of steam around the blades. It will also be noted that the efficiency of this turbine is a little higher than that of the Curtis turbine which was used for an illustration, but one explanation of this fact may be that the Parsons turbine is two and a half times the capacity of the Curtis. It is a peculiar and very interesting fact that the proportion of the total energy necessary to revolve the rotating members in both turbines is almost exactly the same in both cases, though the form of the rotors is entirely different.

In this turbine there is little or no opportunity for the operator to make any changes in the running conditions which will effect an economy. On the other hand, a study of the losses shows that there is practically nothing that can be done to the turbine to lower its efficiency, which is a very important point in favor of the turbine in general. The same cannot be said about the reciprocating engine, which is sensitive to any slight

alteration in the running conditions, such as a change in the valve setting, caused either by wear or made intentionally by the engineer, something which occurs practically every time there is a change in the engine room staff.

Another interesting fact is shown by the total steam consumption curve in the diagram, Fig. 3, which represents three curves drawn arbitrarily for the purpose of illustration.

From what has already been said about this curve it will appear that if there were no losses of any kind in the turbine, the total steam consumption curve would intersect the base line at the point zero, and would be inclined to it as the curve A, which we will assume to represent the ideal conditions. Then let it be assumed that the turbine in question was subject to no other losses than the power required to revolve the rotor in the atmosphere of steam and turn the shaft in the bearings. In this case, the curve of steam consumption would be parallel to curve A, but would intersect the base line at a point, X. B then would be the curve for this turbine. Now, however, let it be assumed that the turbine had ideal bearings and no power was lost in turning the rotor in the steam, other losses, such as leakage, friction of the steam in the buckets and guides and the loss in final velocity being present. Since the steam consumption would be greater, though proportional to the load, the curve would be located like curve C, intersecting the base line at zero. Finally, now, let the turbine be that of curve B, except that it is also subject to all the losses which turbines have; that is, the losses represented by curve C. If, then, the turbine in question has the losses of curves B and C, the curve

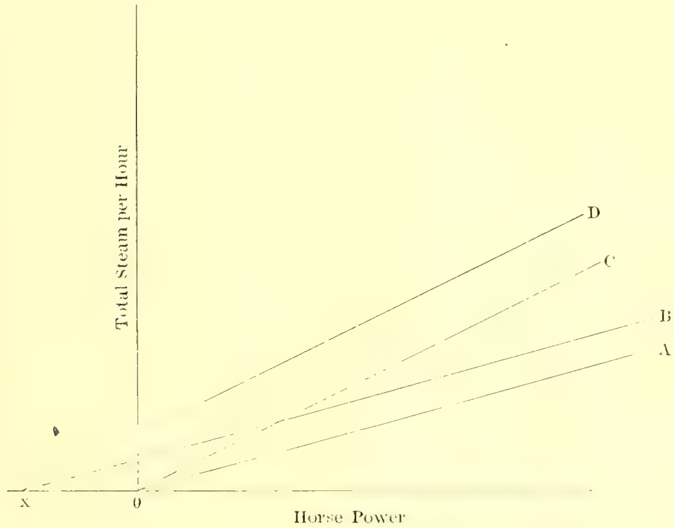


FIG. 3.—TURBINE STEAM CONSUMPTION DIAGRAM

of steam consumption will be a straight line, passing through X parallel to C. The true significance of the steam consumption curve is then (1), that the distance of its intersection from zero represents the power lost in the friction of the bearings, windage of the armature and frictional resistance of the rotor from being revolved in an atmosphere as steam; and (2) that the inclination of the curve to the base line is a measure of the loss by leakage, friction of the steam on the buckets, loss by final velocity, radiation, etc. This one curve, therefore, tells at a glance everything that is to be known about the performance, and the writer would suggest that when summing up the performance of a turbine by a curve, the theoretical steam consumption line be also drawn, by the aid of which a simple inspection of the curve sheet would illustrate the losses graphically, and show where they occurred and their magnitude.

The effect of the degree of vacuum and superheat on the losses in a Parsons turbine is clearly shown by Fig. 2. Referring to this diagram it will be seen that the effect of either superheating or a reduction in the back pressure has, in this case at least, the same influence on the rotation losses, which is indicated by the intersection of the curves E and D at the same point on the base line, but it will be noted that the curve E is steeper than D, which is the superheat performance of the turbine. Now, since the reduction of the rotation losses is small in either case, it follows that the increase in economy by the use of either alone is only partially influenced by the re-

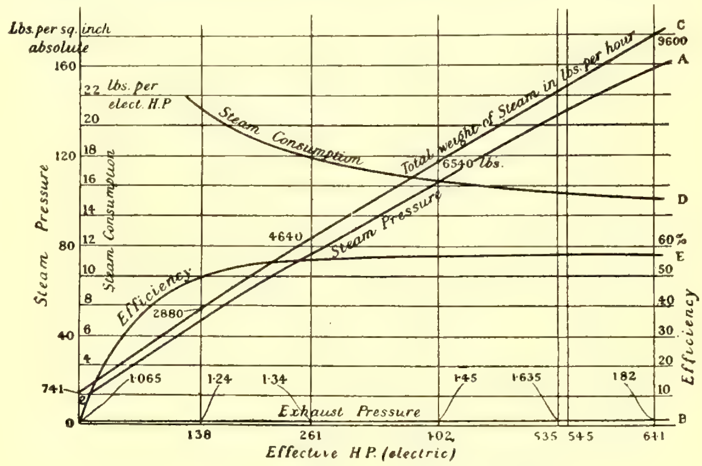


FIG. 4.—TEST OF 500-HP RATEAU TURBINE

duction of the frictional losses, and that the chief cause for the reduced steam consumption is found in the fact that 1 lb. of steam, when either superheated or at a lower pressure, occupies a much larger volume, consequently the proportion by weight which will leak around the buckets will be less than when dry steam or a higher back pressure is employed. This is further substantiated by the fact that the superheating reduces the bucket losses more than the high vacuum, for it is self-evident that an increase in the volume of 1 lb. of steam at the high-pressure end will have a greater effect in reducing the leakage than an increase at the exhaust end of the turbine, for the proportion of area for leakage to that for the passage of steam is probably ten times as great at the high-pressure end as it is at the exhaust. While superheating increases the efficiency of the turbine considerably more than would be expected, the maintenance of a higher vacuum does not better the efficiency in the same proportion as the additional available energy in the steam due to the changed conditions. Curve F presents the results that were obtained when both a higher vacuum was maintained and the steam was superheated.

Fig. 4 gives the data of a test made on a Rateau turbine which was to give 500 ehp at 2400 r. p. m. From the preceding analysis of the losses of the Curtis and Parsons turbines the reader will now be able to examine the losses of the Rateau turbine himself.

In conclusion, it may be said that it is very gratifying to find that a study of the losses in the turbine brings out the facts that have been found in practice, and confirms the reasons that have been given for them. Although the investigation has not pointed out any definite line to assist the engineer to run his plant more economically, it has, at least, shown conclusively that outside of demanding the ordinary care required by all machinery they are not sensitive to any changes in operating conditions which do not affect the pressure and vacuum in the condenser.

A street railway company in New York State has found it necessary to issue a formal notice to its employees regarding the circumstances under which emergency stops are to be made. It seems that the practice had grown common with the men of making ordinary stops by reversing, thus greatly increasing the wear on the equipment. This method of braking cars seems to have grown entirely too prevalent on a number of systems.

REPAINTING STREET RAILWAY CARS

BY JOHN C. WEAVER

Railway corporations of the past decade used to vie with each other as how best to paint a car so as to make it attractive to the eye, and while their efforts sometimes led into grievous infractions of the laws of color and taste, the aims of the companies were to be commended. Now, however, the principal object sought is economy, consequently the general appearance of the cars has declined in tone. First, nearly all the finer lines of striping and ornamenting which require any special ability in the workman in their reproduction were gradually eliminated. Then the style of lettering was attacked, and, finally, the body or main color of the car suffered. But a cheaper job in car painting is secured only by a sacrifice of the appearance of the car. If we cut out a number of the surface or preparatory coats, and substitute a lower grade of a certain pigment, we lower the standard of tone. If the surfacer is dropped, a surface is secured which no amount of varnish can smooth out, and the result is cheap in appearance only, for it is very expensive in reality.

The selection of a body, or main color, seems often to be based on its first cost only. This has led to the almost universal adoption of the so-called Tuscan red, and the cheaper grades of yellow. The brilliancy of finish has suffered from this cause, and where once the car painter's art was closely allied to that of the coach painter, it has gradually declined, and is now nearing that of the ordinary house painter.

In the selection of a suitable color for the painting of a railway car, the first consideration is the adoption of a durable pigment, and one which is easily handled. Though all pure colors have a tendency to tone down, they should maintain their purity of tone, and after a service of nine or twelve months should be capable of being thoroughly washed, and after being touched up and revarnished should present a brilliant finish. When revarnished yearly the car exterior should be good for several years' service. The selection of the color should be made by one who is practically familiar with colors, their nature and working qualities, and the difference between fugitive and permanent pigments. After selecting the color of the final coat, the next problem is how to build up the foundation coats, which should be of such a nature as to sustain or hold out the final coat. This again requires practical experience and particular attention, especially in the use of some of the finer colors.

In the selection of a color, if economy is to be considered, the question of time occupied in the painting should be kept in mind. This again is a question for an expert. For instance, a color may be selected which, although cheap in its own cost, would prove to be expensive in the handling, or the preparation of the surface to sustain it, also in the time taken in the drying of the surface of the body color so as to hasten the operation of striping and lettering. Some colors are so slow in drying that any attempt to hasten this process would result in the utter ruin of their beauty of tone. For instance, Tuscan red, pure, is one of the very slowest natural driers. When this pigment is ground up in a vehicle suited to maintain its durability of shade and of proper surface to sustain the varnish coats, it is so slow in drying that in order to overcome this trouble a drier is often used to expedite the work. In this way its peculiar bright purity of tone is often destroyed, and after a few months exposure to the elements the color becomes dull and sleepy. But as Tuscan red is such a kindly opaque body, and so economical in the number of coats needed, it seems a pity it is not given its own natural time to dry, the result would prove so satisfactory in the end. The writer has in mind one or two railroad corporations whose painting department uses Tuscan red. When a newly painted car is put into service in a train of older painted cars, the difference in appearance between the newly painted car and the old ones is so great that the ordinary passenger cannot help but notice it.

White has been largely selected as a body color, no doubt from the general knowledge that white lead is a kindly pigment, is a wood preserver, and is also easily handled by the average painter. All of this is true, but the use of raw lead in the operation of painting a car can be overdone. Too much lead in the under coats is to be avoided, while just enough makes a very durable underground, and is of vital importance, but to bring up a pure white surface requires much skill.

The question of time consumed in the operation of painting a car in a first-class manner in strict order of durability, brilliancy and economy is a varied one, but durability being really an economic question, it has been the writer's experience that proper time allowed in the drying of the undercoats is of the very greatest moment, and that a fast and loose system in this respect should not be allowed under any circumstances. While the usual time required to repaint a car from bare wood to finish is three weeks, this time can be cut down, if necessary, to twelve days, as described below.

Years ago much trouble and friction occurred between the railway companies and the insurance companies, owing to the matter of burning off the old paint, the danger of the gasoline lamp being recognized. If care is used in the original painting it is not always necessary to burn the old paint off in repainting cars, because if the old surface is intact it can be simply rubbed down and repainted. Where this has not been possible the writer has used a Bunsen illuminating gas and air burner, with rubber pipe, which is allowed and endorsed by the insurance companies, and is employed by carriage painters generally.

The work of car painting can be greatly facilitated by the use of the same paints to bring up a surface on a new car, a burnt-off car, or a car painted over the old surface. This can be done by varying the liquid or vehicle used to thin out the paint, but the same thinner can be used for all the coats, except the surfacer coats. By this method a uniform system of work, and one very simple in application by the ordinary workman, can be secured. What is more important, however, the painter can produce a uniform system of under coats. Such a plan is economical in quantity of paint used, and if systematically applied will dry out as one complete whole coat. This is not a small thing to accomplish, owing to the different drying qualities of the finishing colors used in railway car painting. For instance, the writer made 152 tests of a certain pigment before he succeeded in bringing it under his control. The surfacer, or rough stuff, also cost much experiment and patience to perfect it. The process of the application of the system is as follows:

First day, priming coat; second day, puttying and filling; third day, three coats surfacer; fourth day, rubbing out surfacer; fifth day, first coat foundation body color; sixth day, second coat foundation body color; seventh day, third coat or finishing body color; eighth day, striping, ornamenting and lettering; ninth day, first coat durable body varnish; tenth and eleventh days, varnish drying; twelfth day, second or finishing coat of durable body varnish.

It will be observed that in this system no rubbing or surfacing varnish is used. The finishing coats of colors are applied in such a manner and with a certain fine grade of brush as to produce a perfectly smooth surface, rendering a rubbing varnish unnecessary, and the omission of the rubbing varnish renders the surface of the work more durable. Of course, care must be exercised in the selection of a high grade of durable body varnish.

It will also be noted in this system that with the exception of the surfacer 24 hours are allowed between each coat of paint and drying of the surface after rubbing, and 48 hours between each coat of varnish. Cars painted in this way, with the ad-

dition of one coat of varnish yearly, will present a surface free from cracks and perfect in tone of color six or seven years.

The writer desires to impress the fact that moisture in the operation of painting is a deadly enemy of success, and where possible, the paint shop should be well heated and ventilated. It should also be well lighted, and should be so far elevated above the earth as to be above the natural moisture which arises from the ground, especially in the night.

HIGH TENSION TRANSMISSION FOR ELECTRIC RAILWAYS*

BY W. J. DAVIS, JR.

The subject given me to-night is a very broad one, and I will not attempt to cover the whole field, but will confine myself to the consideration of a few of the very latest of the prominent high voltage systems of transmission.

In the early days of power transmission at high voltage, failure of the simplest parts of the system, namely, the overhead lines, proved to be the chief and most persistent source of interruption to the service, whereas the generators, transformers and switching appliances, although calling for greater skill in design, responded successfully and uniformly to the work expected of them.

This condition was due to the fact that line construction details were neglected for the more complex and attractive problems arising in design of apparatus and the study of electrical phenomena. The frequency of line troubles soon attracted engineering talent to investigate the causes leading thereto, with the result that defects were in due time eliminated, and it is now possible, with modern methods of construction and the perfected appliances available, to transmit with safety and reliability at potentials as high as 60,000 volts.

The electrical and mechanical strains existing in wires, insulators and poles are all capable of accurate calculation, rendering the line as open to economical design as a steel bridge or other structure, and calling for the same degree of engineering ability. In attacking a problem it is necessary to know

(1) The character of the service.
(2) The distance.
(3) The amount of power to be transmitted.
(4) Its commercial value per kilowatt-hour.
(5) The topography of the country to be traversed.
(6) Local conditions as to right of way.

The first four items are usually independent of the transmission lines and serve to fix the frequency, voltage and size of wire, while items 5 and 6 determine the route and the design of the poles.

Having the above information, the first step is to decide upon the size of wire and coincidentally the transmission voltage. Aside from electrical or economical factors, the wire must have sufficient section to be mechanically strong against breakage. For lines exceeding 50 miles in length the wire should not be smaller than No. 0 B. & S. if solid, or No. 1 B. & S. if stranded wire is used. Under 50 miles No. 2, and under 10 miles or 15 miles No. 4 wire may be safely employed. Where the voltage is limited by local conditions, the size of wire is economically fixed as that for which the annual value of the power lost plus interest and depreciation on the line investment is a minimum. It may be shown mathematically that this minimum condition occurs when the two items are equal. The most satisfactory and quickest way, however, to find the proper size of wire is to solve each problem graphically, making calculations of cost of power, maintenance and interest on investment for several sizes and plotting the sum of the results as ordinates to cross section of the wire as abscissas. The size of wire most economical under the conditions of load and voltage assumed is then found at the minimum point of the curve as shown in Fig. 1.

The general practice where local conditions permit is to fix upon the minimum size consistent with mechanical strength, and adapt the voltage thereto, so as to give the most economical operating costs, care being taken in comparing the various voltages to include in the annual interest and maintenance charges, the interest and maintenance on the increased cost of transformers, switchboard, lightning arresters and line material upon the basis of equal factors of safety against electrical strains.

The standard voltages most frequently found in interurban railway work in the United States at present are 13,200, 16,500,

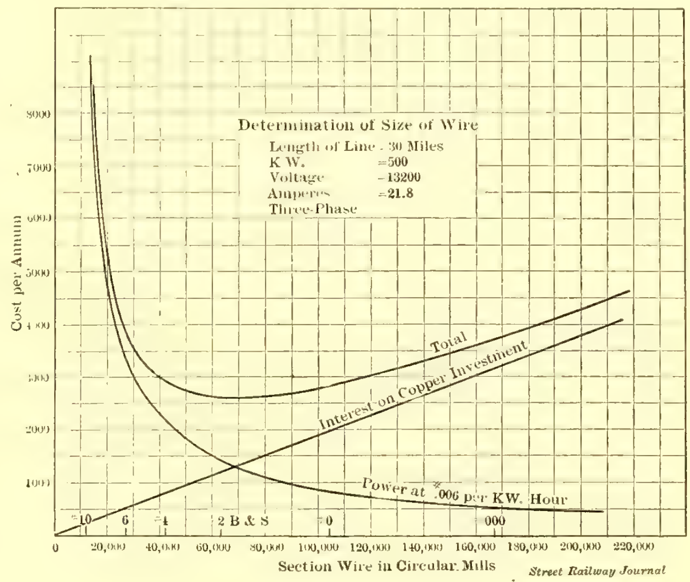


FIG. 1.—DIAGRAM SHOWING METHOD OF DETERMINING MOST ECONOMICAL SIZE OF WIRE

22,000 and 33,000 volts. In water-power transmission 44,000 and 66,000 volts are in successful use.

REGULATION

In calculating a line, consideration must be given to regulation in voltage at the receiving end. This is a function of character of load, its power factor and the capacity and reactance constants of the line. It is well to remember that in rotary converter installations the synchronizing power is a direct function of the line loss, and it is, therefore, necessary to keep the latter within certain limits determined by experience and tests in order to prevent "hunting" or dropping out of step under overload. The maximum resistance loss between any two synchronous machines should not, as a rule, exceed 15 per cent for frequency of 25 cycles, or 10 per cent for frequency of 60 cycles. The use of reactance in circuit with the rotary converter permits of compounding for high tension line loss by means of resonance, the rotary converter acting as a condenser, with a capacity varying in proportion to the series field current. A 15 per cent artificial reactance will permit compensation for 10 per cent energy lost in line and transformers. Where the load is composed of induction motors the only limitation is that due to speed regulation and maximum torque of the machine, the latter varying inversely as the square of the voltage, so that 20 per cent energy drop will give 36 per cent decrease in maximum ouptput.

CONNECTIONS

There are now in common use four methods of supplying transformer sub-stations from high-tension lines. These we may designate as:

(1) The continuous system, where the transformer leads are simply tapped into the line.

(2) The section system, which, as its name implies, consists in dividing the line at sub-stations into two or more parts,

*Paper presented at meeting of the New England Street Railway Club, May 27, 1904.

(3) The individual system, where each sub-station has its own feeder, or set of feeders.

(4) Duplicate lines.

The general scheme of connections for the above systems is illustrated diagrammatically in Fig. 2. Of these the section system is to be recommended for single lines, as it permits ready location of a fault and a break in the line does not necessarily mean the complete shut down of the system. Even in cases where there is only one point on the line receiving power, it is well to section the line where the distance of transmission exceeds 30 miles to 40 miles. For complex systems where a large number of sub-stations are fed from a single power house, sometimes individual feeders and sometimes duplicate lines will be found advisable, the choice depending upon local conditions.

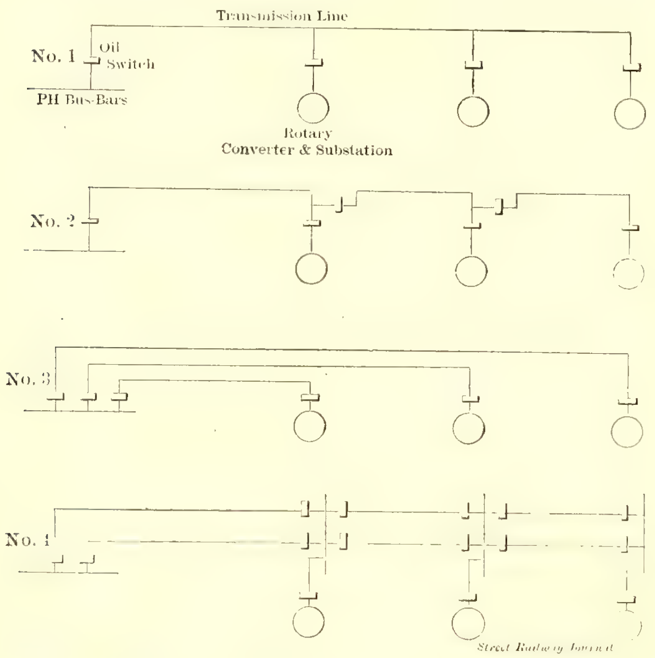


FIG. 2.—DIAGRAM SHOWING DIFFERENT METHODS OF SUPPLYING TRANSFORMER SUB-STATIONS.

CONSTRUCTION

Experience has shown that the transposition of wires in a high-tension line is an unnecessary complication. Such transposition is supposed to reduce induction in contiguous telephone circuits, but frequent transposition of the telephone wires, say every 300 ft. or oftener, placing them 6 ft. to 10 ft. below the lowest high-tension wire, is preferable and necessary in any case.

The allowable distance between wires varies with the voltage and length of span. There is a certain minimum distance, however, fixed by necessity of avoiding short circuit due to flying leaves and twigs, or to large birds attempting to pass between the wires in flight. This distance is about 18 ins., and in many localities preferably 24 ins. The concensus of good American practice appears to favor the following spacing:

	Inches
60,000 volts	80
30,000 volts	40
Under 20,000	18 to 24

The conductors on the Guanajuato (Mex.) line, transmitting at 60,000 volts, are spaced 78 ins.; on the Bay Counties (Cal.) line, 55,000 volts, 84 ins.; the Cauvery line (India), 30,000 volts, 40 ins.; Niagara Falls line, 22,000 volts, 24 ins.

The majority of transmission systems in America use wooden poles spaced 100 ft. to 150 ft. apart. The tendency of late, however, is to use steel poles or towers, spaced 300 ft. to 500 ft. apart. The increased spacing reduces the number of poles, insulators, cross arms and other material, making the cost of the line with steel pole construction approximately equal to wooden pole construction, especially where the voltage is high and where the transmission line is run on its own right of way, and the poles are not, consequently, required for supporting an overhead trolley construction. The chief advantages of the steel pole construction are long life and possibly less cost of maintenance, although at present we have not had sufficient experience to determine whether the latter item is of very great importance. It is claimed that the steel poles are much more susceptible to damage by lightning, and repairs on such damage are, of course, more expensive. The latest example of steel pole construction is found in the line of the Guanajuato (Mex.) power and transmission plant, running from Guanajuato to Zamora, total length being 101 miles and total energy transmitted about 3000 hp. These poles are spaced on an average of 440 ft. apart, and the wires are suspended 42 ft. from the ground. The general arrangement of the wires is in the form of an equilateral triangle with 78-in. sides, and the line is divided into three sections so as to facilitate location of fault. The towers are built of angle-iron, and were constructed by the Aer Motor Company. In Cauvery, India, a combination pole is used, consisting of 17 ft. of iron piping, 6 ft. of which is imbedded in the ground. A piece of timber, 7 ins. in diameter and 17 ft. long, is inserted in the socket of the steel section. This construction is to be commended in climates such as that of India, as by it is secured great durability with the added advantage of decreased liability to injury by lightning.

INSULATORS

Insulators are required to have sufficient electric strength to withstand puncture at the working voltage to which they will be subjected, and to be of such general dimensions as to preclude possibility of leakage or arcing over to the pin. The first requirement is dependent upon the quality of glaze and thickness of the porcelain. Where the porcelain is very thick, cracks or other defects not evident on inspection are likely to exist, causing failure during test. An improvement in construction is secured by making the insulator in two or more parts, which may be inspected and tested separately and afterward assembled with suitable form of cement. Experience with various materials in this country has shown good Portland cement to be about the best binder available. It has been found that lead will crack the insulators, due to unequal expansion, and that sulphur is likely to melt under the influence of the hot summer suns. In Europe excellent results, I understand, have been obtained with a mixture of ten parts of litharge and one part of glycerine, but I have been unable to find any record showing the superiority of this mixture over Portland cement. Under 20,000 volts insulators may safely be made in one piece from 20,000 volts to 40,000 volts in two pieces, and from 40,000 volts to 60,000 volts in three pieces.

In the early part of the art insulators were constructed very much after the practice then prevailing in telephone and low-voltage lighting work, and consisted of a glass or porcelain piece with hole threaded to receive a wooden pin. A great many defects resulted owing to mechanical weakening of the insulators through poor bearing surface existing between the insulator and pin, producing unequal strains and also by burning of the wooden pin through leakage. These defects have been eliminated by the use of malleable iron pins fastened into the insulator with Portland cement.

ELECTRIC RAILWAY FOR TIENTSIN, CHINA

The Compagnie Internationale de l'Orient has obtained a concession from the Chinese Government permitting it to install electric street car lines and electric lighting in Tientsin, the port of Pekin. The company has been trying to obtain this concession for two years.

STANDARD LOCATION OF THIRD RAIL FOR ELECTRICAL OPERATION*

BY F. M. WHYTE AND A. S. VOGT, COMMITTEE

The committee found that very little could be accomplished concerning the standard location of third rail, because various steam railroads about New York City which were considering, and which have considered, the question of electrical operation, had representatives, either as commissioners or individual officers, considering the subject more thoroughly and having more authority than could be delegated to a committee of the Master Car Builders' Association. These representatives of the various railroads, after much consideration of the subject, have fixed upon a location for third rail, which is very apt to be standard in the electrical construction on steam railroads about New York City, and this location is shown in Fig. 1. Some of the railroads near New York City, which will be operated electrically, have adopted a location for third rail slightly different from the location shown in Fig. 1, but the difference is so slight that the equipment which is constructed to take current from the third rail located as shown in Fig. 1 will operate satisfactorily over the construction with the slight variation referred to. It is possible, then, to consider the location shown in Fig. 1 as the most pronounced standard for location of third rail, and one which, no doubt, will be followed more or less closely by such roads as may take up, in the future, electrical operation. The location of the third rail having been determined as in the foregoing, the next is the question concerning proper protection for the third rail. This protection will be different on different railroads, and the different construction for this protection will affect the rolling stock clearance to a greater or lesser degree. The construction of this protection will probably be determined upon by each road independent of the others, and, having been determined upon, it will be incumbent upon those who design rolling stock for use over railroads where the third rail is used to make the equipment clear the particular third-rail installation over which the equipment will be operated.

The Pennsylvania Railroad and the Long Island Railroad have determined upon certain clearances which will be required for passenger car equipment, freight car equipment and locomotive equipment which will run over their electrical installation, and these clearances are indicated in Fig. 2. It is probable that members of this association will need consider only the clearances prescribed for passenger car equipment and for freight car equipment, but clearance for locomotive equipment is also shown, in order that the same may be upon record.

The New York Central & Hudson River Railroad Company has determined upon certain clearances which will be required for all classes of equipment, and these are shown in Fig. 3.

It is possible that a composite diagram, showing the maximum dimensions which will clear both the Pennsylvania, the Long Island and the New York Central installation, will be of service to those members who may be interested in designs of equipment which can be operated over any of the railroads mentioned, and for their guidance Fig. 4 is added, showing this composite clearance diagram.

Probably the Master Car Builders' Association cannot adopt any of these clearance diagrams as standard, and the most that can be expected to be accomplished by the labors of this committee is the placing upon record the clearances of the third-rail installation, so far as such installation has now been determined upon, at least so far as has come to the attention of your committee.

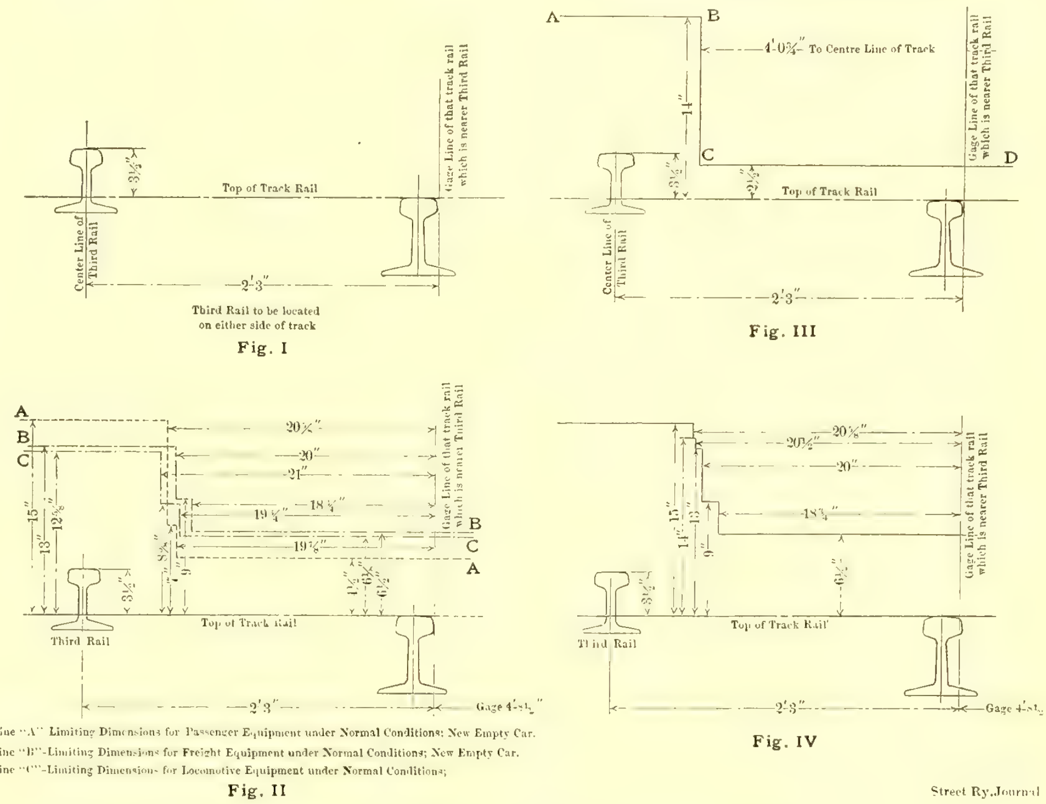


DIAGRAM SHOWING STANDARD LOCATION OF THIRD RAIL RECOMMENDED BY MASTER CAR BUILDERS

FIRST TRACKLESS TROLLEY IN PRUSSIA

A trackless trolley line is being built by the community of Monnheim, to be the first of its kind in Prussia. It will run from Monnheim to Langenfeld, and will be about 2½ miles long, with two short branches intended for freighting purposes. The roadway from Monnheim to Langenfeld is about 23 ft. wide, with a good basaltic cover about 15 ft. in width, running almost in an air line, with the exception of a few curves. A special contrivance for coupling will be provided in order to keep an exact rut of all the cars. The power will be conducted to and from the cars by means of two rotary poles, placed on the top of the cars, and sliding blocks enabling the train to give way from 10 ft. to 12 ft. For entering farmyards lying close to the road there will be used, instead of the regular wire, a connector and flexible cable 50 ft. to 70 ft. in length, by means of which the current will be transmitted to the motor car. The trains will consist of an electric locomotive for drawing two or three cars, driven by two electric motors of from 25 hp to 40 hp. The conducting crew will have its place on the locomotive. The cars for carrying freight have a capacity of about 5 tons. Some of the cars will be open and some closed, and all will be fitted with brakes. Couplings will be provided for attaching farm wagons.

* Report presented at the Master Car Builders' Convention at Saratoga, June 22, 1904.

THE PROBLEMS OF THE MASTER CAR BUILDER ON THE ELECTRIFIED STEAM ROAD*

BY H. H. VREELAND

On an occasion like this, and in this company of gentlemen devoted to a special art, still full of the enthusiasm that has made them a recognized factor in the development of American railroading, nothing, it seems to me, could be more fitting than for an outsider identified with the craft, in the only relationship possible, that of a purchaser of cars, to call attention to the magnitude of certain forces now at work tending to a revolution intimately affecting every man interested in the business of building and maintaining rolling stock; and so I venturously contribute a word or two. It will not be expected of me, in the company of so many others more competent for such a discussion, to say anything on the technical side of what seems to me to be the new problem presented to you as a craft. Formally and informally I have no doubt the subject has, from time to time, received attention, but it may be that men immersed in the details cannot detect with the same promptness tendencies that are obvious to a sympathetic onlooker; and, hence, I presume in this company to say what I have in mind.

It is true, too, that in a broad generalization of the kind I make, it would serve no good purpose and only confuse the main idea I wish to insist on, to go into a discussion of all the causes involved in this problem. I only desire to state what is obvious before discussing the details of a magnificent revolution now under way, at which I may call—without, I hope, giving offense to brother members residing further west—the greatest railroad center in America, to wit, New York City, which is bound to affect in the immediate future the personal fortunes of all of you. In and about that center there is now in progress of installation a practically new means of propulsion, as applied to steam railroads, an incident of which will be the virtual combination of two heretofore separate and distinct activities, the maintenance and efficiency of which is to be in your charge. With the introduction of electricity at the New York termini of the New York Central Railroad, and possibly the Pennsylvania Railroad, there will come into use a new class of vehicle, i. e., the electric motor car, each with individually-contained power apparatus, and the intimate association between the vehicle and the mechanism of its propulsion is so close as to make the divorcing of them practically impossible. The day when the motive power was sent to a round-house, and the inert rolling stock to a yard or shops, is at an end. A young man who aspires to shop efficiency must, in the very nature of things, find himself equipped to handle both. In a single stroke many sacred old methods—as, for instance, of lighting and heating—are abolished, along with the engine that has now gone to the eternal round-house; they are no longer of interest. They are one with those other twin nuisances—smoke and cinders—and the safety and maintenance of the new appliances by which they are furnished have been suddenly thrown, as a new responsibility, on the craft of car building.

From this it will be seen and appreciated how much higher is the demand that will be made upon you in the immediate future. When I say you, I include the journeymen car builders, forming that valuable recruiting army from which men for important station can be graduated. This great revolution in motive power will not only tax you, but every man down the line. Tracks, switches, round-houses and repair shops will need, under these new conditions, men with considerably more than the rudimentary knowledge that has heretofore sufficed, and it is the duty of all of us having the direction of those activities wherein our life is cast, to drive this truth home, in order that it may be fully appreciated, and that those who are with us may recognize, if they wish to progress, the new necessity that is upon them.

*Address delivered at the Convention of the Master Car Builders at Saratoga, June 22.

To my way of thinking, not only for the benefit of the business as a business, but for the individuals engaged in it to the last number, a revolution is going on which might profitably be insisted on with a slight note of alarm, in order to fully awaken the mind to the subject. Every other revolution—I use the term for want of a better one—that has taken place in the matter of railway equipment, has been, so to speak, a gradual one, and men have had time to slowly adapt themselves to altered conditions. The basis has been all along practically the same, and the successive revolutions (if we are to continue using the term as expressing an idea) have been, at best, mere modifications and improvements along a given line. This is not the case, as you will see, if it is considered for a moment what the present change involves. There is an absolute annihilation, not only of the present means of power, but the substitute for that power instead of being centralized and capable of isolation, is so associated with the rolling stock as to make it, as I have said before, an integral part of it which must, in the necessity of things, be given into your charge. There has been very little preparation for this change, which adds over night to the requirements of your craft the elements of an art with which none of us is any too familiar.

All of your roads, and particularly these two great railway corporations that I have mentioned, as soon as they have installed electric traction in New York, will be handing over to their shops these new hybrid combinations, which are neither all cars nor all locomotives, but something of both, and it will take more than expert carpenter or blacksmith to keep them in order.

For proof that I have not overstated the magnitude of the change under discussion, I will give, in tabulated form, the total present electric generating capacity located at New York, so divided as to show at a glance the amount in operation at the present moment and that contracted for for near future delivery.

ELECTRIC GENERATING MACHINERY IN OPERATION OR CONTRACTED FOR TO TAKE PLACE OF STEAM LOCOMOTIVES IN VICINITY OF NEW YORK CITY

	In operation		Contracted for	
	Kilowatts	Equivalent horse-power	Kilowatts	Equivalent horse-power
Manhattan Railway	48,000	72,000	6,000	9,000
Brooklyn Elevated Lines.	20,000*	30,000*		
Interborough (Subway).			48,000	72,000
Long Island Railroad....			16,500	24,750
New York Central Railroad			40,000	60,000
Total	68,000	102,000	110,500	165,750

* Estimated.

It will be noticed from this table that it is proposed to substitute for steam on the Interborough, the Long Island, and the New York Central roads 165,750-hp units, or 63,750 units more than the Brooklyn elevated lines and the Manhattan Railway are at present developing. This all shows that within the next two or three years you are to have turned over to your care much of the machinery by means of which this tremendous volume of energy is to be translated into work, for adjustment on the vehicles you make and repair.

All this brings me to what, after all, is the most interesting element in the change relating, as it does, to the individual worker. Academic and scientific men have done their work. Their problem has been solved—yours is yet to be. As I look the field over, this seems to me to be, for the men involved in this trade, no small matter. Into your keeping is to be handed over the successful adjustment and disposition of the machinery the scientific men have invented and adapted, and on your efficiency depends the validity of the investment of millions of dollars and virtually the whole onus of reforming the method

by which the most important part of the business of any civilized people—that of transportation—is conducted. It is well to bear in mind, too, in considering this subject, that the demand to be made upon you is very sudden. The changes which have resulted in standardization have been so gradual as to place no very serious handicap on the slow man. He could educate himself as he went along and easily keep abreast of the advance. Now there is to be made upon him a sudden demand affording smaller opportunity for the gradual acquirement of efficiency. The demand must be answered at once, or the man failing to answer must inevitably fall back. I have in mind to point out that what the situation needs is preliminary preparation, so that when the demand arises the men may be already equipped. You know that in examination for entrance to universities a man may answer all the questions he is able to, and then be kindly furnished with a list of what are called "conditions." These "conditions" cover the subjects in which he is deficient, and he is mercifully allowed to repair his defects, due credit being given for the subjects in which he is perfect. In other words, he is allowed to standardize all his information to some fixed height. Unfortunately for us in the strife of industrial life, no such charity is extended. There are no "conditions." The demand is made on a man when the emergency arises, and if he fails to qualify at once he is, in the picturesque language of the Marquis of Queensbury, "down and out." It is some one else's turn next. And so I come to point out what I have for years recognized as a great necessity in all kinds of railroad work, and that is, preparedness. Slowly, year by year, with the enlargement of the necessities of a great business like transportation, its demand upon the individuals employed becomes more and more exacting. As I look over the field and see the individual railroad employee virtually taken from his old employment and placed in the midst of an entirely new set of conditions, demanding qualities of mind and intelligence greater than that called for by a chief engineer fifty years ago, I am impressed.

If these suggestions and generalizations of mine shall have the effect of stimulating the ambition of any man down the ranks to prepare for the moment when the demand is made upon him, they will have served their purpose.

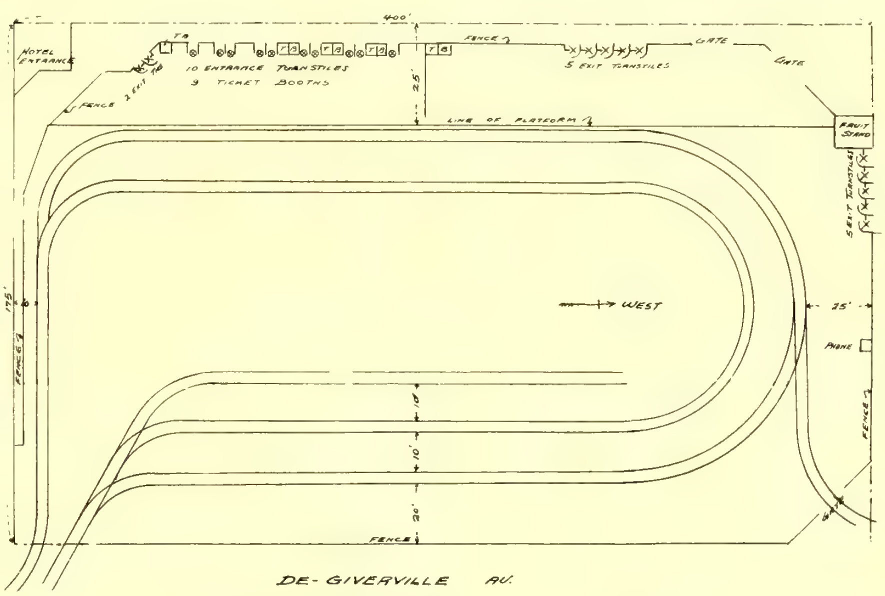
THE INTERURBAN STATION AT LOUISVILLE.

Plans are being prepared for the new interurban terminal station of the Louisville & Interurban Railway Company, in Louisville. As yet only the general plan of the structure is known. It will be three stories high, the two upper floors to be used by the Louisville Railway Company for office purposes. The ground floor will be used solely for the operation of cars. It is probable that the Louisville & Interurban will share the ground terminal with the Louisville & Eastern. The Louisville & Southern Indiana also is willing to operate into the station, though the negotiations between that company and the Louisville & Interurban are as yet only tentative. Then there is a possibility of the Kentucky Traction Company and the Ohio Valley Traction Company also making terms to use the station. The tracks will be so laid as to pemit both east and westbound cars equal facilities. The north end of the building will be devoted to a ticket office, baggage room, news stand, toilet rooms and other conveniences required by passengers in waiting. The south end of the building will be taken up with sidings, on which cars will be stored when out of use.

THE OLIVE STREET TERMINAL AT THE WORLD'S FAIR

In the Street Railway Journal of May 14, 1904, the location of all the street railway terminal loops at the Louisiana Purchase Exposition were shown. The arrangement of the details of the largest, or Olive Street terminal, near the main entrance, is now shown in the accompanying engraving. This loop being the one which receives the heaviest travel, because the cars of the Olive Street line, which enter it, take the most direct route to the city, was the first one to be fully completed. The other loops, on account of different conditions, require different treatment.

The Olive Street loop, which is here illustrated, is entirely enclosed by a high board fence except where the cars enter, which is at the northeast or most remote corner of the terminal. As seen by the plans, there are two complete loops within the terminal and one storage track. There is also a single-track entrance at the northwest corner, through which cars can be



OLIVE STREET TERMINAL AT THE WORLD'S FAIR

brought from large storage yards, three blocks north, at Delmar and De Baliviere Avenues. The exit turnstiles and the next gates are located at the southwest corner of the terminal, near the point where the cars usually unload. Passengers must purchase tickets at the ticket booths before entering the terminals, and in entering must pass through turnstiles and exhibit their tickets. It will be noticed that the ticket booths and turnstiles are alternated, so that there will not be too much congestion at one point.

At the Delmar terminal, which is directly across the street from this Olive Street terminal, no attempt has been made to fence in the terminal, or to require purchase of tickets before boarding the cars, because in this case the cars enter the terminal from the street at a point near where the crowds would enter the terminal, and in case of heavy traffic people would be likely to board the cars before they entered the terminal, making any attempt to require the purchase of tickets before entering the cars, useless.

By an order of the St. Louis Transit Company, which went into effect June 1, each man gets a day off every two weeks. Mr. McCulloch, the general manager, has organized what are known as relief crews on all the lines. These crews run alternately in place of each regular crew on every line on a certain day, thus allowing one regular crew to lay off a day in about two weeks. The holiday is not optional with the men, but most of them seem to like the arrangement.

THE MELAUN RAIL-JOINT

BY ARTHUR BUSSE

The first trial of the Melaun rail-joint was made about three years ago on Potsdamerstrasse, one of the most important lines of the Grosse Berliner Strassenbahn, of which the writer is engineer. At that time, owing to the laying of a new asphalt pavement on that thoroughfare, the worn-out rails between the Kurfürstenstrasse and Bülowstrasse were replaced by grooved rails with bottom fish-plates and half-joints. On this occasion about 100 m (328 ft.) of track were equipped with Melaun joints, of which several views are shown in Fig. 1.

The joints are applied as follows: Where the rail ends meet

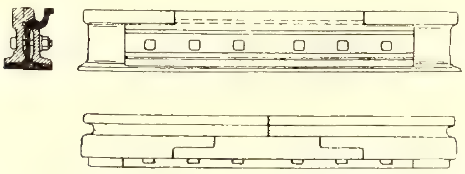


FIG. 1.—SHOWING ORIGINAL CONSTRUCTION OF RAIL-JOINT

the head of each rail is milled off, as shown in Fig. 1, for a certain distance back of the joint. An angle-plate is then used on the outside, whose head is rolled similar to the head of the rail and whose foot rests on the base of the rail in the usual way. The inwardly projecting head of the angle-plate does not rest on the top of the rail, there being a space between it and

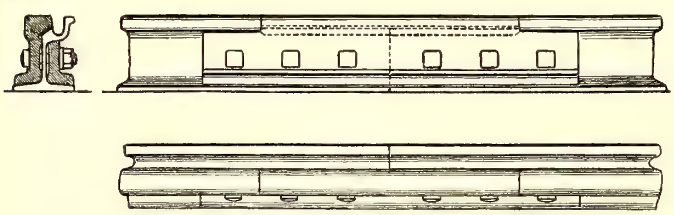


FIG. 2.—SHOWING LATER CONSTRUCTION OF RAIL-JOINT

the top of the web. The angle-plate is maintained in its vertical position by a horizontal rib, which bears against the web of the rail, and also by the vertical abutting surface of the dove-tailed rail head, so that the plate cannot get out of alignment. The inner angle-plate is held in place by bolts in the usual way. In laying the trial track the rail ends were not butted together, but were laid with spaces between ends from 2 mm to 3 mm (.078 in. to .12 in.) wide.

As stated before, this joint was laid at a point subjected to very heavy traffic, but in spite of this it has given entire satisfaction during the three years it has been service. The asphalt has shown no breaks at the rail-joints, and the bolts have not been tightened. Nevertheless, all longitudinal joints in the tread surface are so tight that they are not visible. Almost all the joints, also, even the half-transverse joints, which were not entirely closed at the time the rails were laid, have become perfectly closed by the movement of the cars running over them. Measurements recently carried out with an instrument, by means of which the condition of the alignment at the joints is accurately measured, have proved that the tread of the joint presents an even surface; on the other hand, all the other joints laid in the same street three years ago with base angle-plates and mitered joints were found to be badly worn out.

The Melaun joint is not only applicable to new track but may also be used to replace worn-out rail-joints without taking the old rails out of the pavement.

In the repairs carried out in Berlin last summer, the construction of the joint was changed, as shown in Fig. 2, that is, without the dove-tailing in the tread and with head of the angle-plate extending the entire width of the tread surface. The head was inserted so tightly that the joints were closed at the start. Experience has shown that overlapping is unnecessary, as the strains on the Melaun joint are uniform throughout even without overlapping. By leaving the overlapping out the joint can be constructed much more cheaply and easily.

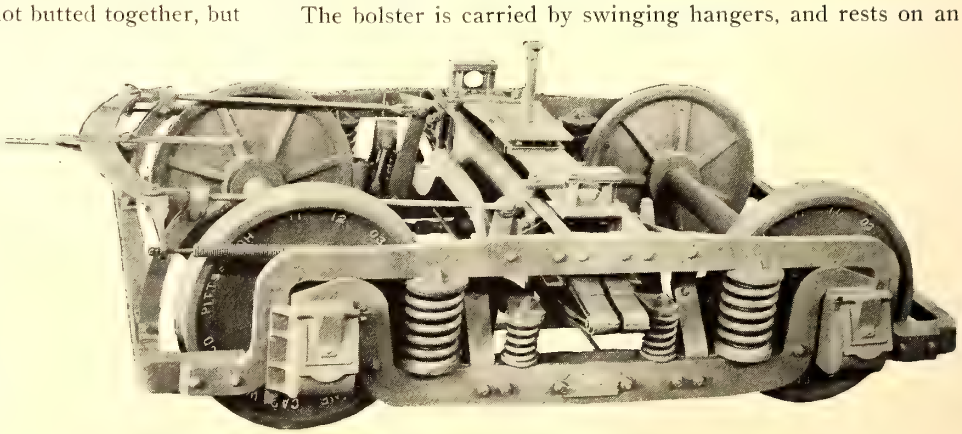
Over 6000 of these joints have now been laid on old rails in Berlin. While the cost per joint is somewhat high, the good results thus far achieved with the joint have induced the Grosse Berliner Strassenbahn to continue its use on a large part of its track reconstruction.

NEW TYPE OF TRUCK

The accompanying illustration shows a new type of truck, one of which was recently put in service on the Youngstown & Sharon Railway, of Youngstown, Ohio. The truck was designed by W. G. Price, who has also patented the new features contained in it. Arrangements have been made by which this truck will be constructed at the works of the Standard Steel Car Company, at Butler, Pa.

This truck, as will be seen, constitutes quite a departure in design from any heretofore used. The side frame is formed of one piece of rolled open-hearth steel, which is pressed to an inverted U-form, so as to provide pedestals, which are guided by the lugs on one side of the journal boxes. There are no pedestals on the other side of the journal boxes; the boxes are held in place by being bolted and rigidly secured to the equalizer bars. The pedestals are protected from wear by a covering of steel, which is riveted to them and which slides between the lugs on the journal box. This wear piece carries a bolt at the lower end which acts as a stop to the upward movement of the frame. The side frames are connected by angle-shaped end frames and channel transoms, which are secured by large hydraulic-driven rivets. The transoms are also connected to the side frames by diagonal braces.

The bolster is carried by swinging hangers, and rests on an



NEW TRUCK ON YOUNGSTOWN & SHARON RAILWAY

elliptic spring of a new type. The wheel base of the truck is 6 ft. 4 ins., and the space required for the motors limits the spring to a double elliptic having leaves 3½ ins. wide. The length of the spring is 37 ins., and in order to carry the load it was necessary to use six leaves. As a three-leaf spring is much easier riding than a six-leaf spring, the leaves were divided so as to form two independent springs, each having three leaves, one spring of three leaves being outside of the other, but both

being secured by the same bands, as can be seen in the engraving.

The brake-shoes are hung from brackets, which are secured to the equalizer bars, and have no connection with the truck frame. Brake beams are not used. The brake hangers and pins are held in contact with each other by strong coil springs, so they cannot rattle.

The motor suspension bars rest on coil springs, which are carried on the equalizer bars. Smaller coil springs, located between the equalizer bars, resist the upward thrust of the motor. The support of the brakes and motors is upon the equalizer bars, so they have no connection with the truck frame. This, it is claimed, will prevent the noise and vibration of the brakes and motors from reaching the car body. The equalizer bars are rigidly connected across the truck by small channel bars, which prevent the tilting of the equalizer bars by the pull of the brake hangers. The brake-shoes, being carried by the equalizer bars, are always the same height on the wheel and do not move up and down, as they do when hung from the truck frame. This construction permits of a much closer adjustment of the shoes to the wheels.

The journal boxes and bearings are of the M. C. B. type. The boxes are planed inside to one exact width, and the bearings are planed to a width 1-32 in. less than the boxes. As the boxes are rigidly connected by the equalizer bars the maximum movement of the axles away from or towards each other is thus reduced to 1-16 in. This construction also permits of a very close adjustment of the brake-shoes, and increases the efficiency of the brakes, as the wheels cannot give away to the brake-shoe pressure.

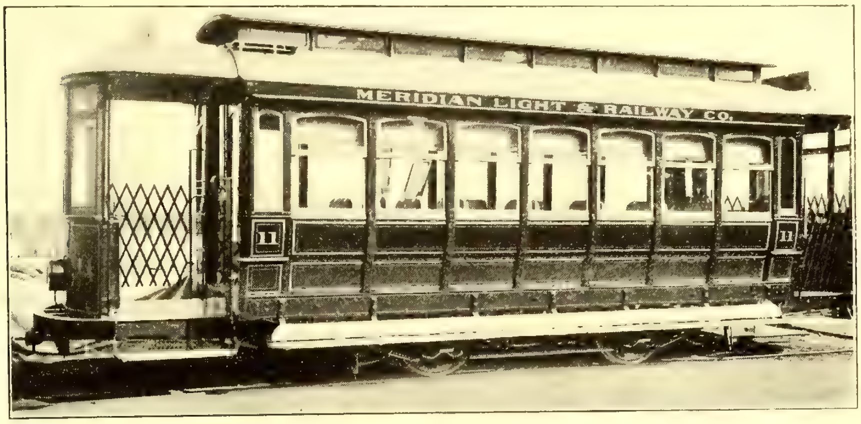
The trucks are very light for the required strength. They have no castings under tensile strain, and, except the wheels, there are no gray iron castings. The journal boxes are malleable iron. The side frames, being solid forgings without welds, should be very safe against breakage. This construction permits the truck frame to be lifted entirely away, so as to leave the wheels, motors and brakes connected in operative position, which may be of some advantage when repairs are required.

The space between the equalizer bars and the truck side frame permits the use of equalizer springs 12 ins. long, which, in combination with the improved elliptic spring in the bolster, insures a very easy riding truck.

CONVERTIBLE CARS FOR MERIDIAN, MISS.

Five convertible cars of the Brill type were recently delivered to the Meridian Light & Railway Company, of Meridian, Miss., by the American Car Company, of St. Louis, Mo. An interesting part of the furnishings of these cars are screens made of glass in stout frames, which may be fastened to the backs of seats between those occupied by white persons and colored. These screens may be noted by examining the illustrations.

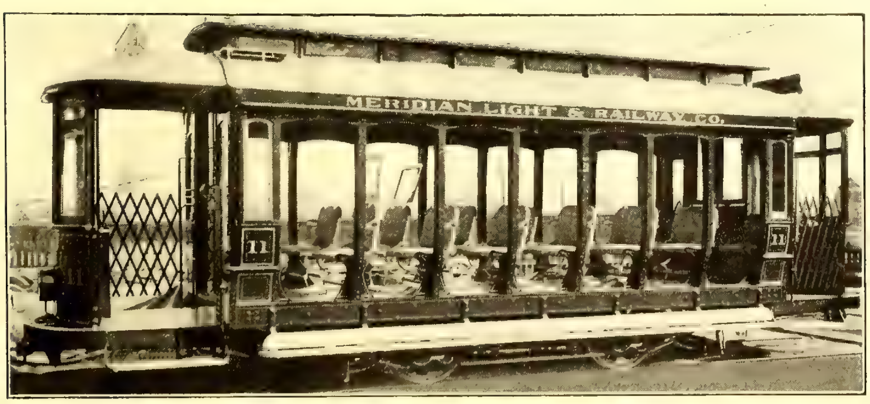
The general dimensions of the car are as follows: Length over end panels, 20 ft. 7 ins., and over crown pieces, 29 ft. 7 ins.; from end panels over crown pieces, 4 ft. 6 ins.; width over sills and plates, 6 ft. $11\frac{1}{4}$ ins., and over posts at belt, 7 ft. 9 ins.; sweep of posts, 5 ins.; from center to center of posts, 2 ft. 7 ins.; thickness of corner posts, $3\frac{3}{4}$ ins., and of side posts, $3\frac{3}{8}$ ins.; size of side sills, $4\frac{1}{4}$ ins. x $7\frac{3}{4}$ ins.; sill plates, 8 ins. x $\frac{5}{8}$ in.



CONVERTIBLE CAR READY FOR WINTER SERVICE


INTERIOR OF CONVERTIBLE CAR, SHOWING GLASS SCREENS AT THE END

The interiors are finished in cherry with birch ceilings. The seats are $33\frac{1}{8}$ ins. long, leaving the aisle $17\frac{3}{4}$ ins. wide. Portable vestibules are used, and the entrances to the platforms are furnished with folding gates. The guard rails at the sides slide inside the posts. Instead of grab handles on the side posts the seat brackets are made in such a form as to serve that purpose. The height of platform steps from track is $15\frac{1}{2}$ ins., and from steps to platform 12 ins. The running boards are $18\frac{7}{8}$ ins. from the track, and from board to car floor $13\frac{3}{4}$ ins. Angle-iron bumpers, folding gates, round-corner seat-end panels, platform and conductors' gongs and sand-boxes are included in the equipment. The cars are mounted on No. 21-E trucks, with 7-ft. 6-in. wheel base and 33-in. wheels. The motors are of 38-hp capacity.



CONVERTIBLE CAR ARRANGED FOR SUMMER USE

TALEQUEGA PARK

Talequega Park, at Briggsville, in Attleboro, Mass., is on the line of the Bristol County Street Railway, and is 10 miles from Taunton, Mass., and 11 miles from Pawtucket, R. I., with direct electric railway connections with both cities. The park was first opened to the public two summers ago, and proved so popular that changes and improvements made imperative after the close of the 1903 season, saw it open this year as one of the best equipped amusement resorts of its kind in all New England.

The ground that the park now occupies was formerly a farm, and is 30 acres in extent. Enclosed by a high wire fence it is entered either through the front driveway gate or by the steps of a handsome new Casino. Visitors who come by way of the electrics receive a ticket that, with 5 cents additional, gives them the freedom of the grounds and all that is offered in the way of amusements. The general admission price is 10 cents.

The Casino which, as just stated, was opened this year for the first time, is quite elaborate. The lower story, built against the side of a knoll, is used as a transfer station by passengers traveling between any two points on the line and not directly connected. Cars are also stored here. Space has been reserved as well for bowling alleys and a billiard and pool room. Upon the first floor are a large kitchen and dining room with several private, or at least less public, apartments leading out of them. The decorations, the furniture and all the accessories are in a quaint mediæval style. This floor lies level with the top of the knoll, and is surrounded on all sides by a broad veranda, affording a beautiful view of the surrounding country. The balconies of the second floor are just as extensive. There is a dance hall upon this floor, and it has been so arranged that it opens directly out upon the verandas, an arrangement that is very convenient and has proved most popular.

Across from the Casino and not in the present park, six acres of land have been acquired for baseball grounds.

Within the park proper are to be found many attractions besides those that the Casino offers. There is the open-air vaudeville theater that already seats 600 people and will soon be enlarged. It is situated among a little clump of pines, with which the grounds are plentifully supplied, and adds greatly to the natural charm.

Three acres further on have been flooded to form a lake, which is used in summer for rowing and in winter for skating. The park is lighted by 1600 incandescents, and some of these lights have been placed among the trees, which rise out of an artificial pond with somewhat of a weird effect, especially at night. A platform has been built in the center, and here fireworks are shown upon special occasions. A small menagerie is also popular.

Refreshment stands are not lacking, and shady nooks have been provided in abundance. At 10:30 in the evening the theater closes, but there is a half-hour after that before the grounds are cleared.

The park was laid out by Edward M. Bevins, of Gloucester, Mass.

AN INTERESTING TYPE OF CALIFORNIA CAR FOR CORONADO

The interesting type of California car shown in the accompanying engravings has just been completed by the J. G. Brill Company for the Coronado Railroad Company, Coronado, Cal. The closed compartment, which is 14 ft. long over the end panels, has longitudinal seats and stationary windows. The open parts are 14 ft. long from the panels over the vestibules. In the open parts the seats are placed longitudinally and back to back with a space of 2 ft. 1 in. between. The motorman stands in this space, and there is also room for several standing passengers. This seating arrangement and the straight-fronted vestibules are unusual. Both the open and closed parts of the car are finished in ash, of natural color, with decorated birch veneer ceilings. The long-leaf yellow pine side sills are 4¾ ins. x 7 ins., and are plated on the outside by 8-in. x ¾-in. steel. The white oak cross joists are 3½ ins. x 5⅞ ins. The truss rods are made of 1-in. Norway iron. The corner posts of the closed compartment are 3¾ ins. thick, and the vestibule corner posts 3⅝ ins., the side posts of the closed compartment are 2¼ ins. thick, and in the open 2¾ ins. The distance from the tread of steps to the car floor is 12 ins., and from the rail-head to the step 21 ins. This latter height is allowable, because passengers mount from platforms. Among the builder's specialties are gongs, sand-boxes and radial draw-bars. The trucks carry 38-hp motors, and are of the "Eureka" maximum traction type, with solid forged side frames. The wheel base is 4 ft.; diameter of wheels, 30 ins. and 20 ins., and axles 4 ins.

VIEW SHOWING ARRANGEMENT OF INTERIOR

EXTERIOR OF CALIFORNIA TYPE CAR USED IN CORONADO

STANDARD UNIFORM FOR PACIFIC ELECTRIC RAILWAY TRAINMEN

After carefully considering for some time the merits of different styles of uniforms for its trainmen, the operating officials of the Pacific Electric Railway Company, of Los Angeles, Cal., have adopted one which possesses several good features as well as being very neat and serviceable. The specifications for the uniforms require that they be made of Burlington cloth, with five-button sack coat, having round corners, six-button vest without collar, and pants to match goods. The coat has three buttons on sleeves, two large inside pockets, two small inside pockets, two large outside pockets, one large outside upper pocket and one small punch pocket. The initial letters of the company in silver braid are sewed on each side of the coat collar. The pockets are not reinforced, and should a man leave the service of the company, by removing the buttons and letters he would have a suit of clothes that would be very presentable for ordinary civilian wear—something that cannot be said of the uniform with reinforced pockets.

The specifications further state that all uniforms are subject to inspection, and the company reserves the right to reject any. No second-hand uniforms are accepted unless inspected by the superintendent of the division. The company has been using nickel-plated buttons, but has now adopted aluminum ones, as nickel and gold-plated buttons were found to tarnish quickly in that locality.

The old breast-plate badges that were used have been abolished, and in their stead neat metal number badges adopted for the sides of the cap. These numbers are stamped plainly on metal pieces about 1½ ins. x ¾ in. in size, and as the raised surfaces of the numbers are polished and have a dark background, they can be seen even farther than the breast-plate badge. One trouble with the latter was that the black paint on the indented number could be easily scratched out by the men, so they could only be read at a short distance. Another feature of the cap numbers is that as there is one on each side of the cap they can be seen in almost every position, and also when a breast-plate might be hidden by a crowd.

On the front of each cap is a thin metal plate, bearing simply the word "Conductor," or "Motorman." This is held in place by a silver cord. The style of cap used consists of a skeleton frame, and with each cap are furnished two white duck covers and oil covers for use in wet weather. The duck covers are kept laundered by the men.

The general appearance of this uniform on the men, with white cap, silver letters on the coat collar, and no heavy metal badge to wear a hole in the coat, is a very pleasing one, and it has called forth several compliments from the traveling public. One especially commendable feature of the uniform is the cap number badge, which is certainly to be preferred to the badge hanging by a leather strap from a coat button, which can be so easily removed by the trainman and put in his pocket should he have any trouble with a passenger and desire to conceal his identity.

The uniform mentioned above has also been adopted as the standard for the trainmen of the Los Angeles Interurban Railway Company, a corporation closely allied with the Pacific Electric Railway Company.

The Blue Grass Traction Company, of Lexington, Ky., has made arrangements with J. B. Haggin to have Elmendorf Farm, his beautiful private estate on the line of the road, and one of the finest in the country, thrown open to visitors on certain days each week. Only a short distance from the farm the company has laid out a small park, where a dancing pavilion has been erected and other amusement features provided. Thus the company offers its patrons combined amusement and educational features, the like of which is probably not offered by any other street railway company in the United States.

THE WORKING HOURS OF MOTORMEN IN GERMANY

The somewhat anomalous condition of hours of street railway employees in Germany has already been mentioned in these columns, a condition brought on by the fact that the conductors often receive tips from passengers for information and other services. This makes them advocates of long hours. The motormen, on the other hand, want short hours, and claim that they are rendered unfit for the proper performance of their duties if overworked.

Several of the State authorities have drawn up a number of rules regulating the employment of motormen, basing their right to do so on their responsibility for the public safety of streets. The working time in large cities is, of course, much shorter than in the small towns and country districts, where the motormen are not required to give such constant attention to their duties. An idea of what the authorities require in the large cities may be obtained by examining the following ordinance, which went into effect in Dresden on March 14, 1904:

> Motormen and other employees must not be employed more than 200 hours during a period of three weeks, nor for more than ten hours a day without an intermission of two hours. Even where such intermission is given the total number of working hours a day must not exceed twelve. Once in every seven days the working day may be increased to fourteen hours. There must be an interval of at least eight hours following a day's work. Lay-offs of a half-hour or less are to be counted as working time. Motormen and signalmen must be granted at least three resting intervals of twenty-eight hours each, within every three weeks.

It is probable that in no case in Germany have rules been made regulating the working time of conductors, as the authorities apparently do not hold the former so responsible for the public safety as the motormen. The railway company is the only one which suffers if the conductor is too tired to tend to his duties properly. In general, the working time of conductors is from 1 hour to 1½ hours more than that of motormen on the same line.

The laws relating to the hours of motormen are not the only ones by which the authorities regulate the internal affairs of street railway companies. Lately some other rules have been issued with reference to advertisements in cars. The windows as well as the exterior sides of the car must not be used for advertising matter, nor are dull or colored windows permitted. The only advertisements allowed on the outside of cars are those relating to the routes.

Returning to the subject of motormen, one of the questions brought up at the February meeting, in Essen, of the Rheinisch Westfälische Strassenbahn Betriebsleiter-Vereinigung (Street Railway Managers Association), was, "Should a manager always suspend a motorman who has had an accident until the case has been finally settled in the courts, or should he judge each case on its own merits?" It is plain that there are two sides to this question. If the motorman is retained in the employ of the company while the case is on trial, and another accident occurs to him, it will be brought up as strong presumptive evidence of negligence in the first accident, and the manager would be censured for not having discharged the motorman immediately. Should, however, a new man be employed in the interim, the likelihood of accidents resulting is much more probable than if the other man is retained, as the latter would naturally be very careful to avoid another accident. Of course, if the motorman had shown gross negligence in a number of cases he should be discharged at once. The convention decided unanimously that each case required separate treatment, and that it would, therefore, be a mistake to suspend the motorman in every instance.

FINANCIAL INTELLIGENCE

WALL STREET, June 22, 1904.

The Money Market

The question of the money supply has ceased to occupy the prominent place in financial discussion that it did up to a short time ago. This is because of the feeling of certainty that money rates are going to continue at their present low level for at least a number of weeks to come. There are not a few critics who think that even when the crop moving demands are well under way no appreciable advance in rates will occur. The harvest requirements are the only thing now in sight to draw at all heavily on the redundant stores of capital in the New York market. Gold exports are over for the season, the Treasury is paying out more on its ordinary disbursements than it is taking in on revenue collections, and, finally, scarcely a week goes by but what checks for a million or two millions are paid out by the local sub-Treasury on account of arrivals of new gold. Under these several influences reserve holdings in the banks are piling up at an extraordinary rate, and surplus reserve has risen to the unusual figure of $38,000,000. This is the largest total for the season in ten years. In view of this remarkable accumulation of idle capital there is plainly good ground for believing that the usual autumn outflow to the interior will have comparatively little effect. Two changes might occur later on which can now only be ranked as possibilities. One of these is a revival in general business, and the other the renewal of speculative activity, through both of which the demand for bank money might become much more active, causing in the end a rise in money rates. But as matters stand at present the opinion of bankers is best expressed in the eagerness of which long-time loans are being offered at purely nominal figures. Six months' accommodation is easily obtainable at 3 per cent, and loans extending over the first of the year are made at 3½ per cent. For sixty and ninety days 1¾ to 2 per cent is the best that the market affords, while call money is going begging on the Stock Exchange at 1 per cent.

The Stock Market

Interest in the week's proceedings on the Stock Exchange has centered largely in the remarkable financial plan announced by the Southern Pacific Company. With the details of the proposal for a $40,000,000 new preferred stock issue the public is now familiar; its bearing on the immediate financial situation is the point of most concern. Professional Wall Street has greeted the announcement very coldly, and has accepted the view that it is something decidedly unfavorable for the holders of present Southern Pacific stock; the financial representatives of the company have, on the other hand, contended that the time had come to pay off the floating debt amounting to $30,000,000, and that this was a necessity in order to pave the way for refunding the high interest-bearing obligations into a long-term, low-rate bond. They claim that a 7 per cent stock issue, for which the stockholders should have the privilege of subscribing, is a much sounder method than either an issue of new bonds at a high rate interest or a flotation of stock carrying lower dividends for which the services of a banking syndicate would be required. At this writing it is uncertain what the final effect of the episode will be upon the market. Sanguine critics profess to see in it a mark of confidence in the general financial outlook from high financial quarters, while those of less cheerful temperament regard it as a decisive check upon the improvement in prices which appear to have gained a vigorous start a week ago. At all events, speculation for the rise has quieted down visibly within the last few days, and trading has again become inactive. So far as any tendency is shown, it is upward rather than downward. Liquidation, it is now seen, is over, and will not start up again unless outside affairs take some unexpected turn for the worse. A large short interest has not yet been entirely covered, and while there is no outside buying to speak of, these covering purchases from time to time are sufficient to keep the market strong. More interest is felt in the crop reports than in the political conventions. The possibility of a chill preceeding the Democratic meeting at St. Louis on the sixth of July is not ignored by cautious persons. But the apparently slight chances for the nomination of a candidate committed to radical principles, prevents this matter from having any practical effects on financial calculations. A decided improvement has occurred in the condition of all the growing crops, and it is on this chiefly that the hopes of better things in Wall Street now rest.

A further sharp advance in Manhattan Elevated and exceptional weakness in Metropolitan issues have been the incidents of the week in the local traction dealings. A good deal of the buying in Manhattan has been for investment, and this, as well as the rise in the price, proceed from the conviction that if the Interborough Company is able to pay dividends to its own stockholders out of the surplus earnings of the elevated lines, the 7 per cent on Manhattan is assured for all time. No new reason that is at all satisfactory has appeared for the weakness in Metropolitan shares. There have been various stories of an impending bond issue, of a reduction in dividends, and of somebody depressing the stock in order to acquire a commanding interest in the property. But all of this is pure Wall Street gossip. It looks now as if there has been real Metroplitan stock for sale for some time, and that the professional traders using this selling as a basis have been able to raid it successfully. Brooklyn Rapid Transit stock, and all the associated bonds, have made the highest prices this week that they have recorded for some time. The large increase in the company's earnings is still the main incentive for buyers.

Philadelphia

The only movement of consequence in the Philadelphia market during the week was the advance in American Railways. The stock was bid up on light transactions from 43¼ to 46, at which latter figure several hundred shares changed hands. In connection with the rise, a good deal was heard about the increasing earnings of the property, but no definite explanation other than this appeared. About 250 shares of Consolidated Traction of New Jersey sold at 67½, an advance of 2 points from recent prices. Philadelphia company common was dealt in in a somewhat smaller quantity than usual, between 38¼ and 38½. There were no sales of the preferred during the week. The advance in Philadelphia Traction continued, the stock rising to 96⅝, but later easing off to 96¼. Philadelphia Electric was dull around 6. Union Traction sold between 50 and 50¼. Fifty shares of Rochester Passenger preferred went at 100 and a small lot of Pittsburg preferred at 49.

Chicago

It is said that strong interests are buying quietly into the underlying shares of the Union Traction Company. North Chicago has sold this week at 79, and West Chicago at 45, but the dealings in both issues have been much lighter than in the previous weeks. Metropolitan Elevated is reported to be making an excellent showing in its traffic for the month of June. The management expect to open a new down-town terminal early in July, and it is calculated that the road will at once feel the return of a large travel formerly driven from it by the congested conditions prevailing. Close friends of the company are talking of the strong probability of its resuming dividends on the preferred stock in August. They argue that 5 per cent at least will be shown as earned for the fiscal year. These anticipations explain the recent strength in the stock, which has sold freely this week again as high as 57. Metropolitan common has changed hands between 20½ and 20¾, Northwestern common between 17 and 17¼, and a small lot of Northwestern preferred at 46. South Side has been notably strong, 100 shares selling at 91 ex the quarterly dividend of 1 per cent.

Other Traction Securities

The feature in the Boston list has been a further advance in Boston Elevated from 147½ to 151½ on fairly large dealings. This stock is up now more than 10 points as compared with a few weeks ago. It has been accumulated for no new reason, but apparently through better appreciation of the investment merits of the property. After selling at 19, Massachusetts Electric common declined to 18 on sales of 100 shares. It dropped to 17½, but later returned to 18. Only a few sales occurred in the preferred stock at 70 and 71. West End common was dealt in moderately between 90¾ and 91, while transactions were reported in the preferred at 111. In Baltimore the market for United Railway securities has not recovered from the shock given it by the recent passing of the coupon on the income bonds. These bonds made a new low record during the week, getting down from 44¼ to 41⅝. One hundred shares of the stock sold at 5⅞. The general mortgage bonds, after reaching 90¾, declined to 90. A sale of Augusta Street Railway 5s took place at 100¼; no other transactions in the other street railway issues, sometimes active in Baltimore, were reported on the week.

On the New York curb, Interborough Rapid Transit made a new high price, selling up to 120. About 9000 shares were dealt in last week on the advance from 115. Five hundred Washington Railway & Electric common sold in all at 15½. Nassau Electric 4s were very active, both on the curb and the Stock Exchange, gaining another point to 83½. One bond of the Washington Railway went at 78.

Cincinnati Street Railway suffered a decline at Cincinnati last week. It opened at 145 and fell gradually to 142½, sales of about 600 shares. Cincinnati, Dayton & Toledo made gains, opening at 22⅛ and closing the week at 23⅝. There were small sales in Cincinnati, Newport & Covington common at 28½, and the preferred at 85½, both old prices.

At Cleveland the demand for Cincinnati, Dayton & Toledo continued strong. The low at 22¾ and the high 24. Cincinnati interest are said to have increased their holdings by about 4500 shares during the past week, and the available supply in Cleveland has been reduced to a few hundred shares, the balance being closely held. Old prices prevailed on Cleveland Electric, Northern Texas and Syracuse, with but few sales. Northern Ohio Traction & Light 4s sold at 56, and there was a demand at a little under that price. A small lot of Miami & Erie Canal bonds sold at 12½, the lowest price on record.

At Columbus, the Columbus Railway preferred sold at 106½, and the new Railway & Light advanced to 36¾, a dividend being predicted for this stock in the near future. Columbus, Buckeye Lake & Newark Traction is in demand at 91, and Columbus, Delaware & Marion preferred at the same price.

At Toledo last week there was considerable trading in Toledo Railway & Light, and it showed a decline of from 19½ to 19. Detroit United sold at 60½, and Toledo & Western at 14.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with last week:

	Closing Bid	
	June 14	June 21
American Railways	43	44½
Aurora, Elgin & Chicago	a14	a14
Boston Elevated	147	150
Brooklyn Rapid Transit	48⅝	48¾
Chicago City	175	a175
Chicago Union Traction (common)	5¼	—
Chicago Union Traction (preferred)	a30	a30
Cleveland Electric	70½	69
Consolidated Traction of New Jersey	66	67
Consolidated Traction of New Jersey 5s	105¼	105¾
Detroit United	61	66¾
Interborough Rapid Transit	118¼	118½
Lake Shore Electric (preferred)	a30	—
Lake Street Elevated	3¼	—
Manhattan Railway	148⅜	148½
Massachusetts Electric Cos. (common)	18¼	18
Massachusetts Electric Cos. (preferred)	70	70½
Metropolitan Elevated, Chicago (common)	20½	18½
Metropolitan Elevated, Chicago (preferred)	56	55
Metropolitan Street	114½	110⅞
Metropolitan Securities	80	76¼
New Orleans Railways (common)	9	9
New Orleans Railways (preferred)	27½	27½
New Orleans Railways, 4½s	—	74
North American	84	85½
Northern Ohio Traction & Light	13	13
Philadelphia Company (common)	38¼	38⅝
Philadelphia Rapid Transit	12	11¾
Philadelphia Traction	96¼	96½
St. Louis (common)	13½	13
South Side Elevated (Chicago)	91½	90½
Third Avenue	120½	119
Twin City, Minneapolis (common)	93½	94
Union Traction (Philadelphia)	50	50¼
United Railways, St. Louis (preferred)	57	56½
West End (common)	90½	90¾
West End (preferred)	111	109

a Asked.

Iron and Steel

Although a more hopeful feeling seems to prevail in some quarters of the iron trade, it is hardly based on anything substantial according to the testimony of recognized authorities. On the contrary, reports have come to hand this week of numerous mills, active in the spring, which are doing nothing now. All branches of the industry are quiet, and the outlook favors continuation of the dullness throughout the summer. Opinion differs as to whether or not further price concessions will be necessary, but close observers agree that there are no signs immediately in sight which would suggest any decided turn for the better. Quotations are as follows: Bessemer pig iron $12.85, Bessemer steel $23, steel rails $28.

Metals.

Quotations for the leading metals are as follows: Copper 12½ and 12¾ cents, tin 26¼ cents, lead 4¼ cents, and spelter 4 13-16 cents.

NEW YORK CENTRAL CUTS RATES TO MEET TROLLEYS

The New York Central Railroad last week made a reduction in fare of 25 per cent to points along the Auburn & Syracuse Electric Railway, a competing line. It is understood that like reductions will be made at other points in the Mohawk Valley where the New York Central Road is parallel with the trolley lines.

PHILADELPHIANS BEHIND INDEPENDENT COMPANY IN BALTIMORE

It is now disclosed that Philadelphians with important holdings in electric railways in different parts of the country are behind the Maryland Electric Railway Company, which has an application pending before the City Council of Baltimore for a franchise for an electric railway in that city. Clarence Wolf and W. R. Benson, of Philadelphia, the former of whom is a member of the banking firm of Wolf Brothers & Company, are now in Baltimore in the interest of the company. Mr. Wolf also is a large stockholder of the Philadelphia Rapid Transit Company, and Mr. Benson is an experienced street railway man, having been general manager of the Hestonville Railway Company, of Philadelphia. Besides Mr. Wolf and Mr. Benson, who, as just stated, are in active charge of the affairs of the company, Charles A. Porter, of Philadelphia, and William A. Walker, of New York, are interested in the company. Mr. Walker formerly was a director of the American Tobacco Company, but is unknown in the traction field. Not so, however, with Mr. Porter. He is connected with the Fairmount Park Transportation Company, operating an electric railway in Fairmount Park, Philadelphia, and is president of the Long Island Electric Railway Company. Those back of the company see in Baltimore a lucrative field for operations, and are determined to carry out the project if anything like equitable terms are offered by the City Council for the privileges they seek.

CANADIAN STEAM ROADS BUY ELECTRICS

The Grand Trunk Railroad has completed the purchase of the Hamilton, Grimsby & Beamsville Electric Railway and the Canadian Pacific Railway is reported to have arranged the purchase of the Niagara, St. Catharines & Toronto Railway. In the case of the Grand Trunk purchase, the price at which the electric company's stock was taken is understood to have been $200 a share. Although the final arrangements in this deal were only completed a few days ago, the Grand Trunk has assumed full charge. Already A. H. Myles, C. H. Myles and Robt. Ramsay have retired as directors, and in their stead have been elected J. W. Nesbitt, K. C., J. G. Gould and Jos. Dixon, all Grand Trunk representatives. No changes have as yet been made in the officers. The Hamilton, Grimsby & Beamsville Company operates 23 miles of standard gage line laid with 50, 65 and 70-lb. girder and T-rails The authorized capital stock of the company is $200,000, of which $113,300 is outstanding. There is an authorized issue of 5 per cent bonds to the amount of $100,000, of which $85,000 has been issued. The road was placed in operation Oct. 18, 1894, and extending from Hamilton to Grimsby and Beamville, traverses a region most fruitful, and has enjoyed a large freight business.

The Niagara, St. Catharines & Toronto Railway is a converted steam line, and is a model of its kind. It is built almost entirely over private right of way, and operates a through freight service in connection with the various steam roads. There are freight sidings into as many as fifty manufacturing plants. The company also has its own private telegraph and telephone lines. In short, it is operated entirely on the basis of a steam road. The authorized capital stock of the company is $1,000,000, of which $925,000 has been issued. Bonds to the amount of $710,000 are authorized, but only $394,000 has been issued, of which $116,000 is in the treasury.

ANOTHER CHICAGO FRANCHISE PROPOSITION

The local transportation committee of the Chicago City Council has sent the following communication to the Chicago City Railway, defining its position as regards franchise extensions:

This committee is willing to consider the completion of the "tentative ordinance" for the Chicago City Railway Company on the basis of a fixed term in commutation of all the rights of the company in the streets under its unexpired grants including its claims under the ninety-nine-year act. The commuted or average term on which this basis would be, say, about twelve years. The ordinance should give to the city the right, upon the expiration of the commuted term or of any subsequent year up to twenty years, to deal freely with the tangible property of the company on the basis of its fair value—that is (a) to purchase it, or (b) to require its sale to another corporation. The grant, if on this basis, is to carry less compensation for the commuted term, with greater compensation after its expiration for such time as the company may thereafter operate under it up to twenty years from the date of the ordinance.

TROLLEY VERSUS STEAM

Ray Morris has contributed to the current "Atlantic Monthly" an interesting article entitled "Trolleys Versus Steam," in which he reviews the growth of the electric railway since 1890, and discusses the effect of electric competition with the steam roads. He takes as his authority for the increase of 1637 per cent in trolley lines since 1890, the census bulletin on electric railways, and in discussing this remarkable growth reviews the reasons why New York, Chicago and other large cities similarly situated, have not reaped the benefits of the trolley lines. As examples of the development that has been so general Mr. Morris takes several Western roads that connect two or three good-sized cities. His first reference for purpose of comparing steam and electric traffic is to the Lake Shore & Michigan Southern, and the electric railway operating between Cleveland and Oberlin, Ohio, 34 miles west. In 1895 the Lake Shore & Michigan Southern carried 104,246 westbound between these places, and 98,588 eastbound passengers. The competition of the electric roads, which at this time had commenced building a network of lines around Cleveland, was so severe, that in 1896 the steam road carried 68,000 pasengers less between the points named, and in 1902 carried a total of 91,761 as against 203,014 seven years before. Between Cleveland and Painesville, 29 miles, and intermediate points, the Lake Shore & Michigan Southern carried a total of 199,292, or an average of 16,608 a month in 1895, and 28,708, or an average of 2392 a month in 1902. In other words, the steam road carried more passengers in two months, during the formative period of the electric lines, than it did in a year after they were completed and had developed their traffic between the competitive points.

The following table summarizes these results, showing the surprising traffic losses which the steam roads have sustained. The lower average fare on the New York, Chicago & St. Louis indicates the effort made by that company to compete with the electric road for the business, but the falling off in number of passengers carried shows how futile this effort has been.

LAKE SHORE & MICHIGAN SOUTHERN

Passengers carried between Cleveland and Oberlin, and intermediate points:

	Westbound	Eastbound	Total	Average per month
1895	104,426	98,588	203,014	16,918
1902	46,328	45,433	91,761	7,647

Passengers carried between Cleveland and Painesville, and intermediate points:

	Westbound	Eastbound	Total	Average per month
1895	97,460	101,832	199,292	16,608
1902	13,106	15,602	28,708	2,392

NEW YORK, CHICAGO & ST. LOUIS

Passengers carried between Cleveland and Lorain:

	Total Passengers	Revenue	Average Revenue
1895	42,526	$25,523	60c.
1902	9,795	4,379	44c.

Mr. Morris also refers to the ability of the electrics to create traffic where none seems to exist, citing the Detroit, Ypsilanti, Ann Arbor & Jackson as a remarkable instance. In closing his article he refers to the futility of the cut rate as a means of checkmating the electrics, and also calls attention to the policy of the New York, New Haven & Hartford toward electric competition, and to the tendency in England toward the electrification of the steam lines.

BRITISH REQUIREMENTS OF UNDERGROUND ELECTRIC ROADS

The following are the requirements of the British Board of Trade in regard to the precautions to be taken against the risk of accidents by fire on underground electric railways, and contained in an order issued last month:

A.—STATIONS AND PERMANENT WAY

1. Sleepers to be of hard wood, not creosoted, and to be laid in concrete or ballast, and covered with a layer of gravel or finely broken stone free from dust, the ballast to be finished to a level surface, so as to form a convenient roadway for passengers in case of emergency. If ballast is not used, the space between the rails to be covered with granolithic slabs, or slabs of a similar material, to form as wide a roadway as possible for passengers. No timber planks to be used.

2. Tunnels to be provided with lights capable of being turned on from the stations at either end of each section, and if necessary, at some intermediate points. The lighting circuits to be independent of the traction supply.

3. Separate entrances to and exits from each platform of the stations to be provided, and to be situated as nearly as possible in the middle of the platforms.

4. All stairways, passages and exits from the stations to be conspicuously lighted. Not less than 25 per cent of the lights in these places to be supplied from independent source. If necessary, the exits to be made more conspicuous by the use of colored lights, in addition to white lights.

5. Platforms not to be made of wood, and woodwork to be eliminated as far as possible from signal boxes, lifts, offices, &c., below ground.

6. Efficient hydrants, hose and fire prevention appliances to be provided.

7. Ventilating ways to be provided wherever possible from the station and the tunnels to the surface.

B.—EQUIPMENT

8. Cars to be constructed of metal; woodwork to be reduced to a minimum and to be non-inflammable. Hard wood to be used in preference to soft. Interior fittings, panels, seats, &c., to be of incombustible material.

9. No main electric cable to be carried through the train, and motors to be placed on the front and rear carriages only. No motor to be situated in the middle of the train.

10. Means to be provided at both ends of every train to enable passengers to alight from the cars in case of emergency. Oil lamps to be carried in every train.

11. India rubber or other inflammable insulating material to be avoided as much as possible, and the outer covering of cables to be uninflammable material that will not give off smoke.

12. Means to be provided for enabling a driver at any part of the tunnel to put himself into telephonic communication with the adjacent stations.

HERBERT JEKYLL,
Board of Trade (Railway Department), May, 1904.

ALLIS-CHALMERS TURBINE CONTRACT

The Transit Development Company, acting in behalf or the Brooklyn Rapid Transit Company, has just placed a contract with the Allis-Chalmers Company for a 5500-kw turbine, to be direct connected to a 25-cycle 750 r. p. m., three-phase alternator, wound to give either 6600 volts or 11,000 volts. This equipment is intended to be installed in the enlarged Kent Avenue power station of the Transit Company. It is the second generating outfit ordered for this station, the Westinghouse interests having recently secured a contract for a 5500-kw turbine and generator. The Kent Avenue plant, it is expected, will ultimately have a capacity of not less than 66,000 kw.

FURTHER MANILA CONTRACTS

Further interesting contracts were awarded last week for various equipment for the power house, etc., for the 40 odd miles of electric traction system at Manila, Philippine Islands, which road is now being hastened to completion by J. G. White & Company, of New York. The boilers for the power station will be of Babcock & Wilcox build. There will be six boilers of 400 hp capacity each. The steel work for the car house and shops will be shipped by the United States Steel Corporation. The Western Electric Company has been allotted the contract for the telephone system to be used for dispatching the cars. The Charles E. McInnes Company, of New York, will supply the bracket fittings, etc.

MR. SWIFT, OF AMERICAN SYNDICATE, ON RAILROADS IN THE PHILIPPINES

In this letter dated Manila, P. I., May 19, to the New York Globe and the Chicago Record Herald, and printed in those papers a few days ago, William E. Curtis quotes Charles M. Swift at considerable length regarding the latter's plans for securing steam and electric railway grants on the island. It will be recalled that Mr. Swift is interested in the street railway system now building in Manila, and that associated with him in his various enterprises on the island are the Westinghouse interests, J. G. White & Company, of New York; Frank Buhl and Peter L. Kimberly, of Sharon, Pa.; W. C. McMillan, W. T. Gray, of Detroit, and others. Although Mr. Swift, as previously noted in the STREET RAILWAY JOURNAL, is now in New York, some statements accredited to him by Mr. Curtis seem worthy of mention here. According to Mr. Curtis, Mr. Swift while here will lay before the Government at Washington an offer to build the entire 700 miles of railroad recommended to be constructed by an engineering commission organized by Secretary Taft when he was Governor of the island. This commission recently reported in favor of three routes:

1. From Manila to Aparri, 336 miles; highest point in altitude, 3750 ft.; 4000 ft. of tunnels required; 20 miles of canyon work; maximum grade, 3½ per cent; cost, $6,675,602.

2. From Daigupan to Laoag, 168 miles through flat country, but a good many bridges required; maximum grade not more than ½ of 1 per cent; cost, 3,367,036.

3. From Manila to Batangas; 69 miles through flat country, sugar, rice, coffee and hemp lands; maximum grade not more than 1½ per cent; cost, $1,097,457.

These three lines the commission thought most important and recommended their immediate construction, and their recommendations have been approved by the commission and have been laid before Congress by Secretary Taft.

Mr. Curtis quotes Mr. Swift as saying:

"Such lines can be built and equipped for $30,000 a mile, and can be operated by electricity wherever water power can be utilized, and by steam elsewhere; and the gentlemen with whom I am associated are prepared to undertake the work and develop a system of 700 miles, more or less, of first-class, up-to-date American railway, with frequent fast trains. I have looked over the ground personally and am enthusiastic on the subject, but the first thing is to get politics out of the affair. The trouble in the Philippines now is too much politics and too little trade, and everybody concerned must agree upon certain propositions before anything serious can be done. * * *

"At present the greatest need of the Philippines is transportation. The islands are capable of producing several times as much rice, copra, hemp, tobacco, sugar and other products as are now grown. Hundreds of thousands of acres are uncultivated, because there is no way of getting the products to the market except at a prohibitive cost. They are now brought in by bullocks. It costs as much to haul hemp 25 miles as it does to raise it, so that away from the streams and the seacoast the best land in the world is absolutely worthless. A first-class railway system, supplemented by the proper water transportation, will solve the problem and ought to bring about almost instant prosperity to the people. It will certainly increase the exportable products many fold, and there is a demand for everything that can be raised here.

"There are other considerations also. A railway from Manila to Bagio would take people out of the tropics and in six hours put them into a country as cool, healthy and attractive as the Adirondacks. But good hotels are equally necessary. The Government can afford to sink $150,000 a year in encouraging the establishment of good hotels, for without them you cannot get people to come here, and as long as the people will not come, the islands will have a bad reputation, and the much-needed immigrant with capital and energy and brains will stay away. And he is needed here very badly. If we are allowed to build the proposed railways we will put up good hotels as a part of the railway system at every place they are needed and will see that they are well kept.

"My investigations have been confined to Luzon, and before I make my report to my associates at home I do not care to go further into details, but I can say that we are willing to undertake the proposed railroads. We have that much faith in the future of these islands."

The Philadelphia Rapid Transit Company is following the suggestion of the Department of Health of that city, and is substituting rattan for the plush covering of the seats in its winter cars.

MANUFACTURERS' COMMITTEE OF THE A. S. R. A.

The organization of manufacturers appointed at the last meeting of the American Street Railway Association, and sometimes known as "the Supply Men's Committee," has been enlarged according to the powers given the committee at Saratoga, and now consists of ten gentlemen, as follows: Daniel M. Brady, chairman, president Brady Brass Company; George J. Kobusch, president St. Louis Car Company; John A. Brill. vice-president J. G. Brill Company; J. R. Lovejoy, manager railway department, General Electric Company; Arthur Hartwell, sales manager, Westinghouse Electric & Manufacturing Company; James H. McGraw, president STREET RAILWAY JOURNAL; William B. Albright, director Sherwin-Williams Company; W. J. Cooke, vice-president McGuire-Cummings Manufacturing Company; Fred S. Kenfield, president Street Railway Review; Scott H. Blewett, general agent American Car & Foundry Company.

The headquarters of the committee are at 95 Liberty Street, New York. As there is to be no separate exhibition of street railway apparatus at the convention of the American Street Railway Association this fall in St. Louis, the work of the committee will not be very large this year, but an organization has been effected, and the committee will be able to do such work as may be required of it at the next convention of the association.

BRAKE EQUIPMENTS FOR THE SUBWAY

The Interborough Rapid Transit Company, operating both the subway and elevated lines on Manhattan Island, recently placed an order for the brakes, including motor compressors and governors, for the 200 new steel cars they have been building to operate in the subway. These brakes are understood to be of the Westinghouse quick-action, automatic type, employed on steam railways, with their minor additions necessary to adapt them to trains operated by multiple unit control. The compressors and electric pump governors are to be of the Westinghouse Traction Brake Company's standard type, and will be of the latest form, embodying a number of improvements which this company has recently made in these portions of its apparatus.

BROOKLYN "BOUNCERS" MAKE MANY ARRESTS

The "bouncers" employed by the Brooklyn Rapid Transit Company to protect its patrons from assault at the hands of rowdies, and to force the rougher element of the Brooklyn Bridge crowd to a realization that consideration must be shown others, are doing a lucrative business, but are steadily decreasing the number of rowdies by their vigilant work. On Monday, June 20, thirty-eight men were arraigned before Magistrate Breen, charged with jumping through the windows of the bridge cars at the Manhattan end of the Brooklyn Bridge. A fine of $2 was imposed in each case, and the Magistrate said that hereafter a fine of $5 would be imposed in such cases, and if that was not sufficient to stop the nuisance, he would increase it to $10. The previous Sunday fifty-five arrests were made at the Manhattan end of the bridge. Magistrate Dooley, before whom a batch of climbers was arraigned, was not as lenient as Magistrate Breen. He fined the men arraigned before him $10 apiece. The "bouncers" are also getting in good work at Coney Island. Every Sunday sees a batch of offenders gathered in there and placed in the keeping of the Coney Island police. The conditions at Coney Island, however, are not as good for window climbing as are those at the bridge.

ROCHESTER RAILWAY & LIGHT COMPANY ORGANIZES

The Rochester Railway & Light Company, of Rochester, N. Y., which has consolidated the railway and lighting interests of the city, has organized as follows: Henry D. Walbridge, of New York, president; Frederick Cook, chairman board of directors; E. W. Clark, Jr., and Granger A. Hollister, vice-presidents; William M. Eaton, treasurer and general manager; George E. Hardy, secretary and assistant treasurer; James T. Hutchins, superintendent of electrical department; George A. Redman, superintendent of water power; Albert H. Harris, attorney; Frederick Cook, C. N. Clark, Henry D. Walbridge, Granger A Hollister and Albert H. Harris, executive committee.

The directors of the company are: Frederick Cook, Henry D. Walbridge, Granger A. Hollister, E. W. Clark, Jr., Anton G. Hodenpyl, Alexander M. Lindsay, Edward Bausch, T. W. Finucane, A. O. Fenn, E. H. Satterlee, Henry A. Strong, C. M. Clark, George W. Archer, James Richardson and Albert H. Harris.

ANNUAL REPORT OF THE NURNBERG-FURTHER STRASSENBAHN

The Nurnberg-Further Strassenbahn, of Nurnberg, Germany, purchased by the municipality in June, 1903, has recently issued its report for 1903, which contains some interesting data on traffic conditions in one of Germany's most famous cities.

The total length of all lines was 27.65 km (16.6 miles) and the number of passengers carried 20,400,000, of whom nearly 10 per cent traveled free, because they were municipal employees or people voluntarily serving charitable organizations. This traffic was carried on 109 motor cars and 87 trailers, seating a total of 6600. The gross income was 1,750,688 marks ($437,672); total expenses, including depreciation and interest charges, 1,697,589 marks ($424,147), and ratio of actual cost to gross income, 48.7 per cent. The income per car-km was 28.9 pfgs (12 cents per car-mile), and operating expenses per car-km 14.2 pfgs. (5.9 cents per car-mile). The power station generated 3,159, 100 kw-hours, at a cost of 5.15 pfgs. (1.28 cents) per kw-hour.

AUSTRALIAN TRACTION PROJECT

Australian advices state that the proposals to construct an electric traction system in Essendon and Flemington, suburbs of Melbourne, have at last received the sanction of the Victoria Government authorities.

The scheme is fostered by A. E. Morgan, at one time Premier of Western Australia. The municipal authorities of the districts concerned will obtain an order in council for the construction of the tramways, thereafter transferring their powers to Mr. Morgan, who undertakes to commence the erection of the power house within three months, to start the remaining works within nine months, and to have the lines within operation within twenty-one months from date of the transfer, which is expected to be made without delay.

The Australasian electrical engineering and contracting firm of Noyes Brothers, which represents the Westinghouse and Brill interests in the Antipodes, is after the contract for the construction and equipment of the lines, which it is estimated will represent an initial expenditure of some $500,000.

NEW PUBLICATIONS

Trolley Wayfinder, 80 pages, paper. Price 10 cents. Birdseye View of the Trolley Roads in New England. Price 10 cents. Published by the New England Street Railway Club.

The book mentioned contains maps and time tables, with distance travelled and fares charged, of all of the principal electric lines in New England, and should be found of great convenience to the traveling public. To those who want a birdseye map of the territory traversed, the map mentioned will appeal. Both publications are excellent instances of what may be done in popularizing through excursions, and are a great credit to the club.

The Manual of Statistics, 1904. 1,040 pages. Price, $5. The Manual of Statistics Company, New York.

This manual is now in its twenty-sixth year, and, as in previous years, a large part of the book is devoted to the statistics of steam railroad, the larger street railway and industrial corporations. An important feature of the book is also the stock and bond quotations of the different stock exchanges, giving high and low for each of the last three years. There is also a comprehensive index with 3000 titles.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED JUNE 14, 1904

762,297. Third Rail Insulator; Henry L. Fritze, Jersey City, N. J. App. filed Oct. 27, 1903. The base plate is cemented into insulating material covered with a rubber pad, mica disc, and cover bolted together, all metal enameled.

762,318. Conductor and Collector for Electric Railways or Tramways; Donald Kempf, Buenos Ayres, Argentina. App. filed Mar. 11, 1903. The third rail is grooved for the reception of a number of sharp-edged disc collectors.

762,319 Contact Box and Conductor for Electric Railways or Tramways; Donald Kempf, Buenos Ayres, Argentina. App. filed Sept. 23, 1903. Details.

762,342. Railway Track Structure; Edward Ott, Johnstown, Pa. App. filed Oct. 22, 1903. Relates to novel means for fastening wear-plates in position.

762,375. Apparatus for Removing Snow from Railway Tracks; De Witt A. Beaudette, San Francisco, Cal. App. filed Feb. 10, 1904. Adjustable deflecting wings attached to a car truck for drawing the banked snow at the side of the track onto the track where it can be reached by a rotary snow plow.

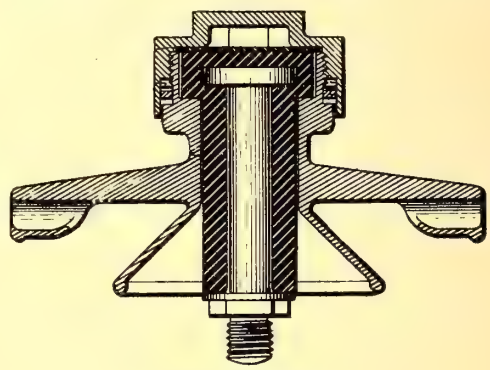
762,379. Trolley Wheel; John S. Briggs, Los Angeles, Cal. App. filed April 25, 1903. A spring mounted in the tread of the wheel to give yielding contact with the wire and avoid sparking.

762,668. Car Traction Device; Samuel C. Webb & Isaac Weil, Monongahela, Pa. App. filed Sept. 26, 1903. A coupling device for connecting cars to a traction cable, consisting of a wheeled clamp secured to the cable and having a connection which directly engages the clamp, and a rail or guide for the clamp arranged to rotate the clamp laterally at curves.

762,749. Trolley; Rowley K. Ortt, Reading, Pa. App. filed Nov. 4, 1903. The trolley wheel is swiveled on ball bearings to turn laterally to accommodate itself to kinks in the wire.

762,768. Rail; Louis Steinberger, New York, N. Y. App. filed Dec. 16, 1903. The third rail is L-shaped in cross section and saddled upon a support which permits it to rock.

762,769. Support for Rails; Louis Steinberger, New York, N. Y. App. filed Feb. 11, 1904. An ordinary T-rail is so mounted as to permit of certain freedom of movement.



PATENT NO. 762,791

762,791. Trolley Hanger; Montraville M. Wood, Schenectady, N. Y. App. filed Dec. 15, 1902. Details of construction.

762,823. Trolley Wheel; Stewart J. Hamlin, Allegheny, Pa. App. filed Mar. 29, 1904. Two trolley wheels mounted in tandem in a pivoted yoke.

762,831. Trolley Base; Peter D. Milloy, Buffalo, N. Y. App. filed Mar. 29, 1904. Details.

762,840. Feed Wire Connection; George L. Osborn, Boston, Mass. App. filed Sept. 2, 1902. A flat plate adapted to be soldered to a rail, a downwardly-projecting neck disposed at approximately right angles to the plate and a cup for the end of the feed wire formed at the lower end of the neck on the side opposite the plate.

PERSONAL MENTION

MR. LEE MESSENGALE has been appointed master mechanic of the East St. Louis & Suburban Railway Company, of East St. Louis. Mr. Messengale has recently been connected with Rossiter, MacGovern & Company, of New York, and previous to that was master mechanic of the St. Louis Transit Company.

MR. HOWARD F. GRANT, resident manager of the Seattle Electric Company, of Seattle, Wash., has returned to that city after a trip to the East, during which he was in consultation with Stone & Webster, of Boston, the managers of the company. In making the trip Mr. Grant visited New York, Buffalo, Toronto and other cities, and stopped at St. Louis for several days to see the exposition.

MR. NEWTON W. BOLEN has resigned as general superintendent of the North Jersey Street Railway; Elizabeth, Plainfield & Central Jersey Street Railway, and Orange & Passaic Valley Railway Company's lines of the Public Service Corporation, of New Jersey, to accept a position under Mr. W. W. Wheatley, as general superintendent of the Mexico City Tramway Company's lines in Mexico City, Mex. Mr. Bolen was connected with the Brooklyn Rapid Transit Company in the capacity of division superintendent before he became connected with the Public Service Corporation. His successor in the Public Service Corporation has not yet been chosen.

9

INDEXED

STREET RAILWAY JOURNAL

A WEEKLY RECORD OF THE WORLD'S PROGRESS IN CITY AND INTERURBAN RAILROADING.

McGRAW PUBLISHING COMPANY, 114 Liberty Street, New York. Branch Offices: Chicago, Philadelphia, Cleveland, London.

VOL. XXIII. No. 1. JANUARY 2, 1904. $4.00 PER YEAR TO UNITED STATES, CANADA AND MEXICO. $6.00 PER YEAR TO OTHER COUNTRIES.

TABLE OF CONTENTS.

Entered as second-class matter at the New York Post Office.

Alphabetical Index to Advertisers, Pages 9-13 Classified Directory, Pages 17-24

SACHS TRADE NOARK MARK FUSE

FILL THE NEW YEAR WITH PROFITS BY USING OUR

SAFE AND CORRECT
PROTECTION
FOR ELECTRIC RAILWAY
MOTORS

SACHS TRADE NOARK MARK FUSE

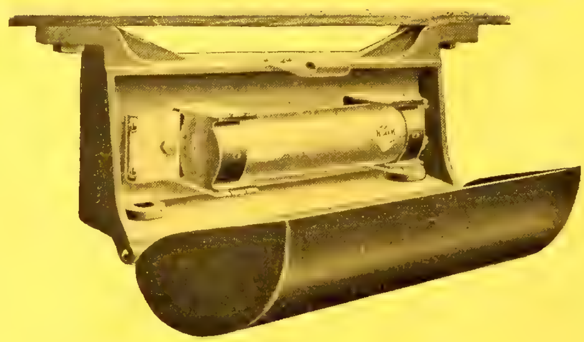
Time interval on overload and arcless operation.

SACHS' "NOARK"

Enclosed fuses for this purpose are the result of experience.

WRITE FOR DATA SHOWING WHY OUR EQUIPMENTS ARE THE BEST

We are the Pioneers.



100-225 Amp. 250-400 Amp.
Type "C"

SEND FOR COMPLETE SET SACHS' "NOARK" FUSE BULLETINS AND "ELECTRICAL SUPPLIES" CATALOGUE FOR LINE MATERIAL.

The largest Street and Elevated Railways in the United States are equipped with about 20,000 "NOARK" Car Equipments.

More money has been paid IN SUITS resulting from unsafe operations of fuses and circuit breakers than would equip all the cars in the country.

NEW YORK
MILWAUKEE
CHICAGO
ST. LOUIS
BOSTON

H. W. JOHNS-MANVILLE CO
100 WILLIAM ST., NEW YORK

PHILADELPHIA
CLEVELAND
PITTSBURG
NEW ORLEANS
LONDON

THE WALWORTH MFG. CO.,

128-136 FEDERAL STREET, BOSTON, MASS.

MAKE THE INSTALLATION OF

High Pressure Power Plants

A SPECIALTY

WROUGHT IRON OR STEEL PIPE BENT TO ANY PRACTICAL FORM

Exclusive Manufacturers of the

WALMANCO PIPE JOINT

which does not weep under the Highest Pressures.
No Threads, No Rivets, Flanges Swivel. . . . .

WALWORTH BRONZE SEAT GATE VALVES FOR HIGH PRESSURE WORK

OUR BOOK OF TABLES AND DIMENSIONS FOR YOUR DRAUGHTING ROOM FREE

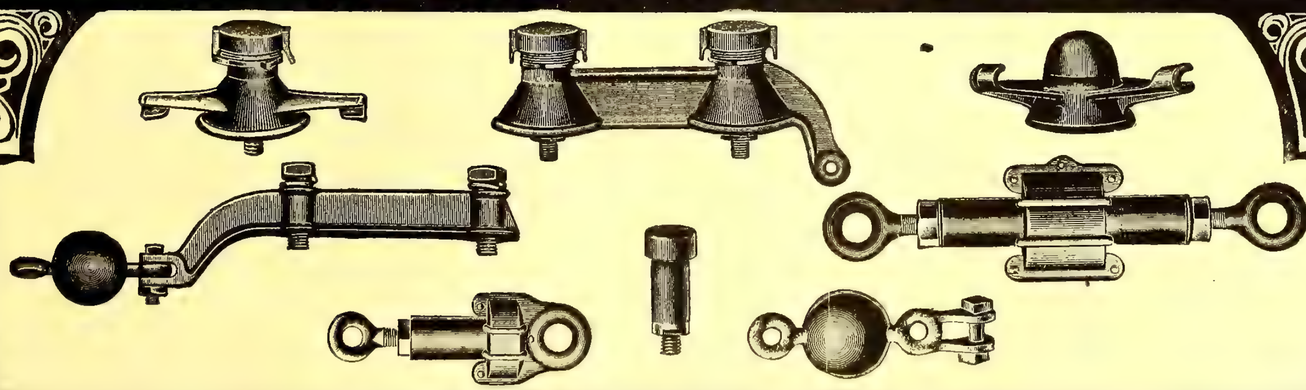
NEW YORK OFFICE: Rooms 807-808 Park Row Building

FOR NEW CONSTRUCTION OR REPAIRS

ON YOUR TROLLEY LINE

ANDERSON LINE MATERIAL AND INSULATION

Can be Depended Upon for Longest and Most Efficient Service. Universally Standard
Made for all Systems and Holding a Record of Over Fourteen Years in Service.



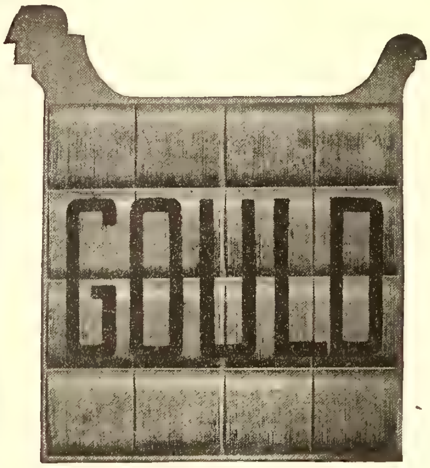
ALBERT & J. M. ANDERSON MFG. CO.,

MAIN OFFICE AND FACTORY, BOSTON.

NEW YORK, 135 BROADWAY. LONDON, ENGLAND, 59 CITY ROAD.
PHILADELPHIA, Girard Building. CHICAGO, Standard Railway Materials Co., Agents.
PARIS, FRANCE, 20 Rue St. George. BRUSSELS, 20 Avenue Du Boulevard. MILAN, 12 Via Dante.

Gould Storage Battery Co.

NEW YORK



TRADE MARK

Storage Battery Installations

For Railroad Regulating, Lighting, Power *and* Isolated Plants

GOULD C. E-M-F BOOSTER SYSTEMS

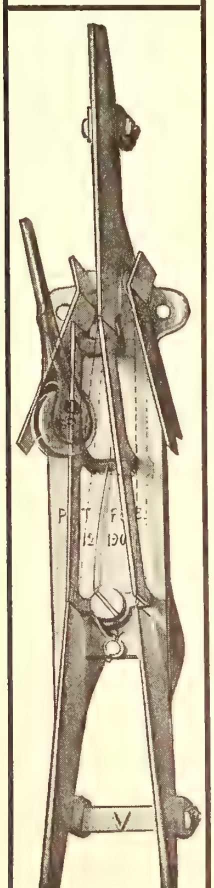
SALES OFFICES

Boston, 89 State Street — Chicago, Rookery Building — New York, 25 West 33d Street

Century Electric Co., San Francisco, Cal. — Pittsburg Engineering Co., Pittsburg, Pa.

WORKS: DEPEW, N. Y.

Bulletins furnished on Application.



THE NAPOLEON

of Them All!

"SPEEDWEAR"

OVERHEAD

TROLLEY SWITCH

Endorsed by Leading Managers

A Long, Fast and Smooth Run for Your Money

Sold by Leading Supply Houses or by the

CORNELL MFG. CO.

2 Clinton Block

SYRACUSE, N. Y.

Sent on 30 Days' FREE Trial

Send for Booklet

W. T. C. MACALLEN CO.

Brass Founders

Manufacturers of

Electric Railway Material

338 Congress St., Boston, Mass.

Distribution of "Chloride Accumulator" Installations

THE ELECTRIC STORAGE BATTERY CO.

PHILADELPHIA

SALES OFFICES: Philadelphia, New York, Boston, Chicago, Baltimore, St. Louis, Cleveland, San Francisco, Toronto, Canada.

RAILWAY EQUIPMENT AND SUPPLIES

Railway Cars and Trucks — Track and Overhead Material
Snow Plows—Wason Mfg. Co. Standard — Poles and Brackets
Gears and Pinions — Wire and Rail Bonds — Contractors' Equipment, etc., etc.

Contracts for Equipment and Material on Favorable Terms

THOMAS F. CAREY

53 STATE STREET, BOSTON, MASS.

Cable Address, Tomkay — Long Distance Telephone

Second-Hand Equipment Bought and Sold

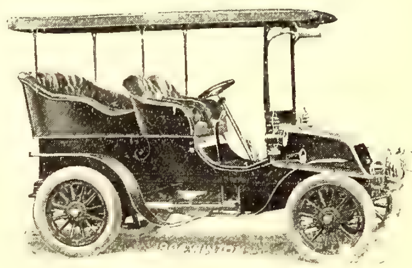
MR. RAILWAY BUILDER

Why Pay Enormous Livery Bills? A WINTON TOURING CAR Will Defeat Them.

Two hundred miles a day is easy with our touring car.

Rain or shine, good roads or bad, you can travel with speed and comfort in a Winton.

A number of electric roads are using Winton cars for inspection purposes.



Price, $2,500.

Ready to start at a moment's notice.

Durable and strong.

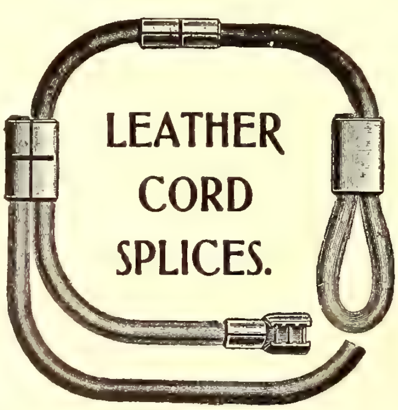
Nothing complicated to give you trouble.

THE WINTON MOTOR CARRIAGE CO., Cleveland

THE SELF RECORDING REGISTER.

SAMPLES AND FULL INFORMATION FURNISHED UPON REQUEST.

TROLLEY WHEELS, TROLLEY CORD, CONDUCTORS' PUNCHES, AND ELECTRICAL RAILROAD SUPPLIES.



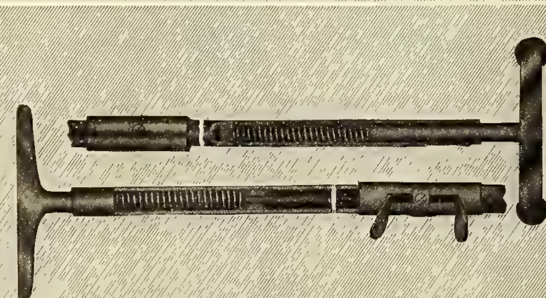
LEATHER CORD SPLICES.

THE

RECORDING FARE REGISTER CO.,

New Haven, Conn.

CURTAIN FIXTURES



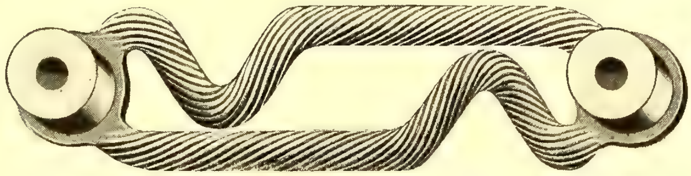
The Keeler "Eccentric" Fixture has no cables, adjusting or retaining devices. Its only bearing points are pivoted eccentric rolls.

The Keeler "Pinch Handle" Fixture is superior in action to other fixtures of this type.

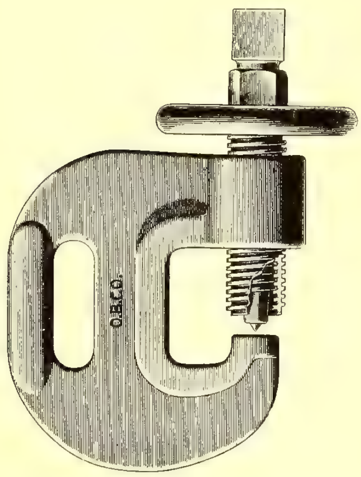
FEDERAL MANUFACTURING CO.
Railway Equipment Dept.
Cleveland, Ohio.

EASTERN AGENT—H. E. HEELER
26 Cortlandt St. New York.

RAIL BONDING REQUISITES



"ALL WIRE" RAIL BOND, TYPE F, FORM 7.



RAIL BOND COMPRESSOR.

"ALL WIRE" RAIL BONDS

Compressed Terminal Type, Soldered Type.

BONDING CAPS

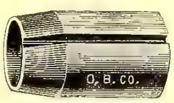
Steel and Copper.

COPPER BONDING SLEEVES

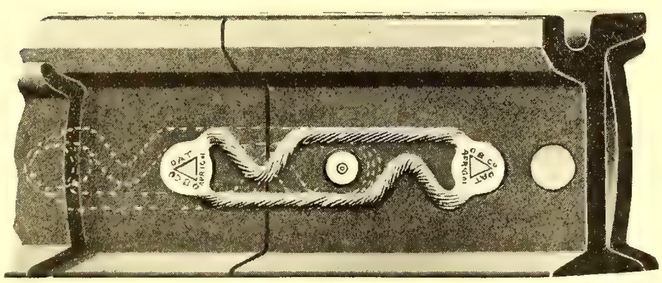
CHANNEL PINS

COMPRESSORS, TRACK DRILLS, Etc.

WRITE FOR CIRCULARS AND PRICES.



BONDING CAP.



CHANNEL PIN.

GIRDER RAIL DOUBLE BONDED WITH TYPE F, FORM 7, "ALL WIRE" RAIL BONDS.

THE OHIO BRASS COMPANY

MANSFIELD, OHIO, U.S.A.

REPRESENTATIVES:

NEW YORK CITY,	136 Liberty Street,	N. M. GARLAND, Manager
PITTSBURG, PA.,	Times Building,	BURT GELLATLY, Manager
CHICAGO, ILL.,	309 Dearborn Street,	PORTER & BERG
ST. LOUIS, MO.,	310 Market Street,	WATTS & UTHOFF
LONDON, ENGLAND,	11 Queen Victoria St.	BRITISH ELECTRIC EQUIPMENT CO.
PARIS, FRANCE,	12 Rue St. Georges,	E. H. CADIOT & CO.

OKONITE

1889 PARIS EXPOSITION MEDAL

1893 WORLD'S FAIR MEDAL

The Standard for Rubber Insulation

RAILWAY FEED WIRES insulated with OKONITE are unequaled for flexibility, durability and efficiency, and are in use by the leading Electric Street Railway Companies. OKONITE is preferred above any other insulation for Car Wiring, Telegraph and Telephone Purposes.

Okonite Wires, Okonite Tape, Manson Tape, Candee Weather Proof Wires

SAMPLES AND ESTIMATES ON APPLICATION

WILLARD L. CANDEE, H. DURANT CHEEVER, } Managers

GEO. T. MANSON, Gen'l Supt.
W. H. HODGINS, Secretary

OKONITE TRADE MARK

THE OKONITE CO. LTD
253 BROADWAY NEW YORK

OKONITE TRADE MARK

...OUR...

Air Compressors

ARE THE MOST

Economical, Efficient and Compact

MACHINES ON THE MARKET

Write for Catalogue No. 13

N. A. CHRISTENSEN
1212-1217 Herman Building, Milwaukee

WAX ENGRAVINGS of plans, machinery or stationery forms are clear, accurate and economical. Our wax engravings are especially good.

MANZ-HOLLISTER

200 MANZ BLDG., CHICAGO 20 LUPTON BLDG., NEW YORK

Railroad and Tram Car Specialties

New Inventions developed, perfected and worked for the English Market

Messrs. G. D. PETERS & CO.,
Moorgate Works Moorfields, LONDON, E. C.

ALL THREE FOR $7.50 PER ANNUM

Street Railway Journal
A weekly record of the world's progress in city and inter-urban railroading.
Regular Price, - $4.00 per Annum

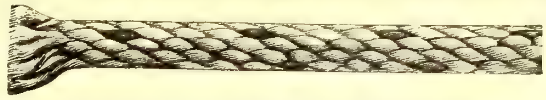
American Street Railway Investments
(The Annual "Red Book")
The standard manual of street railway statistics and finances.
Regular Price, - $5.00 per Copy

Electric Railway Directory and Buyers' Manual
(Three times yearly)
A complete directory of the street railway and traction companies of North America.
Regular Price, - 50 Cts. per Copy

McGRAW PUBLISHING CO., 114 Liberty St., New York

Index to Advertisers.

An asterisk (*) indicates advertisements appearing only in the International Edition.

If you look at your

Trolley Cords

You will see that the Hard, Smooth kind is the kind that wears. Send for Sample.

SAMSON SPOT CORD (Waterproofed)

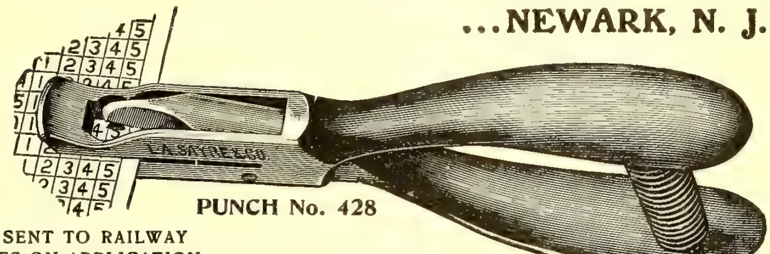
is therefore the most economical trolley cord.

SAMSON CORDAGE WORKS. BOSTON, MASS.

L. A. SAYRE & CO.

...NEWARK, N. J.

The Best Punch Ever Made for Transfer Tickets...



PUNCH No. 428

SAMPLES SENT TO RAILWAY COMPANIES ON APPLICATION.

THE PRACTICAL ELECTRIC RAILWAY HAND BOOK

BY ALBERT B. HERRICK

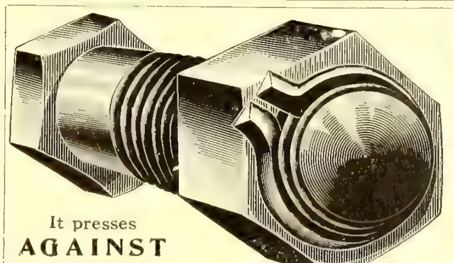
An exceedingly valuable compilation of engineering facts, figures and dimensions which are directly applicable to the construction, testing and operation of electric railway systems

THREE DOLLARS PER COPY, POSTPAID

McGRAW PUBLISHING COMPANY

BOOK DEPARTMENT

114 LIBERTY STREET, NEW YORK



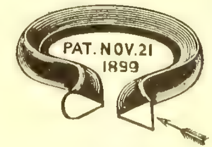
It presses AGAINST the nut

Spiral Nut-Lock

Most effective because it **grips the bolt** —and becomes a part of it.

Cheaper than a jam nut or cotter key.

Locks both bolt and nut absolutely.



The end to which arrow points goes first on thread of bolt.

SPIRAL NUT-LOCK CO.,

143 Liberty Street. New York City.

The Capitalist and the Promoter

The men who make the railroads, who put their money into them, and who wish to see them made into paying propositions, know these facts:

That no investment pays like an investment in good equipment;

That in rail bonds no equipment has ever even approached the record of the Protected Rail Bond;

That some of the best acting railroads in the country are bonded with the Protected Bond; and, finally,

That the Protected Bond is an investment, not an expense.

THE PROTECTED RAIL BOND COMPANY

THE MAYER & ENGLUND COMPANY
GENERAL SALES AGENTS
1020, 1022 and 1024 Filbert Street
PHILADELPHIA, PA.

INDEX TO ADVERTISERS—Continued

WHEN WRITING TO ADVERTISERS

In the STREET RAILWAY JOURNAL you will confer a favor on both publisher and advertiser by mentioning this paper.

"CAR ADVERTISING—

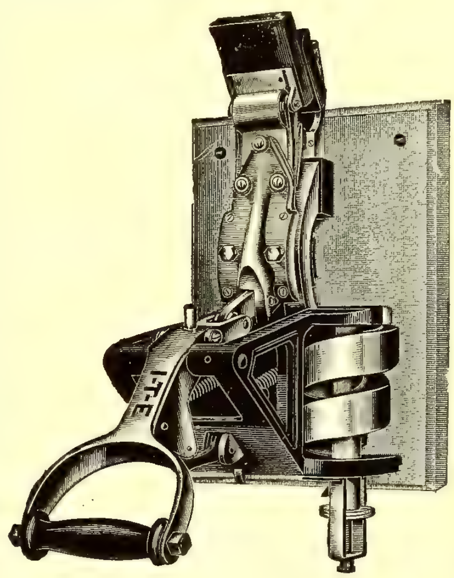
Barron G. Collier

ALMOST EVERYWHERE"

One Fourteen Fifth Avenue, New York

KEYSTONE

Measuring Instruments, Switchboard and Portable Types. These instruments are of the highest grade; we guarantee them to be accurate, "dead beat" and altogether perfectly satisfactory. Let us send you some literature on the subject.



I-T-E

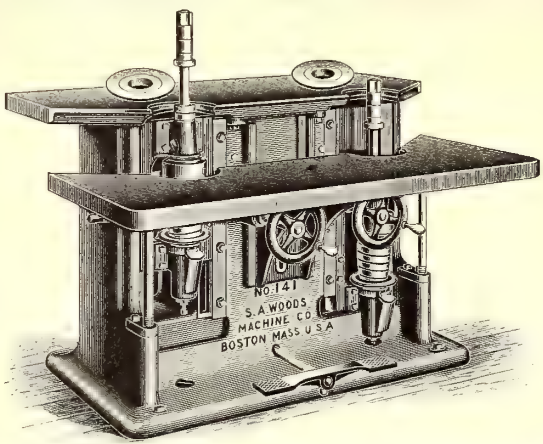
"LAMINATED" CIRCUIT BREAKER

Compare this instrument with any other on the market. You will find it to be better designed, stronger, and more reliable in operation. Built for 750 volts D. C., in sizes from 10 to 10,000 amperes.

THE CUTTER CO.

19th and Hamilton Streets, - PHILADELPHIA
120 Liberty Street, - - NEW YORK

PORTER & BERG - CHICAGO
T. A. BIBBER & CO. - - BOSTON
C. M. CROFOOT - - - CINCINNATI
W. C. JESSUP - - - - PITTSBURG
J. R. COLE - - SAN FRANCISCO
R. W. BLACKWELL & CO. LTD. LONDON



The Patent Drop Table of a Woods' No. 141 Upright Moulder

permits of a wider range of work than is possible on other moulders, and adapts the machine to the special requirements of street railways.

Table, both sections, 40 x 56 inches. Front section lowers 7½ inches.

There are other characteristic features if you are interested.

CAR SHOP WOOD WORKING MACHINERY

S. A. Woods Machine Co.

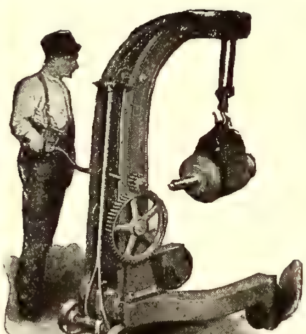
MOTOR APPLICATIONS ARRANGED. BOSTON, MASS.

LIFTS THREE TONS

The Franklin Portable Crane and Hoist.

TEN SIZES

SAVES TIME



Is the very thing you need in your power station, car house and repair shop. One man with this crane can lift heavy apparatus from one point to another, in or out of the shop. Nothing so handy, simple and convenient. Write for Booklet.

The Franklin Portable Crane & Hoist Co.
FRANKLIN, PA.

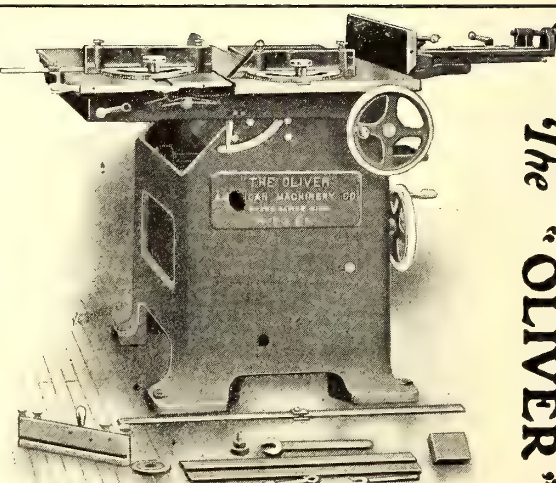
LESSENS EXPENSE

NO TOOL WILL SAVE YOU MORE MONEY in your car or pattern shop than an

OLIVER UNIVERSAL SAW BENCH

Write for Catalog. Let us tell you what it will do and how it is made

The "OLIVER"



The "OLIVER"

OLIVER Wood Trimmers, Saw Benches, Hand Jointers Band Saws, Lathes, Etc., Made Only by

American Machinery Co.

GRAND RAPIDS, MICHIGAN

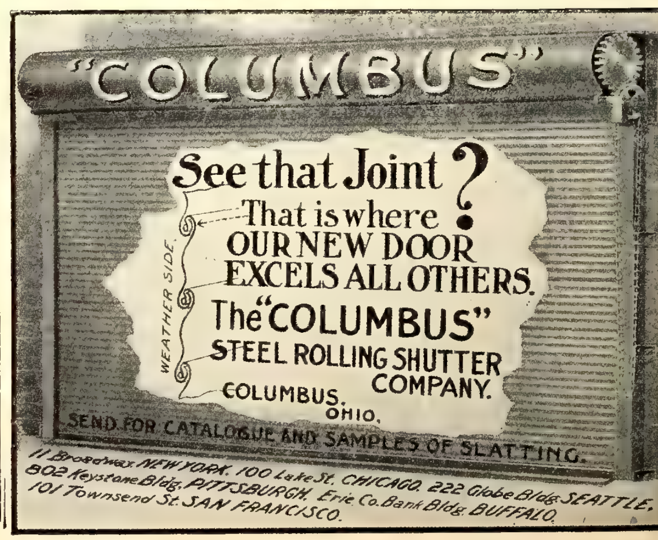
Branch Office and Salesroom, 10 Deansgate, Manchester, England

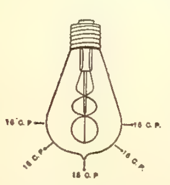
GENERATORS-MOTORS

COMMUTATOR TRUING DEVICES

AUTOMATIC CLUTCHES both MECHANICAL & ELECTRICAL

AKRON ELECTRICAL MANUFACTURING CO., Akron, Ohio
MACKAY ENGINEERING CO., New York Office.

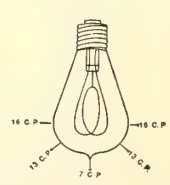




Study These

CUTS, AVERAGE THE CANDLE POWER AND SEND YOUR ORDERS TO

THE STERLING ELECTRICAL MFG. CO. NEW YORK, N. Y.
WARREN, O. CHICAGO, ILL.

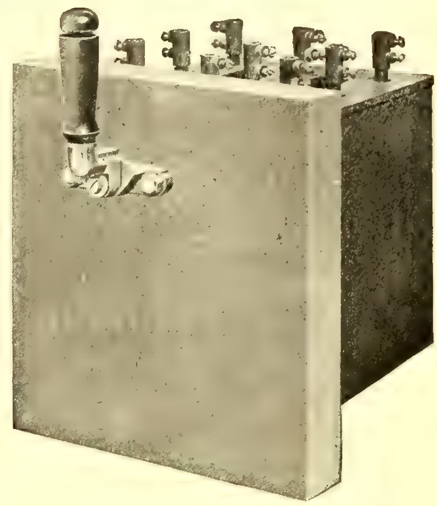


Our Catalogue ....of.... *Street Railway and Electrical Books*

McGRAW PUBLISHING COMPANY, BOOK DEPARTMENT
114 LIBERTY STREET, NEW YORK.

IS YOURS FOR THE ASKING.

Guaranteed to Open or Transfer any Circuit regardless of how low the power factor may be



THE ELDEN

Single and Double Throw Oil Transfer Switches

are built in a scientific and durable manner, in capacities up to 400 amperes at 5,000 volts. They are absolutely reliable and practicable

We are building complete alternating high potential switchboards, equipped with "ELDEN" oil circuit breakers and switches, for the following prominent electric railway and lighting companies:

Manchester Traction, Light and Power Co., Manchester, N. H., (5)
Halifax Electric Tramway Co., Ltd., Halifax, N. S.
Lynn Gas and Electric Co., Lynn, Mass.
Somerville Electric Light Co., Somerville, Mass.
Salem Electric Lighting Co., Salem, Mass.
North Adams Gas Light Co., North Adams, Mass.

If you desire further information regarding the best line of oil circuit breakers and switches made, write to

S. B. CONDIT, JR., & CO.

65 Oliver St., Boston, Mass., U.S.A.

WESTERN ELECTRIC COMPANY

RAILWAY SUPPLIES

TRADE ELECTROSE MARK.

OVERHEAD LINE MATERIAL

New York - Philadelphia - Denver - Kansas City - St. Louis - Chicago

CALIFORNIA ELECTRICAL WORKS, San Francisco, Cal.

STANDARD ELECTRIC CO., Cincinnati, Ohio. AMERICAN ELECTRIC CO., St. Paul, Minn.

...The...

Bellamy Vestlette

PATENTED APRIL 27, 1897.

For Street Railway Conductors

ABSOLUTELY SAFE

Money cannot be lost or stolen from these pockets.

OVER 30,000 IN USE

Saves the price of a coat yearly. Conductor's uniform always presentable. Adopted as a part of the uniform by many Street Railway Companies. Agents wanted on every line.

The Bellamy Vestlette Mfg. Co., Cleveland, Ohio

Sometime This Winter

you will want some repair part in a hurry—send us the order—by wire at our expense, or better yet, order extra parts now and meet emergencies.

General Railway Supply Co.

Park Building, Pittsburg, Pa.

SHELBY TROLLEY POLES

Made from cold drawn seamless tubing. Each pole is tested by suspending, 12 feet from butt-end, a weight of 40 pounds which must not produce a deflection in pole greater than 12 inches. After removal of weight, if pole does not return to its original shape, it is rejected.

ALL STANDARD LENGTHS IN STOCK

GENERAL AGENTS FOR UNITED STATES AND CANADA
FEDERAL MANUFACTURING COMPANY—RAILWAY EQUIPMENT DEPT.
595 PERKINS AVENUE—CLEVELAND, OHIO

THE McCOLLUM MOMENTUM

THE STERLING SAFETY

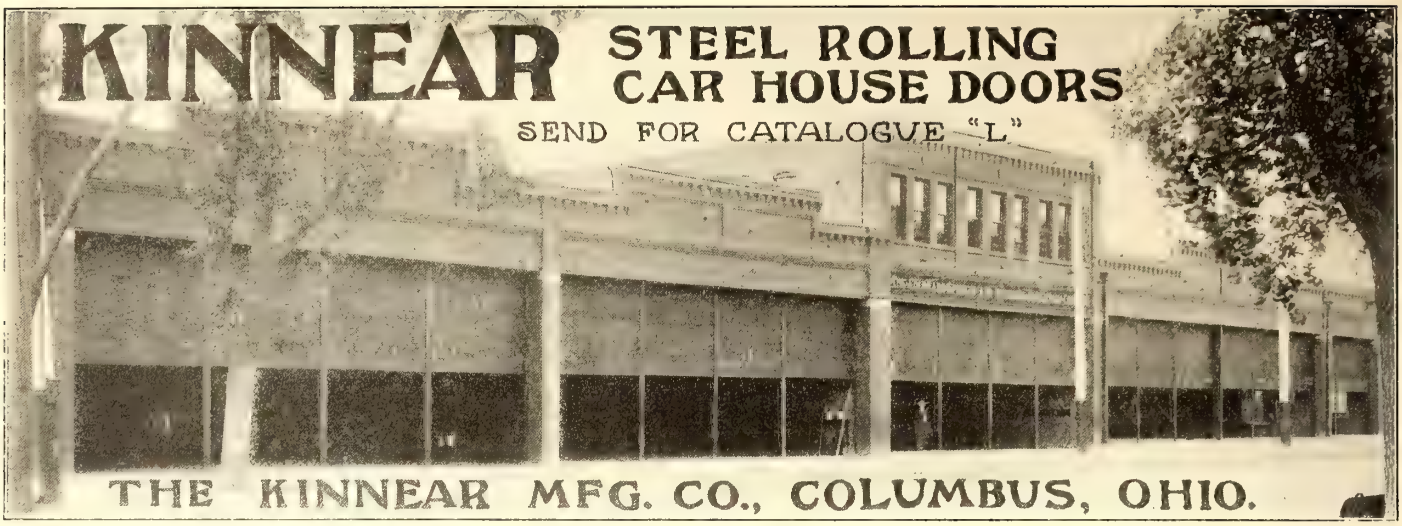
BRAKE

separate, or in combination. These two brakes can be operated with the same handle. Thus combined they form the most perfect and complete braking equipment ever devised.

The McCollum brake utilizes the momentum of the car, ordinarily dissipated, to stop the car. This is done by original devices which two years of service have proven effective in—1st, stopping a car quickly; 2d, stopping a car smoothly; 3d, preventing flat wheels; 4th, never failing; 5th, costing less at first than other power brakes, and but a trifling sum for maintenance.

STERLING-MEAKER COMPANY

NEWARK, N. J., U. S. A.



The
CLASSIFIED DIRECTORY
of
Manufacturers, Dealers, Contractors, Etc.

Published each week in the

STREET RAILWAY JOURNAL

Is the most valuable index available for the purchasers of electric railway apparatus and equipment.

Send for Samples.

SILVER LAKE WATERPROOFED CORD
FOR ARC LIGHT AND TROLLEY CORD.

SILVER LAKE CO., - Boston, Mass.

STUART-HOWLAND CO.

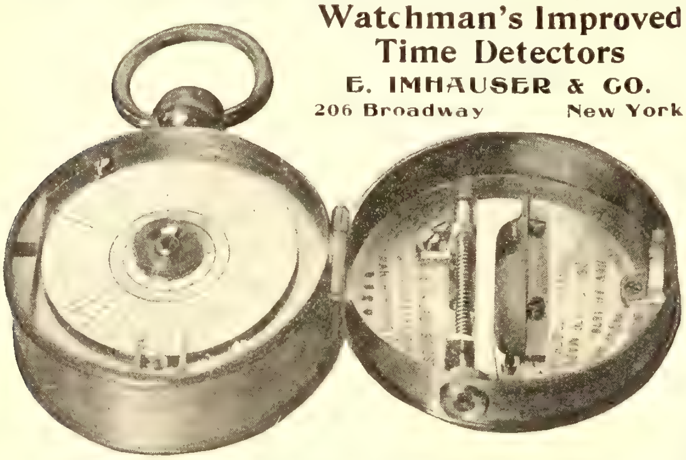
RAILWAY SUPPLIES

261-287 Devonshire Street and
4-5 Winthrop Square, Boston, Mass.
Branch Office: 26 Cortlandt St., New York.

USED BY EIGHTY PER CENT. OF STREET RAILWAY COMPANIES

Watchman's Improved Time Detectors

E. IMHAUSER & CO.
206 Broadway New York



Special
Conductors' Safes....
FOR
STREET RAILWAYS

Conductors can deposit their returns without access to Safe

Made in Several Sizes.

In use on over 100 roads.

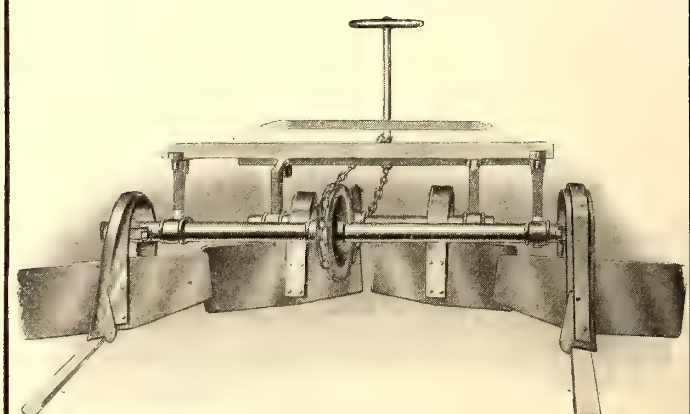
Send for prices and Catalogue.

MORRIS-IRELAND SAFE COMPANY
64 Sudbury Street
BOSTON, - - MASS.

Spring Snow Scrapers

We guarantee all our different styles of Scrapers to be practical and to do all we claim. Thoroughly perfected and easy to install. Let us send you a sample order on approval. We make all kinds and sizes. OUR TRUCK SCRAPER IS GREAT.

SEND FOR CATALOGUE



Our No. 5—THE KALAMAZOO

Will pay for itself many times in a winter. Springs and blades are spring steel. Guaranteed for one year not to break or bend.

ROOT TRACK SCRAPER CO.

KALAMAZOO, MICH.

CLASSIFIED DIRECTORY

OF

Manufacturers, Manufacturers' Agents, Engineers, Contractors, Bankers, Brokers, Etc., Etc.

NOTE—For reference to the advertisements, see alphabetical index on pages 9-13
*Indicates advertisements appearing only in the International edition.

Accountants and Auditors
The Audit Co. of Illinois.

Accumulators
(See Batteries, Storage.)

Advertising, Street Car
Collier, Barron G.
Kissam, George & Co.
The Mulford & Petry Company.

Advertising on Transfers
Duplicate Transfer & Rebate Co.

Advertisement Writing and Designing
Manz-Hollister Co.

Air-Brakes
National Electric Co.
Philadelphia Air Brake Co.
Westinghouse Air Brake Co.
Westinghouse Traction Brake Co.

Air Compressors
Christensen, N. A.
General Electric Co.
Stilwell-Bierce & Smith-Vaile Co.
Westinghouse Electric & Mfg. Co.
*Worthington Pump Co., Ltd.

Alternators
*Kolben & Co., Ltd.
Westinghouse Electric & Mfg. Co.

Aluminum
Pittsburgh Reduction Co.

Ambroin Insulation
*Ambroin-Werke.
*Estler Bros.

Amusement Attractions
Armitage-Herschell Co.
Herschell, Spillman & Co.

Anchors, Guy
Crouse-Hinds Co.
Matthews, W. N., & Bros

Armature and Field Coils
Cleveland Armature Works.
Elliott Bros. Electric Co.
Garton Co., The, W. R.
Ridlon, Frank, Co.
Rossiter, MacGovern & Co.
Van Dorn Elliot Electric Co.
Wendell & MacDuffie.

Armature Lifts
(See Lifts.)

Armature Winding
(See Repair Work.)

Automobiles
Winton Motor Carriage Co.

"Automotoneer"
Garton-Daniels Co.

Babbitt Metal
(See Bearings.)

Badges
Farr & Foster Co.
International Register Co.
Mayer & Englund Co.
Recording Fare Register Co.
Woodman, R., Mfg. & Supply Co.

Baggage Checks
Farr & Foster Co.
Woodman, R., Mfg. Supply Co.

Bankers and Brokers
Dumee, Son & Co.
Equitable Trust Co.
Farson, Leach & Co.
Harris, N. W., & Co.
Hayes, W. J., & Sons.
Hillyer, M. P., & Co.
Moore, Baker & Co.
Perry, Coffin & Burr.
Tennis Bros. Co.
Thompson, Tenney & Crawford.
Trask, Spencer, & Co.
U. S. Mortgage & Trust Co.
Watson, John B.

Batteries, Storage
*Chloride Elec'l Storage Co., Ltd.
Electric Storage Battery Co.
Gould Storage Battery Co.

Bearings
Brady Brass Co.
Brill, J. G., Co.
Mayer & Englund Co.
Nuttall, R. D., Co.
Ohio Brass Co.
Phosphor Bronze Smelting Co.
Pittsburg White Metal Co.
Porter & Berg.
Stuart-Howland Co.
Taylor Electric Truck Co.
Van Dorn & Dutton Co.
Wendell & MacDuffie.
Wesco Supply Co.

Bell Cord
(See Cord, Bell and Trolley.)

Bells and Gongs
American Car Co.
Brill, J. G., Co.
Mayer & Englund Co.
Porter & Berg.
Ridlon, Frank, Co.
Stuart-Howland Co.
Wendell & MacDuffie.
Wesco Supply Co.

Blinds, Car
American Car Co.
Brill, J. G., Co.
Sjoberg, J. P., & Co.

Blowers
American Blower Co.
Sturtevant, B. F., Co.

Boiler & Pipe Coverings
H. W. Johns-Manville Co.

Boiler Cleaners (Mechanical)
Gem Mfg. Co.
Lagonda Mfg. Co.
Liberty Mfg. Co.

Boiler Cleaning Compounds
Dearborn Drug & Chemical Wks.
The Ironsides Co.

Boilers
Allis-Chalmers Co.
Babcock & Wilcox Co.
*Babcock & Wilcox, Ltd.
Cahall Sales Department.
Cooper, C. & G., Co.
Harrisburg Foundry & Machine Works.
Harrison Safety Boiler Works.
Heine Safety Boiler Co.
*Howden, James, & Co.
Keeler, E., Co.
Phœnix Iron Works Co.
Stirling Co., The.
Westinghouse, Church, Kerr & Co.
Wetherill, Robert, & Co.
*Yates & Thom.

Bonds, Rail
American Steel & Wire Co.
Brown, Harold P.
Carey, Thos. F.
Chase-Shawmut Co.
Ewing, Geo. C.
Falk Co.
*Felten & Guilleaume.
*Forest City Electric Co.
Garton, W. R., Co.
General Electric Co.
General Railway Supply Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Protected Rail Bond Co.
Stuart Howland Co.
Wendell & MacDuffie.
Wesco Supply Co.

Boring Machines
American Machinery Co.
Woods, S. A., Machine Co.

Brackets and Cross Arms
Advance Lumber Co.
Anderson, A. & J. M., Mfg. Co.
Bissell Co., F.

Where One Head is Better Than Two

For once the old proverb, "Two heads," etc., is refuted. Cannot use two exhaust heads on a single pipe; one head, and that one a

BURT EXHAUST HEAD

the most reliable, safest and economical head on the market, does the work.

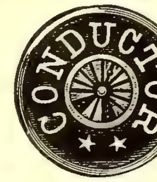
Emporium, Pa., Sept. 10, 1902.
Burt Mfg. Co., Akron Ohio:
Gentlemen—The exhaust heads purchased from you are a complete success and are giving everybody connected with our works satisfaction and real comfort.
Yours very truly,
Emporium Iron Co.,
Per A. Brady.

Send order to-day, with size of exhaust pipe.
If dissatisfied, return.

BURT MFG. CO., Akron, Ohio
Largest Manufacturers of Oil Filters in the World.
Supplied also by Engine Builders and Power Contractors

DETROIT

Waterbury Button Co.
Waterbury Conn.
48 Howard St., N. Y.



When writing to advertisers in the Street Railway Journal you will confer a favor on both publisher and advertiser by mentioning this paper.

BADGES

of every design and description in Imitation Gold, Nickel and German Silver.

Send for descriptive circular and price list of our Railway Supplies

R. WOODMAN MFG. & SUPPLY CO.
63 Oliver St., BOSTON, Mass., U. S. A.

MICA | MICANITE | LINOTAPE

"AS GOOD AS MICANITE" Proves our claim that

EMPIRE OILED MATERIAL

MICANITE IS STANDARD

M. I. C. INSULATING COMPOUND

EUGENE MUNSELL & CO.
"FIRST HANDS"

AWARDED GOLD MEDAL, PARIS, 1900
CHICAGO and NEW YORK

MICA INSULATOR COMPANY
"ORIGINATORS"

3

In Electric Railway work it is more difficult to build a Lightning Arrester that will withstand repeated discharges, than in any other class of Electric Service.

This is due to the fact that when a discharge passes to earth the entire normal difference of potential tries to follow the discharge, and the "ground" thus established is more difficult to open than in other service where the entire normal difference of potential is not between the line and the ground, but between the different sides of the circuit.

With this fact in view Garton Lightning Arresters for Electric Railway service are provided with a graphite resistance, which limits the flow of normal current to about ten amperes—if the resistance was higher it would tend to impede the passage of the discharge.

The flow of normal current being limited makes it more easy to open the "ground" established by the discharge.

This is one reason why Garton Lightning Arresters have so rapidly become Standard in the specifications of many leading Electric Railway Engineers.

Full information will be furnished on request.

GARTON-DANIELS CO.
KEOKUK, IOWA,
U. S. A.

CLASSIFIED DIRECTORY—Continued.

Brackets and Cross Arms—Cont.
Creaghead Engineering Co.
Electric Railway Equipment Co., Cincinnati.
Fowler, Jacobs Co.
Greenbrier Pole Co.
Maus & Co., H. H.
Mayer & Englund Co.
Ohio Brass Co.
Phelan, D. W.
Porter & Berg.
Ridlon, Frank, Co.
Standard Pole & Tie Co.
Stuart-Howland Co.
Wendell & MacDuffie.
Western Electric Co.

Brake Chains
Sterling-Meaker Co.
Taylor Electric Truck Co.

Brake Handles
Brill, J. G., Co.
McGuire Mfg. Co.
Ohio Brass Co.
Porter & Berg.
Ridlon, Frank, Co.
Stuart-Howland Co.
Wendell & MacDuffie.
Wesco Supply Co.

Brake Shoes
American Brake-Shoe & Foundry Co.
American Car Co.
Barbour-Stockwell Co.
Bissell Co., F.
Brill, J. G., Co.
Porter & Berg.
Stuart-Howland Co.
Taylor Electric Truck Co.
Wendell & MacDuffie.
Wesco Supply Co.
Wheel Truing Brake-Shoe Co.

Brakes, Car
American Car Co.
Brill, J. G., Co.
General Electric Co.
Magnetic Equipment Co.
National Electric Co.
Peckham Manufacturing Co.
Philadelphia Air Brake Co.
Sterling-Meaker Co.
Taylor Electric Truck Co.
Van Dorn & Dutton Co.
Westinghouse Air Brake Co.
*Westinghouse Brake Co., Ltd.
Westinghouse Traction Brake Co.

Bridges and Buildings
American Bridge Co.
Garry Iron & Steel Co.
Indianapolis Switch & Frog Co.
Johann, F. A.
Pennsylvania Steel Co.
Sproul & Green.

Brillium Fuel
Brown, Harold P.

Brooms, Track
American Car Co.
Brill, J. G., Co.
Consolidated Car Fender Co.
General Railway Supply Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Stuart-Howland Co.
Wendell & MacDuffie.
Wesco Supply Co.

Brushes, Motor and Dynamo
Garton, W. R., Co.
General Electric Co.
Le Valley Vitæ Carbon Bruch Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Speer Carbon Co.
Stuart-Howland Co.
Wendell & MacDuffie.

Buttons
Waterbury Button Co.
Woodman, R., Mfg. & Supply Co.

Cable and Rope Filler
The Ironsides Co.

Cables
(See Wires and Cables.)

Car Circuit Breaker
Hartman Circuit Breaker Co.

Car Cleaner
Beacon Paint & Varnish-Preservative Co.

Car Curtains and Shades
(See Curtains and Curtain Fixtures.)

Car Gaining Machines
American Machinery Co.
Woods, S. A. Machine Co.

Car House Doors
Columbus Steel Rolling Shutter Co.
Kinnear Mfg. Co.

Cars
American Car Co.
American Car & Foundry Co.
Brill, J. G., Co.
*Brush Electrical Engineering Co.
Carey, Thos. F.
Carriage Works, Ltd.
*Electric Ry. & Tramway.
Ewing, Geo. C.
Jackson & Sharp Plant
Jewett Car Co.
Jones, J. M., Sons.
Kuhlman, G. C., Car Co.
Laconia Car Co. Works.
*Maschinenfabrik Oerlikon.
Romünder, Hermann.
St. Louis Car Co.
Stephenson, John, Co.

Car Shop Woodworking Machin'y
American Machinery Co.
Woods, S. A., Machine Co.

Cast Welded Joints
Falk Co.
*Goldschmidt, Th.
Heil Rail-Joint Welding Co.
Lorain Steel Co.
Pepper & Register.
Wendell & MacDuffie.
Wharton, Wm., Jr., & Co.

Castings
American Brake-Shoe & Foundry Co.
Brady Brass Co.
Falk Co.
Franklin Rolling Mill & Foundry Co.
Laconia Car Co. Works.
Lorain Steel Co.
National Electric Co.
New York Switch & Crossing Co.
Ohio Brass Co.
Pennsylvania Steel Co.
Phosphor Bronze Smelting Co., Ltd.
Star Brass Works.
Wendell & MacDuffie.
Wharton, Wm., Jr., & Co.

Chains (Standard and Special)
Aultman Co.
Jeffrey Mfg. Co.

Change Carrier
Bellamy Vestlette Mfg. Co.

Chemists (Manfg. and Analytical)
Dearborn Drug & Chemical Wks.

Circuit Breakers
*British Thomson-Houston Co.
*British Westinghouse Electric & Mfg. Co.
Condit, S. B., Jr., & Co.
Cutter Co.
Electric Ry. Equipt. Co., Cincinnati.
Garton Co., The W. R.
Garton-Daniels Co.
General Electric Co.
Hartman Circuit Breaker Co.
H. W. Johns-Manville Co.
Mayer & Englund Co.
*Nalder Bros. & Thompson.
Ohio Brass Co.
Porter & Berg.
Stuart-Howland Co.
Wesco Supply Co.
Westinghouse Electric & Mfg. Co.

Clocks, Electric
Imhauser, E., & Co.

Coal Dealers
Borden & Lovell.

Coal Handling Machinery
(See Conveyors.)

Commutators and Com'tator Bar
Akron Electrical Mfg. Co.
Cleveland Armature Works.
Elliott Bros. Electric Co.
*Forest City Electric Co.
Garton Co., The W. R.
General Electric Co.
General Railway Supply Co.
Homer Commutator Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Ridlon, Frank, Co.
Stuart-Howland Co.
Van Dorn-Elliott Electric Co.
Wendell & MacDuffie.
Wesco Supply Co.

Condensers
*Allen, W. H., Son & Co., Ltd.
Alberger Condenser Co.
Allis-Chalmers Co.
Blake-Knowles Steam Pump Wks.
Bulkley, Henry W.
Conover Mfg. Co.
Goubert Mfg. Co.
*Mirrless-Watson Co., Ltd.
Power Specialty Co.
Westinghouse, Church, Kerr & Co.
Wheeler Condenser & Eng. Co.
*Worthington Pump Co., Ltd.

Conductor's Vestlette
Bellamy Vestlette Mfg. Co.

Conduits
American Conduit Co.
Bissell Co., F.
Camp, H. B., Co.
Gest, Guy M.
National Conduit & Cable Co.
Standard Sewer Pipe Co.

Contractors
Archbold-Brady Co.
Arnold Elec. Power Station Co.

CLASSIFIED DIRECTORY—Continued.

Contractors—Continued
*Blackwell, Robt. W., Co., Ltd.
*British Thomson-Houston Co.
Bureau of Expert Investigation & Construction.
Byllesby & Co., H. M.
Chicago Eng. & Constructing Co.
Cowdrey, C. H., achine Works.
Creaghead Engineering Co.
Cullen, Wm. A.
*Dick, Kerr & Co., Ltd.
Electrical Installation Co.
Falk Co.
Gest, Guy M.
Hollingsworth, L. Jr.
Knox Engineering Co.
Kohler Brothers.
Ley, Fred T., & Co.
MacAfee, John Blair.
*Maschinenfabrik Oerlikon.
Muralt & Co.
Pepper & Register.
Sanderson & Porter.
Saxton, E.
Serrell, Lemuel W.
Sheaff & Jaastad.
Smethurst & Allen.
Standard Engineering Co.
Tennis Bros. Co.
Townsend, Reed & Co.
Walworth Mfg. Co.
Watson, John B.
Wendell & MacDuffie.
Western Electrical Supply Co.
Wharton, Wm., Jr., & Co.
White, J. G., & Co.
*White, J. G., & Co. Ltd.

Controllers
*British Thomson-Houston Co.
General Electric Co.
*Maschinenfabrik Oerlikon.
Westinghouse Electric & Mfg. Co.
*Witting, Eborall & Co., Ltd.

Controller Parts
H. W. Johns-Manville Co.

Controller Regulators
Garton-Daniels Co.

Conveyors, Coal & Ashes
Aultman Co.
*Babcock & Wilcox, Ltd.
Brown Hoisting Machinery Co.
Garry Iron & Steel Co.
General Railway Supply Co.
Jeffrey Mfg. Co.
Link-Belt Engineering Co.
Mead, John A. Co.
*New Conveyor Co.
Northern Engineering Works.
Robins Conveying Belt Co.
Steel Cable Engineering Co.

Cooling Towers
Alberger Condenser Co.
International Steam Engineering Co.
Wheeler Condenser & Engineering Co.
*Worthington Pump Co., Ltd.

Cord, Bell and Trolley
American Car Co.
Brill, J. G., Co.
International Register Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Recording Fare Register Co.
Samson Cordage Works.
Silver Lake Co.
Sterling-Meaker Co.
Stuart-Howland Co.
Wendell & MacDuffie.

Cotton Duck
Boyle, John, & Co.

Couplers, Car
St. Louis Car Co.
Van Dorn, W. T., Co.
Westinghouse Air Brake Co.

Cranes, Traveling
Brown Hoisting Machinery Co.
Franklin Portable Crane & Hoist Co.
Garry Iron & Steel Co.
Northern Engineering Works.

Cross Arms
(See Brackets.)

Cross-Overs, Portable
Pennsylvania Steel Co.
Wharton, Wm. Jr., & Co.

Crossings, Frogs and Switches (Track)
*Allen, Edgar, & Co., Ltd.
American Frog & Switch Co.
*Askham Bros. & Wilson, Ltd.
Barbour-Stockwell Co.
Cleveland Frog & Crossing Wks.
Cornell Mfg. Co.
*Electric Tramway Equipment Co.
Elliot Frog & Switch Co.
Falk Co.
*Hadfield's Steel Foundry, Ltd.
Indianapolis Switch & Frog Co.
Lorain Steel Co.
New York Switch & Crossing Co.
Paige Iron Works.
Pennsylvania Steel Co.
Weir Frog Co.
Wharton, Wm. Jr., & Co.

Curtains and Curtain Fixtures
American Car Co.
American Car & Foundry Co.
Boyle, John & Co.
Brill, J. G., Co.
Curtain Supply Co.
Federal Mfg. Co.
Hale & Kilburn Mfg. Co.
Hartshorn Co., Stewart.
*Peters, G. D., & Co.
Ridlon, Frank, Co.

Dating Stamps
Farr & Foster Co.

Derailing Devices
American Frog & Switch Co.
Ohio Brass Co.

Detective Service
Drummond's Detective Agency.
Duplicate Transfer & Rebate Co.

Doors, Car
Sjoberg, J. P., & Co.

Doors, Steel Rolling
Columbus Steel Rolling Shutter Co.
Kinnear Mfg. Co.

Drills, Track
Ridlon, Frank, Co.

Dynamos
(See Generators.)

Economizers
Broomell, Schmidt & Steacy Co.
Green Fuel Economizer Co.
Westinghouse Machine Co.

Electric Brakes
General Electric Co.
Magnetic Equipment Co.
Westinghouse Traction Brake Co.

Elevating Machinery
(See Conveyors.)

Engineers (Consulting)
Baker, W. E., & Co.
Blood & Hale.
*British Westinghouse Electric & Mfg. Co.
Burch, Edw. P.
Bureau of Expert Investigation & Construction.
Byllesby, H. M., & Co.
Chapman, C. A.
Chicago Eng. & Constructing Co.
Coleman, Jilson J.
Engstrom, Axel H.
Ford, Bacon & Davis.
Hodges, Arthur W.
Hollingsworth, L., Jr.
Kitfield, E. H.
Knox Engineering Co.
Pierce, Richardson & Neiler.
Roberts, E. P., & Co.
Sargent & Lundie.
Sheaff & Jaasted.
Sproul & Green.
Standard Engineering Co.
Wagner, Herbert A.
Watson, John B.
Western Electrical Supply Co.
Westinghouse Electric & Mfg. Co.
*White, J. G. & Co., Ltd.
White, J. G., & Co.
Whitted, Thos B.

Engineers, Contracting
(See Contractors.)

Engines, Gas
*British Westinghouse Elec. & Mfg. Co., Ltd.
Loomis-Pettibone Gas Machinery Co.
Westinghouse Machine Co.

Engines, Gasoline
Prouty-Pierce Locomotive Mfg. Co.

Engines, Oil
American Diesel Engine Co.

Engines, Steam
*Allen, W. H., Son, & Co.
Allis-Chalmers Co.
American Blower Co.
Ball & Wood Co.
*Blackwell Robt. W., & Co., Ltd.
*British Westinghouse Elec. & Mfg. Co. Ltd.
Brown-Corliss Engine Co.
*Brush Electrical Engineering Co.
Bullock Electric Mfg. Co.
Cooper, C. & G., Co.
Greenwald, I. & E., Co.
Harrisburg Foundry & Machine Co.
Hooven, Owens, Rentschler Co.
*Howden, James, & Co.
Ironton Engine Co.
*Maschinenfabrik Oerlikon.
McIntosh, Seymour & Co.
Phœnix Iron Works Co.
Providence Engineering Works.
Rotary Engine Co.
Russell Engine Co.
*Stewart, D. & Co., (1902) Ltd.
St. Louis Iron & Machine Works.
Sturtevant, B. F., Co.
*Sulzer Bros.
Tod Co., The Wm.
*Tosi, Franco.

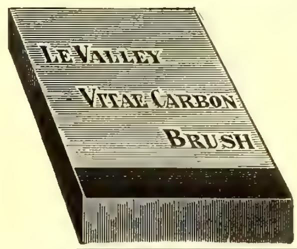
Wesco
Has
Attended
To the requirements of
Railway Companies, **successfully**, for years. That is "**what**" we want you to remember when in need of **Electrical Supplies and Construction Material.**

The Wesco Supply Co., St. Louis, Mo.

STOP! STOP WHAT?

Stop the wear of Commutators! Stop constant renewal of Brushes!

HOW? Equip every Machine with the



And reduce your Brush bills by at least 50 per cent., and your Commutator repair account 80 per cent.

THIS WE GUARANTEE.

LE VALLEY VITAE CARBON BRUSH CO.
125 EAST 42d STREET, NEW YORK, U. S. A.

The Saving Economy of a Metal Pole

Our wrought iron and steel tubular poles will practically last forever. That makes them many times cheaper than a wood pole which you may purchase for possibly a little less money.

In all our poles, as the metal of the outer tube is laid down on the inner tube, it is upset and thickened the whole length of the joint, and not stretched out and thinned as in the ordinary manner of swedging under the hammer. The edge of the outer tube at all joints is champered, so that water cannot rust and corrode and weaken the pole at this point.

We can also furnish iron feeder arms, cross-arm supports, insulator pins, bracket pins, etc., and wood cross-arms, brackets, insulator pins, etc.

Let us estimate when next in need of any supplies of this character.

THE W. R. GARTON COMPANY
STREET RAILWAY SUPPLIES
118-132 West Jackson Boulevard, Chicago, Ill.

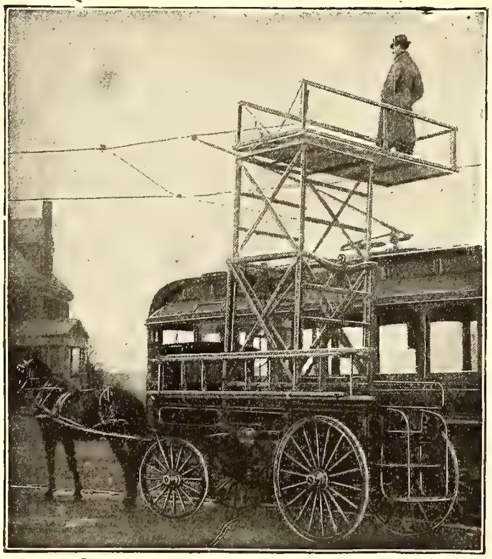
THE TRENTON TROLLEY WAGON

AND THE

TRENTON AUTOMOBILE TOWER WAGON

For Lightness, Convenience, Ease of Operation, Safety, Durability, Low Cost of Maintenance, Simplicity and High-Grade Construction, they have no equal.

Circulars and prices on application.



Derselbe Trolley-Wagon ist bereits auf allen Haupt-Strassenbahnsystemen Amerikas eingefuhrt.

Este Wagon ha sido adaptado por las principales lineas en America.

J. R. McCARDELL & CO.

Patentees and Sole Manufacturers **Trenton, N. J.**

THE NATIONAL TICKET CO.

Write us for information concerning our "tear" Cash Fare Receipt. it gives the best protection of any form in use, and saves time in handling. :: :: ::

CLEVELAND, OHIO

POOLE BROS. CHICAGO. TICKETS TICKET CASES DATING STAMPS AND PUNCHES CORRESPONDENCE SOLICITED

Ticket Systems

Advise us of your wants in the ticket line and let us give you the benefit of our experience.

We will submit a complete system covering your particular needs together with all necessary books and records.

Ask for our illustrated catalog.

THE FARR & FOSTER CO. Chicago, Ill.

CLASSIFIED DIRECTORY—Continued.

Engines, Steam—Continued
Westinghouse Machine Co.
Wetherill, Robert, & Co.
*Willans & Robinson, Ltd.
*Yates & Thom.

Engravers
Manz-Hollister Co.

Exhaust Heads
Burt Mfg. Co.
Sturtevant, B. F., Co.

Fans, Steam and Electric
American Blower Co.
Sturtevant, B. F., Co.

Fare Registers
(See Registers, Fare.)

Feedwater Heaters
(See Heaters, Feed-water.)

Fences
American Steel & Wire Co.
Truss & Cable Fence Co.

Fenders and Guards
Baltimore Car Wheel Co.
Brill, J. G., Co.
Consolidated Car Fender Co.
Eclipse Car Fender Co.
Mayer & Englund Co.
McGuire Mfg. Co.
Parmenter Fender & Wheel Guard Co.
Peckham Mfg. Co.
Sterling-Meaker Co.
*Vesco Supply Co.

Fields
(See Armature & Field Coils.)

Filters
Burt Mfg. Co.
Capilar Co.
Liberty Manufacturing Co.

Fireproof Doors and Shutters
Columbus Steel Rolling Shutter Co.
Kinnear Mfg. Co.

Flooring and Moulding Machine
American Machinery Co.
Woods, S. A., Machine Co.

Forges
Sturtevant, B. F., Co.

Frogs
(See Crossings, Frogs & Switches.)

Frogs, Car Replacing
(See Replacers, Car.)

Furnaces
Harris, J. B.

Fuses
Chase-Shawmut Co.
D. & W. Fuse Co.
H. W. Johns-Manville Co.
Mayer & Englund Co.

Gaskets
Peerless Rubber Mfg. Co.

Gates, Car
Bliss, R., Mfg. Co.
Brill, J. G., Co.

Gates, Railway Crossing
Buda Fdy. & Mfg. Co.

Gears and Pinions
Bliss, E. W., Co.
Carey, Thos. F.
Elliott Bros. Elec. Co.
Falk Co.
Garton, W. R., Co.
General Electric Co.
General Railway Supply Co.
Horsburgh & Scott.
Lorain Steel Co.
Mayer & Englund Co.
New Process Raw Hide Co.
Nuttall, R. D., Co.
Ohio Brass Co.
Porter & Berg.
Stuart-Howland Co.
U. S. Projectile Co., E. W. Bliss Co., successors.
Van Dorn & Dutton Co.
Wendell & MacDuffie.
Wesco Supply Co.

Generators
Akron Electrical Mfg. Co.
Bissell, F., Co.
Blackwell, Robt. W., & Co., Ltd.
*British Westinghouse Elec. & Mfg. Co., Ltd.
*British Thomson-Houston Co.
*Brush Electrical Engineering Co.
Bullock Electric Mfg. Co.
Crocker-Wheeler Co.
*Dick, Kerr & Co., Ltd.
*Electric Construction Co., Ltd.
General Electric Co.
Jeffrey Mfg. Co.
National Electric Co.
*Peebles & Co., Bruce.
Stanley Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.
*Witting, Eborall & Co., Ltd.

Generators, Gas
Loomis-Pettibone Gas Machinery Co.

Glass Cutters
Ridlon, Frank, Co.

Gongs, Car
(See Bells and Gongs.)

Graphite Paint
Detroit Graphite Mfg. Co.
Garry Iron & Steel Co.

Grates
Green Engineering Co.

Grease Cups
Crane Co.
Lunkenheimer Co.

Grease and Oils
(See Lubricants.)

Handles, Register
(See Register Handles.)

Headlights
Brill, J. G., Co.
Consolidated Car Heating Co.
Crouse-Hinds Co.
Globe Electric Mfg. Co.
St. Louis Car Co.
Western Electric Co.

Heaters, Car
Baker, Wm. C.
Brill, J. G., Co.
Gold Car Heating & Ltg. Co.
H. W. Johns-Manville Co.
Hastings, Geo. S., & Co.
McGuire Mfg. Co.
Simplex Electric Heating Co.
Smith, Peter, Heater Co.

Heaters and Purifiers, Feedwater
Allis-Chalmers Co.
*Babcock & Wilcox, Ltd.
Broomell, Schmidt & Steacy Co.
Green Fuel Economizer Co.
Goubert Manufacturing Co., The
Harrison Safety Boiler Works.
Power Specialty Co.
Stilwell-Bierce & Smith-Vaile Co.
Webster & Co., Warren.
Wheeler Condenser & Eng. Co.
Whitlock Coil Pipe Co.
*Worthington Pump Co.

Heating and Ventilating Apparatus
American Blower Co.
Sturtevant, B. F., Co.
Webster, Warren, & Co.

Hoists
Brown Hoisting Machinery Co.
Franklin Portable Crane & Hoist Co.
Northern Engineering Works.

Hollow Chisel Mortisers
American Machinery Co.
Woods, S. A., Machine Co.

Hose Bridges
Ohio Brass Co.

Industrial Railways
General Railway Supply Co.

Injectors
Lunkenheimer Co.

Instruments, Measuring and Testing
Bristol Co.
Cutter Co.
*Elliott Bros.
General Electric Co.
Keystone Electrical Instrument Co.
*Nalder Bros. & Thompson.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Instrument Co.

Insulating Compounds
Garton, W. R., Co.
Johns-Manville Co.
Ohio Brass Co.
Pittsburgh Insulating Co.
Standard Paint Co.
Standard Varnish Works.
Sterling Varnish Co.

Every Genuine Roller has the name of manufacturer, STEWART HARTSHORN, in script on label.

Special rollers for street and steam railway cars.
Brackets suitable for all classes of fittings.
Used all over the world wherever cars are run.

STEWART HARTSHORN CO.

NEW YORK, 7 Lafayette Place.
CHICAGO, 255-257 Wabash Ave.

Office and Factory,
E. NEWARK, N. J.

CLASSIFIED DIRECTORY—Continued.

Insulating Paper and Cloths
Pittsburg Insulating Co.
Sills-Eddy Mica Co.

Insulators, Third Rail
Reconstructed Granite Co.

Insulators, Trolley
(See Line Material.)

Inventions, Perfected and Developed
Peters, G. D., & Co.

Jacks, Car Replacing
Atlas Ry. Supply Co.
Duff Manufacturing Co.
Garry Iron & Steel Co.
Mayer & Englund Co.
Ohio Brass Co.
Ridlon, Frank, Co.
Tilden, B. E., Co.
Watson-Stillman Co.

Joints, Rail
Atlas Railway Supply Co.
Continuous Rail-Joint Co. of America.
Falk Co.
Heil Rail-Joint Welding Co.
Pennsylvania Steel Co.
Weber Railway Joint Mfg. Co.
Wendell & MacDuffie.
Wharton, Wm., Jr., & Co.

Knife Grinders
American Machinery Co.
Woods, S. A., Machine Co.

Lamps, Arc and Incandescent
Anderson, A. & J. M., Mfg. Co.
Bissell, F., Co.
Garton, W. R., Co.
General Electric Co.
Mayer & Englund Co.
Porter & Berg.
St. Louis Car Co.
Sterling Electrical Mfg. Co.
Stuart-Howland Co.
Wendell & MacDuffie.
Wesco Supply Co.
Western Electric Co.

Lifts, Armature and Motor
City Machine Co.
Duff Mfg. Co.
Ohio Brass Co.
Patten, Paul B.
Ridlon, Frank, Co.
Van Dorn & Dutton Co.
Watson Stillman Co.

Lighting, Car
Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.

Lightning Arresters
Bissell, F., Co.
*British Thomson-Houston Co.
Garton-Daniels Co.
General Electric Co.
Mayer & Englund.
Ohio Brass Co.
Porter & Berg.
Stuart-Howland Co.
Wendell & MacDuffie.
Wesco Supply Co.
Westinghouse Electric & Mfg. Co.

Line Material
*Ambroin-Werke.
American Brass Fdy. Co.,
Anderson, A. & J. M., Mfg. Co.
Bissell, F., Co.
*Blackwell, Robt. W., & Co., Ltd.
*British Thomson-Houston Co.
Carey, Thos. F.
Cornell Mfg. Co.
Creaghead Engineering Co.
*Dick, Kerr & Co., Ltd.
Electric Ry. Equipt. Co., Cincinnati.
*Electric Tramway Equipment Co.
Ewing, Geo. C.
*Felten & Guilleaume.
Garton, W. R., Co.
General Electric Co.
General Railway Supply Co.
Hemingray Glass Co.
H. W. Johns-Manville Co.
Macallen, W. T. C., Co.
*Maschinenfabrik Oerlikon.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Ridlon, Frank, Co.
Stuart-Howland Co.
Thomas, R., & Sons, Co.
Wendell & MacDuffie.
Wesco Supply Co.
Western Electric Co.
*Witting, Eborall & Co.

Lockers
Merritt & Co.

Lock Nuts
National Elastic Nut Co.
Spiral Nut Lock Co.
Weber Railway Joint Mfg. Co.
Wharton, Wm., Jr., & Co.

Locomotives, Electric
American Car Co.
Baldwin Locomotive Works.
*British Thomson-Houston Co.
Brill, J. G., Co.
Burnham, Williams & Co.
General Electric Co.
Jeffrey Mfg. Co.
McGuire Mfg. Co.
Taylor Electric Truck Co.
Wendell & McDuffie.
Westinghouse Electric & Mfg. Co.

Locomotives, Gasoline
Prouty-Pierce Locomotive Mfg. Co.

Lubricators
Crane Co.
Lukenheimer Co.

Lubricants
Bissell, F., Co.
Federal Supply Co.
The Ironsides Co.
Railway Journal Lubricating Co
Standard Automatic Lubricator Co.

Machinery and Machine Tools
Watson-Stillman Co.
Wendell & MacDuffie.

Machinery, Woodworking
American Machinery Co.
Woods, S. A., Machine Co

Mechanical Draft
Sturtevant, B. F., Co.

Merry-Go-Rounds
Armitage-Herschell Co.
Herschell, Spillman & Co.

Metal, Anti-Friction
(See Bearings.)

Mica
Mica Insulator Co.
Munsell, Eugene, & Co.
Sills-Eddy Mica Co.

Micanite
Mica Insulator Co.

Miniature Railways
Armitage-Herschell Co.

Motors, Electric
Akron Electrical Mfg. Co.
Bissell, F., Co.
*British Thomson-Houston Co.
*British Westinghouse Elec. & Mfg. Co., Ltd.
*Brush Electrical Engineering Co.
Crocker-Wheeler Co.
*Dick, Kerr & Co. Ltd.,
General Electric Co.
Lorain Steel Co.
*Maschinenfabrik Oerlikon.
National Electric Co.
Stanley Electric Mfg. Co.
Sturtevant, B. F., Co.
Westinghouse Electric & Mfg. Co.
*Witting, Eborall & Co., Ltd.

Multiple Unit Control
British Thomson-Houston Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

Oiler, Car Wheel
Ironsides Co.

Oils
(See Lubricants.)

Oil Cups
Lunkenheimer Co.

Oiling System
Bingham & Co.
Lunkenheimer Co.

Packing
Federal Supply Co.
Peerless Rubber Mfg. Co.

Paints, Insulating
(See Insulating Compounds.)

Paint and Varnish Preservative
Beacon Paint & Varnish Preservative Co.

Paints, Preservative
Atlas Railway Supply Co.
Detroit Graphite Mfg. Co.
Garry Iron & Steel Co.
Sherwin-Williams Co.

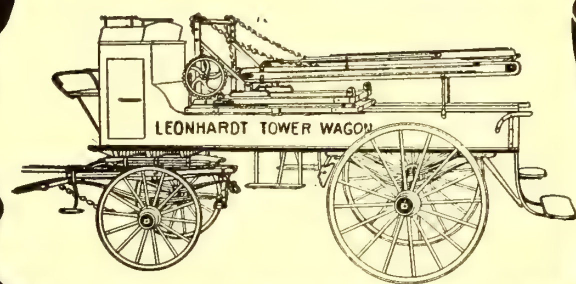
Paints and Varnishes
Detroit Graphite Mfg. Co.
Forest City Paint & Varnish Co.
McCaskill, Dougall & Co.
Parrott Varnish Co.
Poorman, Warren M.
Sherwin-Williams Co.
Standard Paint Co.
Standard Varnish Works.
Sterling Varnish Co.

Panels
(See Woodwork, Car.)

Patent Attorneys
Rosenbaum, Wm. A.
Straley, Hasbrouck & Schloeder

Paving Stri s
American Brake-Shoe & Fdy. Co.

You Will Never Regret
BUYING A
LEONHARDT
REVOLVING TOWER WAGON,
IS THE MOST ECONOMICAL. RELIABLE. QUICKLY OPERATED
INSULATION ALWAYS PERFECT.
SEE TOOL COMPARTMENTS.



PATENTED AND BUILT BY
LEONHARDT WAGON MFG.CO.
BALTIMORE, - MD., - U.S.A.

An Investment which is endorsed by Master Mechanics and Electrical Engineers

Our device will increase the efficiency of the present brake 300 per cent. without changing present mode of equipment. It will do away with slipping wheels and with the use of sand. We substitute magnetism for dead weight to increase adhesion between drive wheels and rails.

THE WABASH RAILROAD COMPANY
OFFICE OF MASTER MECHANIC
C. H. DOEBLER, Master Mechanic SPRINGFIELD, ILL.

MR. JAMES WOOD, Engineer C. R. I. & P.

MY DEAR JIM:—Thought you would be glad to know the Magnetic Equipment Company have their engine equipped with their device, and that it is a decided success.

I had the satisfaction, as well as the pleasure of handling the engine while making the tests, which were made on May 28th. The tests showed an increased efficiency of almost 30 per cent. with device operative.

The C. M. & ST P. R.R. officials are going to make a practical test about the 15th of this month. I feel sure the stock we bought will soon be worth many times what it cost us.

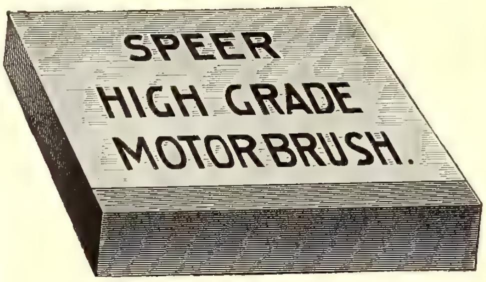
Tell all your friends the good news and have them get some of the stock before it goes out of sight. It can be got now for $1.50 a share. Yours very truly,

A. T. WHITSEL, Wabash Engineer.

SHALL WE SEND YOU OUR PROSPECTUS?

Magnetic Equipment Co.

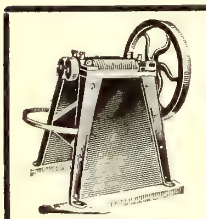
1213 MERCHANTS' LOAN AND TRUST BUILDING
CHICAGO



HIGHEST DEGREE OF QUALITY.

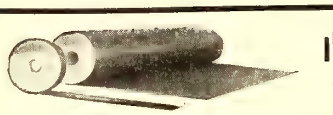
SPEER CARBON CO.

ST. MARYS, PA.



PATTEN TICKET DESTROYER.

Don't burn your used tickets. Destroy them and avoid fraud. Remember, it is difficult to get a man to destroy anything of value to him.
Sell the old stock—it will soon pay for machine.
In use on the Boston & Northern R. R., Old Colony St. Ry. Co., Brockton St. Ry. Co., Waterbury El. Co., Bridgeport Traction Co., Buffalo Ry. and others.
Write for Circular.
PAUL B. PATTEN,
78 Lafayette Street, - Salem, Mass., U. S. A.



If it is insulating tape or cloth in rolls on inch pasteboard centers, any width, it's

IMPERIAL VARNISH CLOTH

Up-to-date goods put up in up-to-date style. The saving in labor in using is possibly equal to 10% of the cost :: :: :: :: ::

SILLS-EDDY MICA COMPANY

NEWARK, N. J. CHICAGO, ILL

PITTSBURG INSULATING COMPANY

Manufacturers of INSULATED PAPER, LINEN, SILK, TAPE, Etc.

SOLE LICENSEES TO USE

STERLING EXTRA INSULATING VARNISH

In the Manufacture of Insulated Paper and Cloths

PITTSBURG, PA., U. S. A.

Brougham Street, Blackfriars Road, Salford, Manchester, England.

If you want an article that will repeat itself, try

U. S. METAL POLISH

For polishing all kinds of metals. Sold by Dealers. Samples free.
3 oz. box, 10c. 5 lb. pail, $1. Geo. W. Hoffman, Mfr., 295 E. Washington St., Indianapolis, Ind.

CLASSIFIED DIRECTORY—Continued.

Phosphor Bronze
Electric Railway Equipment Co, Cincinnati.
Phosphor Bronze Smelting Co.

Pipe, Wrought Iron and Steel
*Aiton & Co.
*Babcock & Wilcox, Ltd.
*Blackwell, Robt. W., & Co., Ltd.
Best Mfg. Co.
Garry Iron & Steel Co.
Crane Co.
Walworth Mfg. Co.
Wyckoff Pipe & Creosoting Co.

Platforms, Car
(See Woodwork, Car.)

Pole Paints
Forest City Paint & Varnish Co.
Sherwin-Williams Co.

Poles, Metal
Electric Railway Equipment Co., Cincinnati.
Federal Mfg. Co.
Franklin Rolling Mill & Foundry Co.
Walworth Mfg. Co.

Poles and Ties, Wooden
Advance Lumber Co.
Beidler, Francis, & Co.
Bissell, F., Co.
Carey, Thos. F.
Eccleston Lumber Co.
Fowler-Jacobs Co.
Greenbrier Pole Co.
Maltby Lumber Co.
Maus, H. H., & Co.
Phelan, D. W.
Porter & Berg.
Shepard, Farmer & Co.
Standard Pole & Tie Co.
Valentine-Clark Co.
Wyckoff Pipe & Creosoting Co.

Poles, Trolley
(See Trolley Poles.)

Polish, Metal
Hoffman, G. W.

Power Transmission Machinery
Aultman Co.
Jeffrey Mfg. Co.

Preservative (Paint and Varnish)
Beacon Paint & Varnish Preservative Co.

Presses, Hydraulic Wheel
Watson-Stillman Co.

Printing, Bank Notes, Etc.
Duplicate Transfer & Rebate Co.
Farr & Foster Co.
Poole Bros.
Sayre, L. A., & Co.
Woodman, R., Mfg. & Supply Co.

Pumps
Alberger Condenser Co.
*Allen, W. H., Son & Co., Ltd.
Blake-Knowles Steam Pump Wks.
Deming Co.
Stilwell-Bierce & Smith-Vaile Co.
*Weir, G. & J.
*Worthington Pump Co., Ltd.

Punches, Ticket
Farr & Foster Co.
International Register Co.
National Ticket Co.
Poole Bros.
Recording Fare Register Co.
Sayre, L. A., & Co.
Woodman, R., Mfg. & Supply Co.

Purifiers, Feedwater
(See also Heaters and Purifiers.)

Purifiers, Oil
Burt Mfg. Co.
Harrison Safety Boiler Works.
Liberty Manufacturing Co.

Rail Bonds
(See Bonds, Rails.)

Rail Joint Testing Instrument
Mayer & Englund Co.

Rail Joints
(See Joints, Rail.)

Rails
*Allen, Edgar, & Co., Ltd.
*Askham Bros. & Wilson, Ltd.
Barbour-Stockwell Co.
*Dick, Kerr & Co.
*Hadfield's Steel Foundry Co.
Lorain Steel Co.
Pennsylvania Steel Co.
Wharton, Wm. Jr., & Co.

Rails, Second Hand
(See pages 86-91.)

Rattan for Sweepers
American Car Co.
Brill, J. G., Co.
Consolidated Car Fender Co.
Hale & Kilburn Mfg. Co.
Heywood Bros. & Wakefield Co.
Mayer & Englund Co.
Ohio Brass Co.
Stuart-Howland Co.
Wendell & MacDuffie.

Reconstructed Granite
Reconstructed Granite Co.

Registers, Fare
Allison, Giles S.
General Railway Supply Co.
International Register Co.
Mayer & Englund Co.
New Haven Car Register Co.
Ohmer Fare Register Co.
Recording Fare Register Co.
Ridlon, Frank, Co.
Security Register Co.
Sterling-Meaker Co.

Register Fitting
International Register Co.

Register Handles
International Register Co.
Oberg, C. O., & Co.
Sterling-Meaker Co.

Repair Work
Akron Electrical Mfg. Co.
Bissell, F., Co.
Chase-Shawmut Co.
Cleveland Armature Works.
Dustin, Chas. E., Co.
Elliott Bros. Electric Co.
Garton Co., The W. R.
Rossiter, MacGovern & Co.
Van Dorn-Elliott Elec. Co.
Wendell & MacDuffie.

Replacers, Car
Duff Manufacturing Co.
Ridlon, Frank, Co.
Tilden, B. E., Co.
Van Dorn & Dutton Co.
Wendell & MacDuffie.
Zelnicker, W. A., Supply Co.

Riding Galleries
(See Merry-Go-Rounds.)

Rolling Doors and Shutters, Steel
Columbus Steel Rolling Shutter Co.
Kinnear Mfg. Co.

Roofing, Car
H. W. Johns-Manville Co.
Sjoberg, J. P., & Co.

Rope, Wire
(See Cables.)

Safes
Morris-Ireland Safe Co.

Sand Boxes
American Car Co.
American Locomotive Sander Co.
Brill, J. G., Co.
DeWitt Sand Box Co.
Ham Sand Box Co.
Newark Air Sand Box Co.
Peckham Manufacturing Co.
Positive Ry. Sander Co.
Ridlon, Frank, Co.
Sterling-Meaker Co.

Sash Cord
Samson Cordage Works.
Silver Lake Co.

Sashes, Car
American Car Co.
Brill, J. G., Co.
Sjoberg, J. P., & Co.

Sawing Machines
American Machinery Co.
Woods, S. A., Machine Co.

Scales, Weighing
Richardson Scale Co.

Scrap
(See pages 86-91.)

Seating, Car
Hale & Kilburn Mfg. Co.
Heywood Bros. & Wakefield Co.
*Peters, G. D., & Co., Ltd.
Sjoberg, J. P. & Co.
St. Louis Car Co.

Second-Hand Apparatus
(See pages 86-91.)

Separators
Goubert Mfg. Co. (Stratton Sep.)
Harrison Safety Boiler Works.
Phœnix Iron Works Co.
Westinghouse, Church, Kerr & Co.

Shades, Car
(See Curtains and Curtain Fixtures.)

Shade Holders, Lamp
Garton, W. R., Co.
Porter & Berg.

Shade Rollers
Hartshorn, Stewart, Co.

Sheathing, Keystone Insulator
H. W. Johns-Manville Co.

Shutters
Columbus Steel Rolling Shutter Co.
Kinnear Mfg. Co.

STANDARD UNDERGROUND CABLE CO.

BOSTON NEW YORK PITTSBURGH PHILADELPHIA CHICAGO SAN FRANCISCO

Bare, Weatherproof, Rubber **Covered Wire and Cables**

TROLLEY WIRE AND FEEDER CABLES LEAD COVERED CABLES FOR ANY SERVICE

CLASSIFIED DIRECTORY—Continued.

Safest to Use, Most Economical

The Sherwin-Williams Surfacing System insures a safe foundation for the color and varnish coats. It cuts down the time required to bring a car from the wood to the color coats with any other system. It holds out the color and varnish coats for the longest time. Write for prices and full information.

THE SHERWIN-WILLIAMS CO.
SPECIALISTS IN PAINTS AND VARNISHES FOR STREET RAILWAY USE

CLEVELAND, CHICAGO, NEW YORK, NEWARK, BOSTON, KANSAS CITY, SAN FRANCISCO, LOS ANGELES, MINNEAPOLIS, MONTREAL, TORONTO, WINNIPEG.

1056

FOR HIGH GRADE INSULATING VARNISHES

ADDRESS Standard Varnish Works
NEW YORK LONDON CHICAGO

Sterling Extra Insulating Varnish

STERLING EXTRA BLACK FINISHING VARNISH
STERLING BLACK AIR DRYING VARNISH
STERLING BLACK CORE PLATE VARNISH

THE STERLING VARNISH CO., Pittsburgh, Pa., U.S.A.

We are Specialists IN Paint for Railroads

The Forest City Paint and Varnish Co. CLEVELAND, OHIO.

CLASSIFIED DIRECTORY—Continued.

Ventilators
Electric Motor & Generator Ventilating Co.

Vestibules
Sjoberg, J. P., & Co.

Vulcabeston
H. W. Johns-Manville Co.

Webbing
Hope Webbing Co.

Wheels and Axles
American Car Co.
American Car & Foundry Co.,
*Baker, John, & Co., Ltd.
Baltimore Car Wheel Co.
Brill, J. G., Co.
Collins, Bouchard & Emery.
National Car Wheel Co.
Peckham Manufacturing Co.
Railway Steel Spring Co.
St. Louis Car Wheel Co.
Taylor Electric Truck Co.

Wheel Grinders
Wheel Truing Brake-Shoe Co.

Wheel Presses
Watson-Stillman Co.

Whistles, Conductors' and Starters'
Woodman, R., Mfg. & Supply Co.

Wires and Cables
American Electrical Works.
American Steel & Wire Co.
Bissell, F., Co.
Bridgeport Brass Co.
Carey, Thos. F.
Chase Shawmut Co.
Chicago Insulated Wire Co.
Creaghead Engineering Co.
*Felten & Guilleaume.
Garton, W. R., Co.
Magnet Wire Co.
*Maguire, F. Z.
Mayer & Englund Co.
National Conduit & Cable Co.
Nuttall, R. D., Co.
Okonite Co., Ltd., The.
Phillips, Eugene F.
Pittsburgh Reduction Co.
Porter & Berg.
Roebling's, J. A., Sons Co
*Smith, Fred'k, & Co., Ltd.
Standard Underground Cable Co.
Stuart-Howland Co.
Wendell & MacDuffie.
Wesco Supply Co.
Western Electric Co.
Zelnicker, W. A., Supply Co.

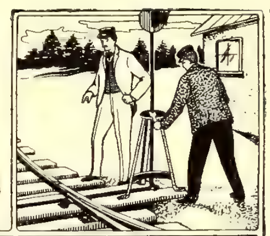
Woodwork, Car
American Car Co.
Brill, J. G., Co.
Sjoberg, J. P., & Co.
St. Louis Car Co.

Woodworking Machinery
American Machinery Co.
Woods, S. A., Machine Co.

INGERSOLL CONSTRUCTION COMPANY

Originators, Builders and Operators of High Grade Park Amusements

307 FOURTH AVENUE, PITTSBURGH, PA.



EXPANDED METAL LOCKERS

HAVE been installed by some of our largest railroads and street railway systems to provide places to stow employees' uniforms, street clothing, tools, etc. Material is neither jointed or interwoven, has no cracks or crevices. It is stronger than woven wire, better in every way than wood, will not rust, warp or sag, and cannot be forced apart by human pressure.

Lockers are built in units to fit any sized or shaped space. Send for Estimate.

MERRITT & CO., 1124 Ridge Ave., Philadelphia, Pa.

WHEN WRITING TO ADVERTISERS

In the STREET RAILWAY JOURNAL you will confer a favor on both publisher and advertiser by mentioning this paper.

CLEAN YOUR CARS

while in service with "BEACON" which removes the dirt, and improves and preserves the varnish, thus promoting beauty more durable surfaces and economy in repainting or revarnishing.
Easy to apply. Write for Booklet.
BEACON PAINT & VARNISH PRESERVATIVE CO.,
1313 Vine Street, Philadelphia, Pa., U. S. A.

WHEN WRITING TO ADVERTISERS in the STREET RAILWAY JOURNAL you will confer a favor on both publisher and advertiser by mentioning this paper.

H. R. PARROTT, President F. W. PARROTT Treasurer

THE PARROTT VARNISH COMPANY

Manufacturers of Fine **VARNISHES for ELECTRIC and RAILWAY CARS** BRIDGEPORT CONN

GEO. C. EWING | Electric Railway Material

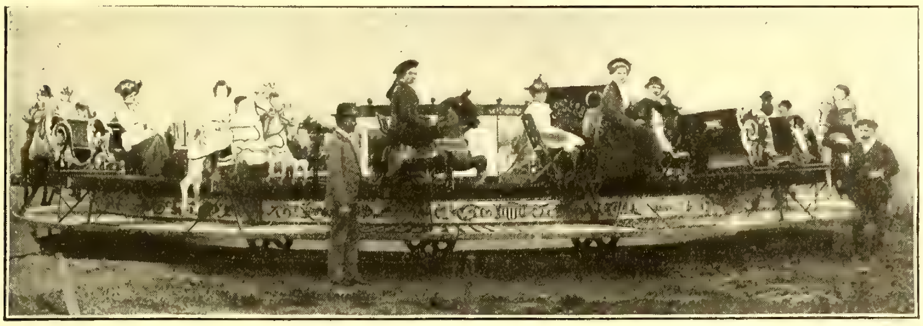
131 STATE STREET : : : BOSTON, MASS.

Prepared to furnish complete construction, maintenance equipment and rolling stock for electric railways

GEORGE KISSAM & CO., Largest Street Car Advertising Concern in the World.

We are prepared to negotiate for Long Time Leases with First Class Roads in any part of the United States.

BRANCH OFFICES IN LEADING CITIES. GENERAL OFFICES, 253 BROADWAY, NEW YORK.



IMPROVED
Steam
Riding Gallery

We are the Pioneers in the manufacture of

RIDING GALLERIES

Our Galleries and Miniature Railways attract the crowds, and pay for themselves in one season.

Let us hear from you

ARMITAGE-HERSCHELL CO., NORTH TONAWANDA NEW YORK, U. S. A.

IMPROVED MERRY-GO-ROUNDS

AND EVERYTHING IN UP-TO-DATE ATTRACTIONS FOR RAILWAY PARKS

A Ride on one of these Galleries is a pleasure which would leave a lasting impression on every visitor to your Park. Each horse has a galloping motion. Will seat comfortably 56 adults. The most durable, convenient and finest in finish.

Can be operated by Steam or Electricity.

HERSCHELL, SPILLMAN & CO. NORTH TONAWANDA N.Y. U.S.A

California

for an ideal outing this winter. There is something to see and something to do. The climate will tempt you out of doors, and you will be glad of it. The trip is made quickly and comfortably by the trains of the

Chicago, Milwaukee & St. Paul and Union Pacific Line

The Overland Limited runs via this route and is the most famous train across the continent. Complete information on rates, routes and train service on request.

F. A. MILLER,
General Passenger Agent.

Chicago

Nineteen Through Trains

In daily service over the Lake Shore & Michigan Southern Railway, between the cities of Chicago and Toledo, Cleveland, Buffalo, St. Louis, Indianapolis, Cincinnati, Pittsburg, New York and Boston, in connection with the New York Central, Boston & Albany, Pittsburg & Lake Erie and Cleveland, Cincinnati, Chicago & St. Louis Railroads.

Don't Forget when you buy a through ticket to tell the ticket agent plainly that you wish it over the Lake Shore & Michigan Southern Railway. You will secure the best in travel that money can buy.

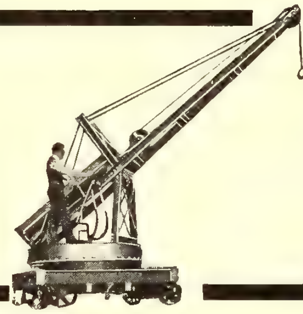
Send for booklet "Privileges for Lake Shore Patrons," contains useful information; also, "Book of Trains."

Address A. J. SMITH,
G. P. & T. A., CLEVELAND, OHIO.

Write for our Catalogue of

STANDARD RAILWAY PANELS

The Walker Co.
PHILADELPHIA
NEW YORK
CHICAGO



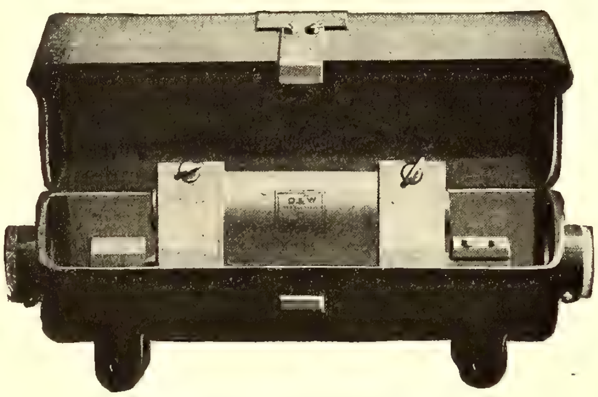
PNEUMATIC OR ELECTRIC REVOLVING

GARRY CRANE

Mounted on car with standard track gauge. May be run to all parts of yard. Rapid — Durable — Efficient. Capacity, 1,000 to 10,000 pounds, or built to any specifications.

The **GARRY IRON & STEEL CO.,** **Cleveland, Ohio**

GENERAL MACHINE AND STRUCTURAL IRON WORK.



Type R-3 Street Car Motor Cut-Out

HEAVY SERVICE CUT-OUTS

350 TO 500 AMPERES, 650 VOLTS

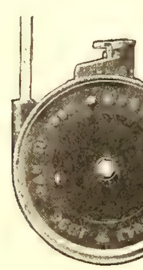
THESE FUSES HAVE BEEN TESTED UP TO 18,000 AMPERES, 650 VOLTS ON DEAD SHORT CIRCUIT, OPENING WITHOUT ARC OR FLASH.

GIVE US A TRIAL

D. & W. FUSE CO. **PROVIDENCE, R. I.**
New York Office, 92 William Street
A. HALL BERRY, Manager

AGENCIES:

BOSTON: Pettingill-Andrews Co.	NEW YORK: Western Electric Co.	PHILADELPHIA: Western Electric Co.
CHICAGO: Central Electric Co.	ST. LOUIS: Western Electric Co.	SAN FRANCISCO. California Electrical Works



There's trouble with the trolley poles on cars that are not equipped with the Wilson Trolley Retriever. There are other retrievers, but only one Wilson. Samples shipped subject to your approval.

Ridlon's Representative is an entertaining little magazine, but not too entertaining to be of vital interest to every street railway man. If you are not receiving it, have your name put upon the mail list. It helps us, of course, but then it will help you.

THE WILSON TROLLEY CATCHER CO.,

200 Summer Street, Boston, Mass.

Indians of the Southwest

Where they live and how to get there — their homes, handicraft and ceremonies — an intensely interesting book of more than two hundred pages — written by Geo. A. Dorsey, Ph.D., Curator of Anthropology, Field Columbian Museum, an authority on the "Amerind" — profusely illustrated with half-tones from special photos — handsome cover in colors — sent anywhere on receipt of fifty cents — valuable for schoolroom or library. Address General Passenger Office, A. T. & S. F. Ry. Co., Chicago.

—WE—
BEG TO ANNOUNCE
THAT WE HAVE A NEW,
THOROUGHLY MODERN, WELL
EQUIPPED PLANT, AND ARE IN A
POSITION TO FURNISH COIL AND ELLIPTIC

SPRINGS

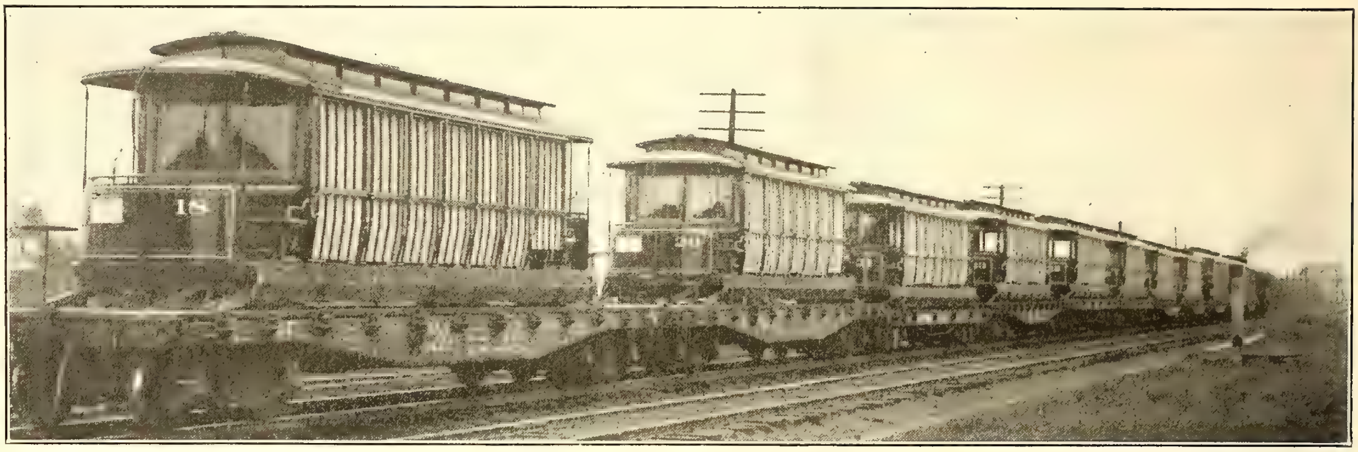
FOR ALL CLASSES OF RAILWAY EQUIPMENT

Simplex Railway Appliance Co.

Office and Works, Hammond, Ind.

SALES OFFICES—NEW YORK AND
CHICAGO

The Jewett Car Company



Shipment of Open Cars to the Wheeling Traction Co.

Interior of Our Standard Interurban Coaches.

We Have Furnished the Entire Equipment for the Above Road.

NEWARK, : : : OHIO, U. S. A.

WE have mailed to all MANAGERS and MASTER MECHANICS as given by the STREET RAILWAY JOURNAL DIRECTORY a copy of our INITIAL CATALOGUE. We hope we have reached *all* interested. If we have not we will consider requests for Catalogues as favors to us. The PHILADELPHIA AIR BRAKE is introduced with the year 1904, but we assure you it has had MORE EXPERIENCE and is NOT AN EXPERIMENT. We respectfully solicit correspondence and investigation.

PHILADELPHIA AIR BRAKE CO.
Real Estate Trust Building
PHILADELPHIA

F. S. DRAKE, Sales Agent   W. W. LAMBERT, Manager

Christensen Air Brakes

INSURE

Quick Stops   Higher Speeds   Perfect Safety

Economy in Operation

Instantaneous Release and Absolute Reliability

Aurora, Elgin & Chicago Railway, Equipped with Christensen Air Brake

Over 10,200

Christensen Air Brake Equipments are in Daily and Highly Satisfactory Service throughout the World

National Electric Company

General Sales Office
of Air Brake Department
135 BROADWAY, NEW YORK

Milwaukee

CHICAGO: Old Colony Building
CINCINNATI: 809 Traction Bldg.
CLEVELAND: 812 Prospect St.
PHILADELPHIA: 1402 Erie Ave.

R. W. Blackwell & Co., London, Brussels and Paris   Edge & Edge, Sydney, Australia

RAILWAY SKC MOTORS

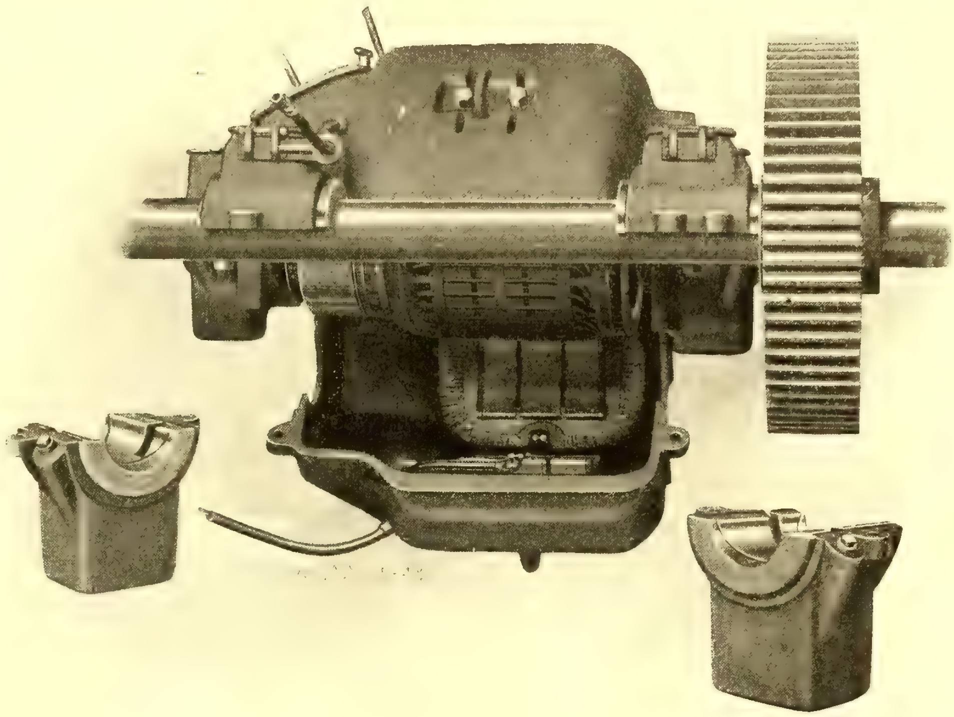
Are distinguished by unusually liberal ventilation and low temperature in operation

FRAME

THE frame is divided horizontally into halves. The lower half can readily be swung down to the position shown in the illustration, or, if desired, it may be entirely removed,

POLE PIECES

The pole pieces are made up of soft laminated steel punchings riveted together. Each pole piece has a flare at the armature end, which, besides holding the field coil in place, effects the best distribution of the lines of magnetic flux. Ventilating ducts through the body of the pole piece permit air circulation and insure a low temperature of the field coil.



BEARINGS

The bearings are Babbitt lined castiron shells of ample dimensions, with means for abundant and constant lubrication. Both armature and axle bearing caps are bolted to the top half of the motor frame.

FIELD COILS

The field coils are wound of square wire, eliminating the air spaces which occur when round wire is used, and thus securing a rapid transfer of heat from the interior to the surface of the coil. The coils are insulated with successive layers of insulating material with an insulating compound, the layers being thoroughly cemented together into a solid mass. This insulation is water proof and elastic, strong both electrically and mechanically, and because of its solidity, permits of the rapid transfer of heat from the coil.

ARMATURE

The armature is unusually well ventilated. Large ducts parallel to the shaft allow the air to enter the body of the armature and ventilating ducts, perpendicular to the shaft, allow the heat to escape. The end castings project above the level of the coils, so as to protect the end winding from injury. The armature coils are form-wound, dipped and thoroughly insulated with old linen and tape. The band wires holding the coils in place lie in grooves below the general surface of the armature, thereby protecting them from injury.

COVER OVER THE COMMUTATOR

A neat cover over the commutator permits inspection of same and replacing of brushes. Another hand-hole allows inspection from below.

Bulletin 130 gives further details of S. K. C. Railway Motors.

Stanley Electric Mfg. Company, Pittsfield, Mass.

BRANCH OFFICES:

NEW YORK, 29 Broadway.
CHICAGO, Monadnock Block.
BOSTON, Equitable Building.
PHILADELPHIA, PA., 26 S. 15th St.
CLEVELAND, O., 129-131 Euclid Ave.

SAN FRANCISCO, 31-33 New Montgomery St.
LOS ANGELES, CAL., Douglas Bldg.
BUFFALO, N. Y., 202 Main St.
SEATTLE, WASH., Pioneer Bldg.

DENVER, COLO., Hendrie & Bolthoff Mfg. and Supply Co.
BUTTE, MONT., Western Mining Supply Co.
ATLANTA, GA., Empire Bldg.

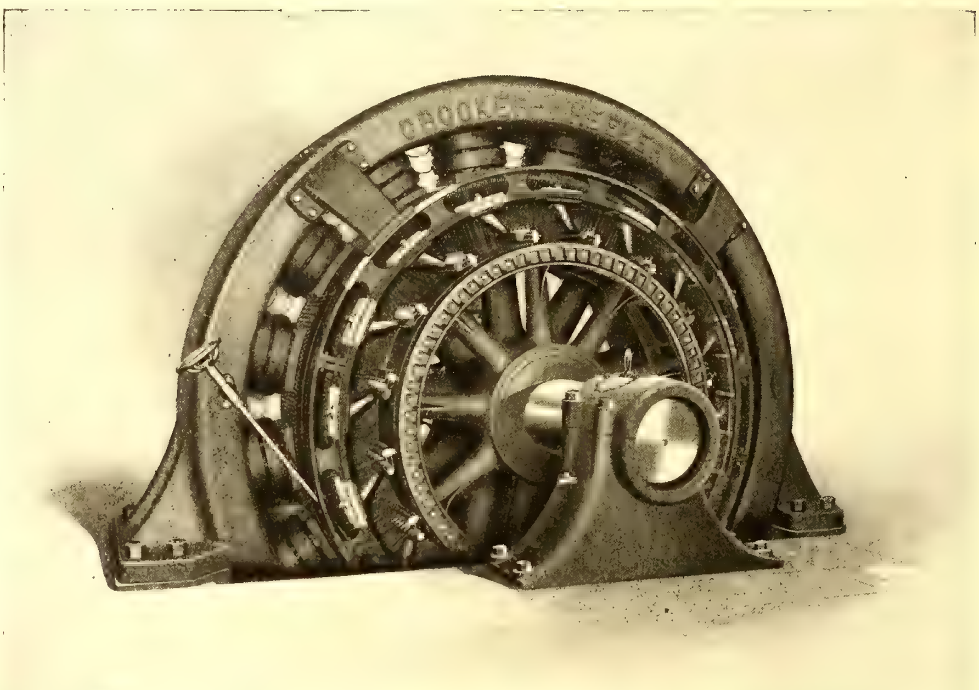
In Canada S. K. C. Apparatus is manufactured by the CANADIAN GENERAL ELECTRIC CO., TORONTO.

LILLIBRIDGE, N. Y.

Crocker-Wheeler Company

Manufacturers and Electrical Engineers

AMPERE, N. J.



Eight of these Railway Type Generators will be seen in Machinery Hall, at the Louisiana Purchase Exposition, in St. Louis, supplying power to the Intramural Railway

We are Manufacturers of Generators and Motors, and Engineers for their installation in Power Stations and Industrial Plants

Branch Offices

BOSTON
NEW HAVEN
NEW YORK
SYRACUSE
PHILADELPHIA
WASHINGTON

PITTSBURG
CLEVELAND
CHICAGO
ST. LOUIS
DENVER
SAN FRANCISCO

Westinghouse Single-Phase Motors For Heavy Railway Lines

With direct current equipments it has been impossible to show any economy in the electrical operation of existing steam roads except in rare instances.

The economical electrical operation of heavy railway lines demands

First: Higher car voltages than are used on existing lines and which probably represents the practicable limit of direct current operation.

The alternating current single-phase motor may be operated with any car voltage demanded by the conditions of economical operation.

Second: A more economical current control than is possible by the rheostatic devices which are required by direct current operation.

The voltage control used with single-phase equipments admits of the operation at all loads with equal economy.

Third: In the handling of long heavy trains, the speed control must be equivalent to the present steam locomotive control.

This is impossible of attainment with direct current apparatus, but may be had with the single-phase equipment with the highest degree of exactness.

Fourth: The system must have a large reserve capacity to "make up time."

Only the single-phase, alternating current equipments meet this important requirement and they may be operated within any limits of speed consistent with safety.

We are prepared to offer these single-phase alternating current equipments for heavy railway service for operation on lines of 25 cycles and under, and to extend the guarantee of this Company as to efficiency and workmanship.

Westinghouse Electric & Mfg. Co.

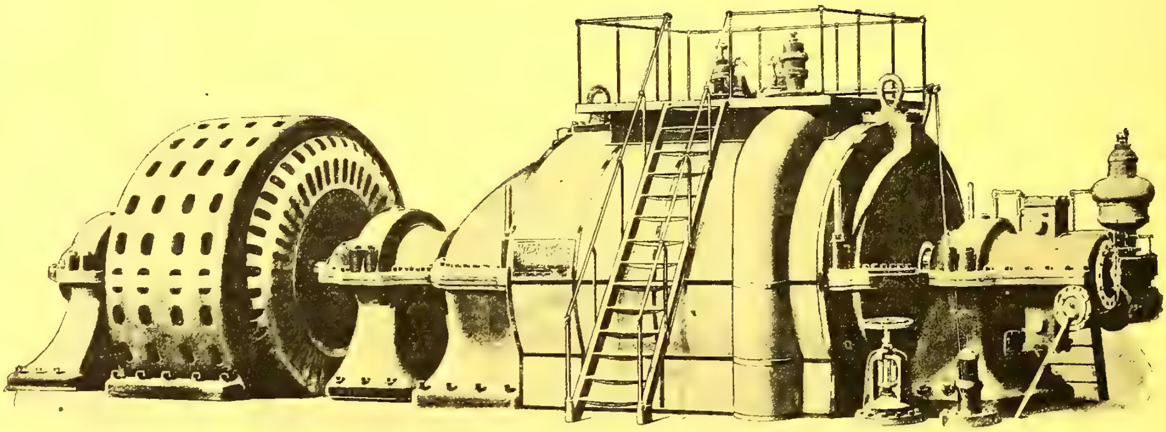
Pittsburg, Pa.

Westinghouse=Parsons

Steam Turbine

The Only Steam Turbine of World=Wide Application

Excepting Small Units



Westinghouse=Parsons 7500 H. P. Steam Turbine Generating Unit.

During the past few years Westinghouse-Parsons Turbines aggregating 175,000 H. P. have been sold in America; 50,000 H. P. of which are in daily operation, the remainder being either ready for shipment or nearing completion.

The first important American installation was made four years ago, consisting of four 600 H. P. Units. These have been running continuously, giving absolutely no trouble.

Official Test Records

of every unit shipped are

Open to Examination

Abroad the Parsons Turbine is represented by an aggregate total of over half a million horse=power. successfully operating in both marine and stationary service.

For particulars address nearest sales office of

The Westinghouse Machine Co.

Works, East Pittsburg, Pa.

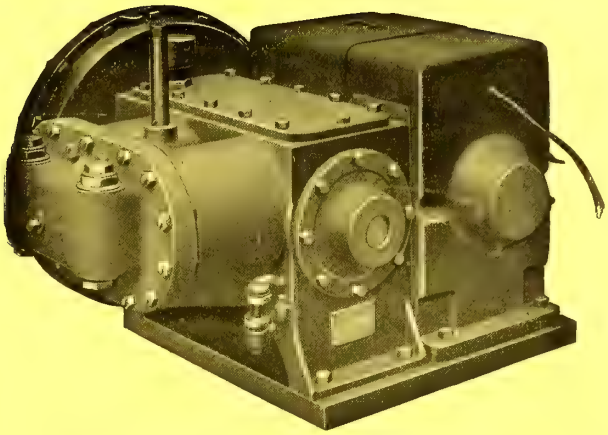
Sales Offices: New York, 10 Bridge St. Boston, 131 State St. Pittsburg, Westinghouse Bldg. Chicago, 171 La Salle Street. Detroit, Union Trust Bldg. Philadelphia, Stephen Girard Bldg.

Designers and Builders of

Steam Engines, Gas Engines, Steam Turbines, Roney Mechanical Stokers

Westinghouse

Motor=Driven Air Compressors



Primarily intended to supply compressed air for traction car brakes, but also particularly adapted for portable blowing outfits and stationary work. They are simple in construction, of the highest efficiency, and designed to occupy the smallest possible space consistent with ample size of all wearing parts.

For air=brake equipments where first cost is an important consideration, Westinghouse Axle=Driven Air Compressors have given the most excellent satisfaction, their use avoiding the cost and maintenance of another motor in the car equipment. Like the motor=driven compressors they are noiseless in operation, and dust and water=proof.

Westinghouse Traction Brake Co.

26 Cortlandt Street, New York.

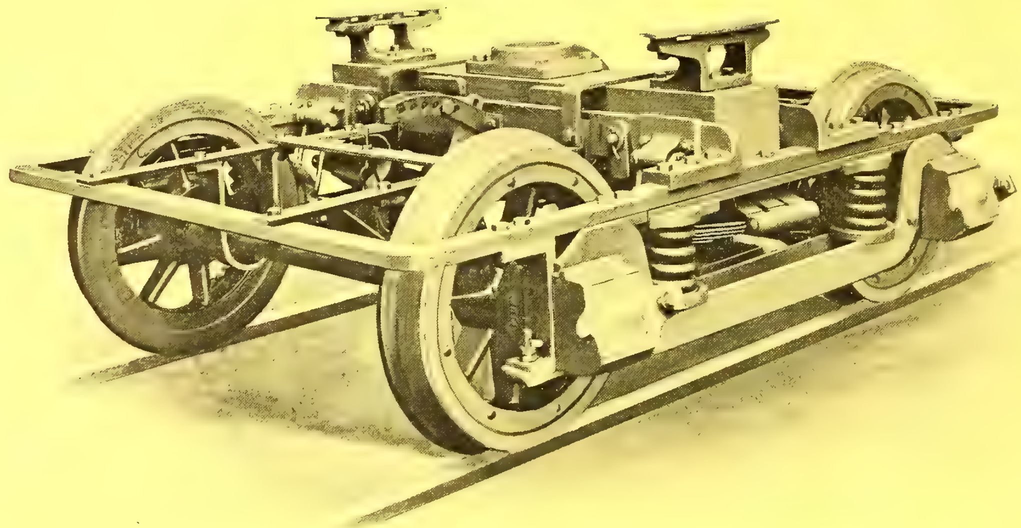
Power Brakes for all classes of Traction Service.
Magnetic Brake and Electric Car Heating System.

Apparatus Manufactured by The Westinghouse Air Brake Co.

Baldwin Locomotive Works

M. C. B. Type Motor Truck

For High-Speed Service



Burnham, Williams & Co.

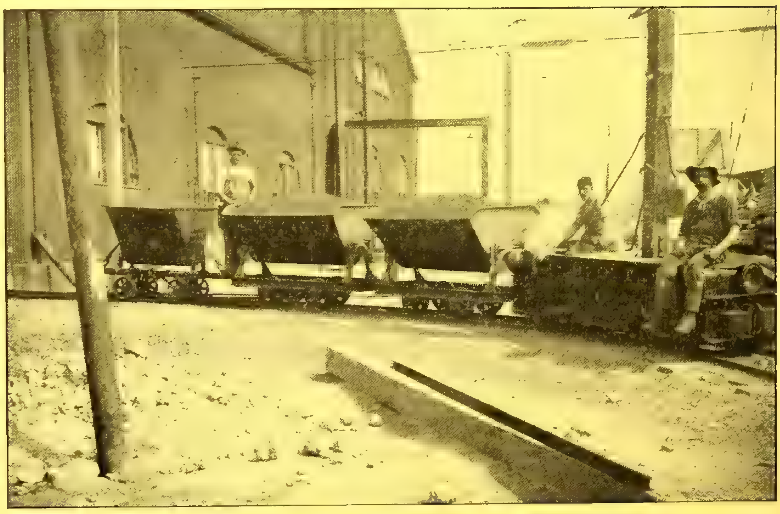
Philadelphia, Pa.

Baldwin-Westinghouse

Electric Locomotives for Surface Haulage

For Industrial Purposes

No expense when standing idle
Strongly constructed
Simple to operate



Hauling Ash Dump Cars. Brooklyn Rapid Transit Co

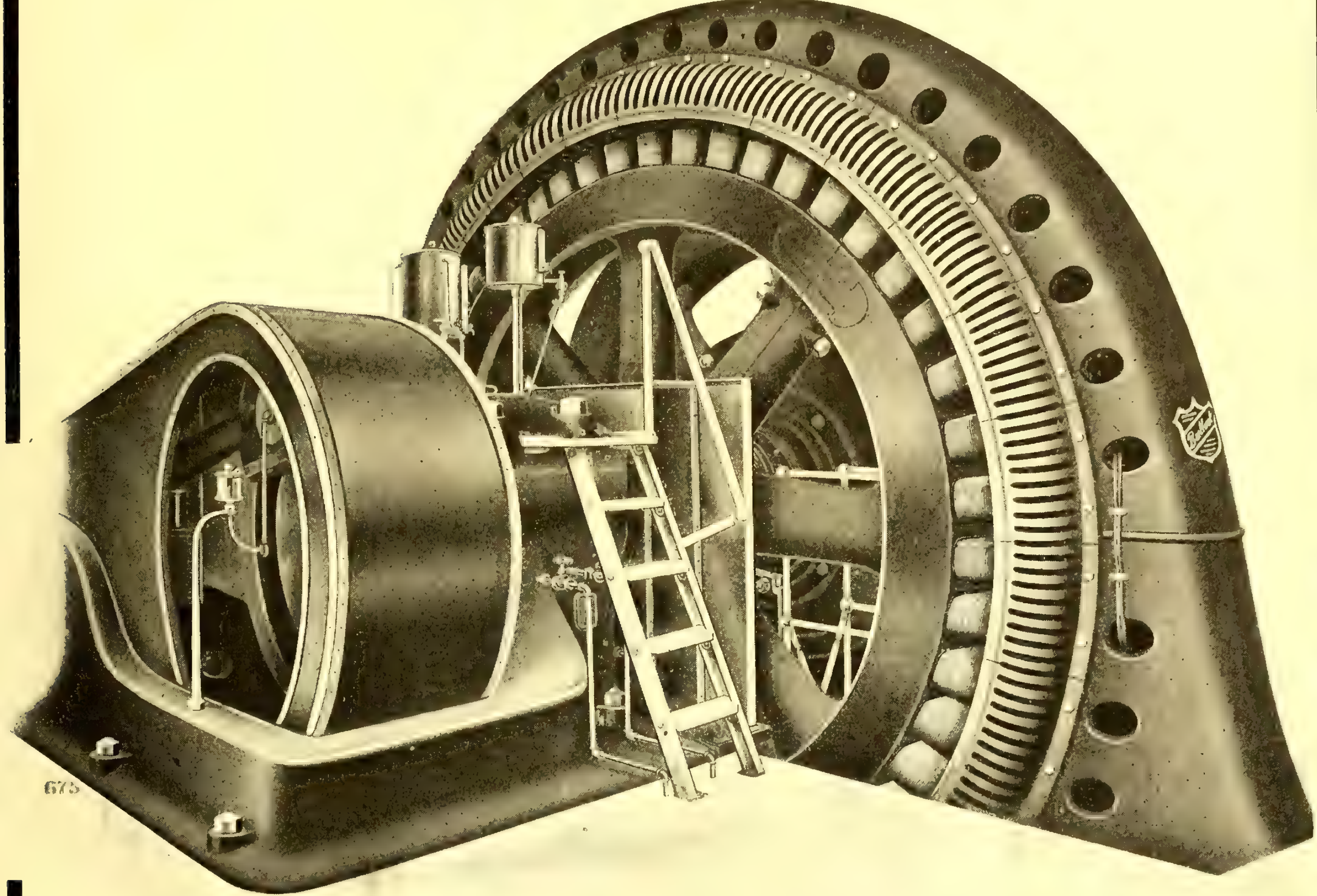
See Illustrated Catalogue: "Electric Locomotives for Surface Haulage."

Baldwin Locomotive Works
Philadelphia, Pa.

Westinghouse Electric & Mfg. Co.
Pittsburg, Pa.

Bullock Electric Mfg. Company

CINCINNATI, OHIO, U. S. A.



1500 kw. Flywheel Type Bullock Generator, Installed at the Denver Gas & Electric Company's Plant

Sales Agents

DISTRICT OFFICES

Boston, Mass., Journal Building
New York, N. Y., St. Paul Building
Philadelphia, Pa., North American Building
Baltimore, Md., 8-10 South Street
Chicago, Ill., Marquette Building
Cincinnati, Ohio, East Norwood
St. Louis, Mo., Chemical Building
Atlanta, Ga., Empire Building
Indianapolis, Ind., Stevenson Building

REPRESENTATIVES

Pittsburg, Pa., A. W. Wyckoff & Co., 1723 Farmers' Bank Building
Cleveland, Ohio, Lehman B. Hoit, 803 New England Building
Detroit, Mich., Michigan Electric Co.
Louisville, Ky., Harry I. Wood, 520 W. Main Street
New Orleans, W. H. Fleming, Hennen Building
Denver, Col., Gilbert Wilkes & Co., 435 Seventeenth Street
Salt Lake City, Utah, Gilbert Wilkes & Co.
Helena, Mont., Gilbert Wilkes & Co.
Buffalo, N. Y., Robertson Electric Co., 190 Main Street
San Francisco, Cal., Wagner Bullock Electric Co., 631 Mission Street
Los Angeles, Cal., Wagner Bullock Electric Co., Stimpson Building
Seattle, Wash., Wagner Bullock Electric Co., Room "A" Pacific Block

CANADA

Montreal, Que., Canadian Bullock Electric Mfg. Co., Ltd., Coristine Building
Toronto, Ont., Canadian Bullock Electric Mfg. Co., Ltd., McKinnon Building

FOREIGN OFFICES

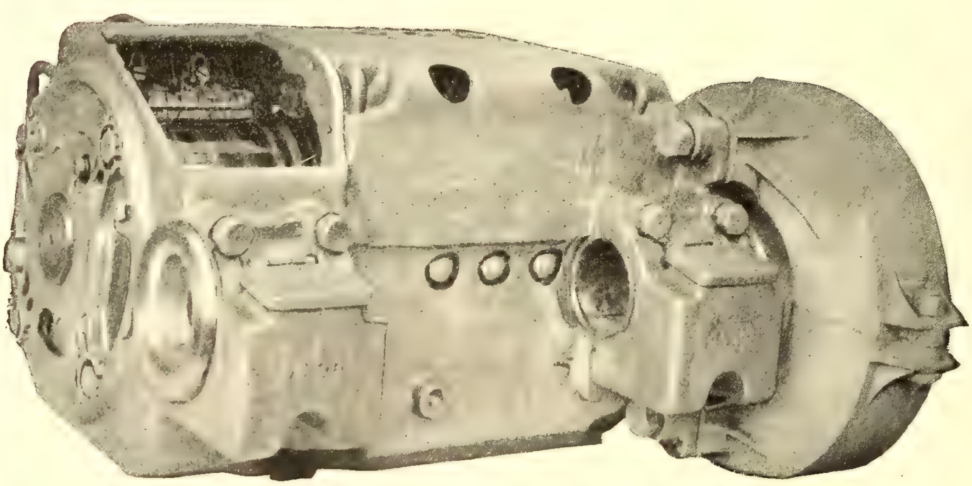
London, Eng., Bergthiel & Young, 12 Camomile Street
Manchester, Eng., Bergthiel & Young, Cleveland Building
Melbourne, Australia, Wm. McLean & Co., 317-319 Flinders Lane
Tokyo, Japan, H. S. Tanaka & Co., Shimbashi
Manila, P. I., Albert Bryan, 100 Plaza Santa Cruz
Managua, Nicaragua, Warren B. Reed
San Jose, Costa Rica, L. E. Allen
Mexico, Mexico, Cia Benbow Dutton & Co., Apartado 2308
Constantinople, Turkey, J. G. Johnson & Co.
Honolulu, H. I., Von Ham Young & Co.

Builders of Direct and Alternating Current Apparatus

GENERAL ELECTRIC COMPANY'S

G. E. 69 Motor

340 of these Motors Ordered by the Interborough Rapid Transit Company, New York City



G. E. 69 Motor. 200 H. P. With Cover Removed

The Sprague-General Electric System of Control has been adopted exclusively by the Interborough Rapid Transit Company, New York City

General Electric Company, Schenectady, N. Y.

New York Office, 44 Broad Street

Sales Offices in all Large Cities

FOR GREAT BRITAIN AND IRELAND:

The British Thomson-Houston Company, Ltd., Rugby and 83 Cannon St., London, E.C

The Record of a Year

Under the above heading there appeared in the Street Railway Journal for January 3, 1903, the following statement:

"During 1901 there were published in the fifty-two American issues of the STREET RAILWAY JOURNAL, 2,070 pages of paid advertising, exclusive of all indexes, book advertisements, etc. In the twelve International numbers for the same year there were 363 additional pages of European advertising, making a total of 2,433 pages for the year.

"The corresponding figures for 1902 show 2,383 American and 417 European pages, a total of 2,800 pages, a gain of 367 pages during the year. Of this increase, 108 pages were published in the twelve larger numbers, and 259 in the forty smaller issues—a gain in the latter of nearly 50% over the previous year."

HERE IS THE RECORD OF ANOTHER YEAR

The total number of pages of American advertising during 1903 amounted to 2,946 pages net; additional European advertising, 397; making in all 3,343 pages of net advertising for fifty-two consecutive issues.

This is a Gain of 543 Pages over 1902

What we said regarding the showing made a year ago is equally true now. It is as follows:

"These figures mean something. To our readers they mean that the STREET RAILWAY JOURNAL—whose advertising pages have always been the most valuable buyers' directory for the important industry which it represents—is becoming even more valuable in this respect from year to year. To our advertisers they mean that the STREET RAILWAY JOURNAL affords the most effective medium, not only for reaching their possible customers in the electric railway and tramway field when they are actually in the market for apparatus and equipment, but also for emphasizing in a convincing manner from week to week the advantages of the material advertised."

STREET RAILWAY JOURNAL

114 LIBERTY STREET NEW YORK

DIRECTORY OF STREET RAILWAY ASSOCIATIONS

American Street Railway Association.

President, W. Caryl Ely, President International Railway Company, Buffalo, N. Y.
First Vice President, Elwin C. Foster, President New Orleans Railways Company, New Orleans, La.
Second Vice-President, John Grant, General Superintendent St. Louis Transit Company, St. Louis, Mo.
Third Vice-President, James F. Shaw, President Boston & Worcester Street Railway Company, Boston, Mass.
Secretary and Treasurer, T. C. Penington, 2020 State Street Chicago, Ill.
Executive Committee: President Vice-President and Jere C. Hutchins President Detroit United Railway Detroit, Mich.; A. B. Colvin President Hudson Valley Railway Company, Glens Falls, N. Y; G. Tracy Rogers President Binghamton Railway Company, Binghamton, N. Y.; W. A. Smith General Manager Omaha & Council Bluffs Railway Company, Omaha Neb; S. L. Nelson, Vice-President and General Manager Fort Wayne & Southwestern Traction Company, Ft. Wayne, Ind.

Street Railway Accountants' Association of America.

President, F. E. Smith, Auditor for Receivers of Chicago Union Traction Company and of Chicago Consolidated Traction Company, Chicago, Ill.
First Vice President, F. R. Henry, Auditor United Railways Company of St. Louis, St. Louis, Mo.
Second Vice-President C. O. Simpson, Auditor Birmingham Railway, Light and Power Company, Birmingham, Ala.
Third Vice-President, J. J. Magilton, Auditor Schenectady Railway Company, Schenectady, N. Y.
Secretary and Treasurer, W. B. Brockway, 40 Morris Street, Yonkers, N. Y.
Executive Committee: H. J. Davies, Cleveland, O.; S. C. Rogers, Youngstown, O.; S. G. Boyle, Louisville, Ky.; H. M. Pease, Buffalo, N. Y.

American Railway Mechanical and Electrical Association

President, E. W. Olds, Superintendent rolling stock the Milwaukee Electric Railway & Light Company, Milwaukee, Wis.
First Vice President, Alfred Green, Master Mechanic Rochester Railway Company, Rochester, N. Y.
Second Vice-President, C. F. Baker, Superintendent motive power and machinery Boston Elevated Railway Company, Boston, Mass.
Third Vice-President, W. O. Mundy, Master Mechanic St. Louis Transit Company, St. Louis, Mo.
Secretary and Treasurer, Walter Mower, Detroit United Railway Company, Detroit, Mich.
Executive Committee: The above officers, and T. J. Mullen, Master Mechanic Scranton Railway Company, Scranton, Pa.; H. H. Adams, Master Mechanic United Railways and Electric Company, Baltimore, Md.; D. F. Carver, Chief Engineer North Jersey Street Railway Company, Newark, N. J.; H. J. Lake.

The California Street Railway Association.

President, Chas. F. Crocker, San Francisco.
Vice-President, S. B. McLenegan, San Francisco.
Secretary and Treasurer, J. E. Morris.
Executive Committee: E. P. Vining, San Francisco; F. W. Wood, Los Angeles; L. Wheeler, Alameda.

Colorado Electric Light, Power and Railway Association.

President, J. F. Vail, Pueblo.
Vice-President, Wm. Mayher, Greeley.
Secretary and Treasurer, Geo. B. Tripp, Colorado Springs.

Connecticut Street Railway Association.

President, J. B. Carrington, New Haven.
Vice-President, A. M. Young, Branford.
Secretary, E. W. Poole, Bridgeport.
Treasurer, E. S. Goodrich, Hartford.
Executive Committee: The above officers and J. E. Sewell, Bridgeport; C. S. Treadway, Bristol; Walter Learned, New London.
Next annual meeting, November, 1903.

The Maine Street Railway Association.

President, W. R. Wood, Portland.
Secretary and Treasurer, E. A. Newman, 471 Congress St., Portland.
Executive Committee: William R. Wood, Portland; Amos F. Gerald, Waterville; J. Manchester Haines, Augusta; G. E. Macomber, Rockland.

Massachusetts Street Railway Association.

President, Edward P. Shaw, Newburyport.
First Vice-President, Francis H. Dewey, Worcester.
Second Vice-President, Robt. S. Goff, Fall River.
Secretary, Charles S. Clark, 70 Kilby St., Boston.
Treasurer, Fred H. Smith, Quincy.
Executive Committee: President, Vice-Presidents and P. F. Sullivan, Lowell; H. H. Crapo, New Bedford; William S. Loomis, Holyoke; R. T. Laffin, Worcester; and W. W. Sargent, Fitchburg
Auditing Committee: Geo. W. Cook, Springfield, Charles F. Grosvenor, Palmer; H. C. Page, Pittsfield.
Monthly meetings second Wednesday of each month excepting July and August.

Michigan Interurban and Street Railway Association.

President, J. D. Hawks, Detroit.
Vice-President, W. L. Jenks, Port Huron.
Secretary and Treasurer, Benjamin S. Hanchett, Grand Rapids.
Executive Committee: Officers of the Association and Strathearn Hendrie and John Winter, Detroit.
Next meeting to be held at call of president.

New England Street Railway Club.

President, H. E. Farrington, Chelsea, Mass
Vice-President, E. E. Potter, New Bedford, Mass.
Vice-Presidents for States, W. G. Meloon, Kittery, Me.; H. A. Albin, Concord, N. H.; A. J. Crosby, Springfield, Vt.; H. W. Young, Woonsocket, R. I; J. S. Thornton, Putnam, Conn.
Secretary and Treasurer, J. H. Neal, of the Boston Elevated Railway Company, 101 Milk St., Boston, Mass.
Executive Committee: President, Vice-Presidents and Secretary-Treasurer; D. L. Prendergast, Boston; A. J. Purinton, Palmer; H. E. Reynolds, Quincy; P. W. Davis, Boston; Frank J. Stone, Manager Electric Storage Battery Company, Boston; Franklin Huntress, Boston; John C. Spring, Boston.
Finance Committee: J. F. Wattles, Boston, Mass.; H. E. Farrington, Chelsea, Mass.; Paul Winsor, Boston, Mass.
Meetings are held the last Thursday of every month at various points in New England.

New York State Street Railway Association.

President, E. G. Connette, Syracuse.
First Vice-President, A. B. Colvin, Glens Falls.
Second Vice-President, J. L. Heins, Brooklyn.
Secretary and Treasurer, W. W. Cole, Elmira.
Executive Committee: C. L. Allen, Utica; B. B. Nostrand, Jr., Peekskill; W. H. Pouch, Newburgh; J. H. Pardee, Canandaigua.

Ohio Street Railway Association.

President, S. L. Nelson, Springfield.
Vice-President, John F. Flood, Steubenville.
Secretary and Treasurer, Chas. Currie, Akron.
Executive Committee, A. A. Anderson, Youngstown; W. A. Lynch, Canton.

Pennsylvania State Street Railway Association.

President, F. B Musser, Harrisburg
Secretary, Charles H. Smith, Lebanon.
Treasurer, W. H. Lanius, York.
Executive Committee: The President, Secretary, Treasurer and B. F. Meyers, Harrisburg; John A. Rigg, Philadelphia.

Southwestern Gas, Electric and Street Railway Association.

Acting President, A. E. Judge, Tyler, Tex.
Vice-Presidents, E. Dysterud, Monterey, Mexico; Chas. F. Yeager, Laredo, Tex.; H. F. MacGregor, Houston, Tex.
Secretary, F. E. Scovill, Austin, Tex.
Treasurer, Thomas D. Miller, Dallas, Tex.
Directors: The above and T. H. Stuart, Waco, Tex; S. A. Spencer, Jennings, La.; H. T. Edgar, El Paso, Tex.; W. A. Guthrie, San Angelo, Tex.; J. R. Ward, Beaumont, Tex.

Tennessee Street Railway Association.

President, C. C. Howell, Knoxville.
Vice-President, E. J. Jones, Memphis.

Toronto (Canada) Railway Roadmasters' Association.

President, E. Whitaker, Toronto.
Vice-President, George A. Greene, Toronto.
Secretary and Treasurer, John F. Argue, Room 52, Janes Building, King and Yonge Sts., Toronto.
Executive Committee: F. M. Blight, D. Kearney and Louis Wheeler.
Executive Committee meets the first of each month.

Virginia Street Railway and Electric Association.

President, R. D. Apperson, Lynchburg.
Vice-President, E. R. Williams, Richmond.
Executive Committee: The above and R. L. Williams, Norfolk, and E. L. Trafford.
Next annual meeting, May 15, 1904, at Norfolk, Va.

Union Internationale de Tramways et de Chemins de fer d'intérêt local.

President, Leon Janssen, Gen. Mgr. Société des Tramways Bruxellois, 6, Impasse du Parc, Brussels
Secretary, M. t'Serstevens, 6, Impasse du Parc, Brussels.
Treasurer, F. Nonnenberg, Chief Engineer of the Compagnie des Chemins de fer Secondaires, Brussels.
Executive Committee: Officers and Messrs. Broca, Paris; Géron, Cologne; Kessels, Brussels; Köhler, Berlin; Lavalard, Paris; Ziffer, Vienna.
Next convention, Vienna, 1904 (date to be fixed by Executive Committee).

Municipal Tramways Association.

President, C. R. Bellamy, General Manager of the Liverpool Corporation Tramways.
Vice-President, Alfred Baker Manager of the London County Council Tramways.
Executive Committee: Officers of the Association and Councillor Walter Patton, Glasgow; Councillor Boyle, Manchester; Councillor Smithson, Leeds; C. J. Spencer, Bradford; H. England, Sunderland and P. Fisher, Dundee.
Next meeting to be held in Liverpool in 1904.

Tramways and Light Railway Association (London, England).

President, L. A. Atherley Jones, K. C., M. P. 4 Paper Buildings, Temple, London, E.C.
Vice-President, W. M. Murphy, Dartry, Upper Rathmines, Dublin.
Secretary, Ernest Benedict, M. Inst. C. E.; Clun House, Surrey Street, Strand, London, W. C.

Verein Deutscher Strassenbahn und Kleinbahn Verwaltungen.

Presiding Company, Strassen-Eisenbahn-Gesellschaft, Hamburg.
Secretary, Heinrich Vellguth, Hamburg.
This is an organization of German street railway and light railway companies, with permanent headquarters in Hamburg.

STREET CAR ADVERTISING THAT PAYS
both your company and the advertisers represented, is the kind that would be placed in your cars by
THE MULFORD & PETRY COMPANY
Eastern Offices, St. Paul Bldg., NEW YORK
Executive Offices, Stevens Bldg., DETROIT
Also Offices at Chicago, Indianapolis, Toledo, Dayton, Grand Rapids, etc.

Drummond's Detective Agency
RAILWAY WORK A SPECIALTY
A. L. DRUMMOND, General Manager, Ex-Chief U. S. Secret Service
Park Row and Ann St., New York

MOTOR BEARINGS
BRASS CASTINGS
JOURNAL BEARINGS
BABBITT METALS
TROLLEY WHEELS
BRADY BRASS COMPANY
Gen'l Office and Works
202-208 Tenth Street
Jersey City, N. J.
DANIEL M. BRADY
PRESIDENT

DESIGNING AND MANUFACTURING
OF HIGH GRADE
Switchboards & Tablet Boards
A SPECIALTY

Bulletin 726, illustrating and describing some of our switchboards, sent prepaid on request.

THE F. BISSELL COMPANY
TOLEDO, O.

The **Duplicate Transfer & Rebate Company**
P. O. BOX 562
Norfolk, Va.

OUR LINE OF BUSINESS CONSISTS OF
Secret Service Work on Street Railways.
Advertising on Transfers of Street Railways.
Also represent one of the largest Printing Companies in the U. S., handling all kind of Books used by Purchasing Agents and Store Keepers of Street Railway Companies. Address all communications to H. N. BROWN, Gen'l Mgr.

Headquarters Can Talk To Each Station and to Every Car On the Line and Vice Versa

That is exactly what the result is of installing our complete telephone system.

Time is saved; money is saved. Accidents are prevented, and delays are minimized. These things are important.

Bulletin No. 1-S will tell you that hese statements are not mere conjectures—just a narrative of the daily operation of our system on some of the best and biggest interurban electric railways in the country.

It will also show you why the Stromberg-Carlson Telephone is the best for your use. Shall we send you a copy?

STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY
Rochester, N. Y. Chicago, Ill

Patented March, 1898

No. 600475

THE BEST
HIGH VOLTAGE PORCELAIN INSULATOR
—IS—
BOCH'S "BLAZE-FILLED"

Boch's Patent No. 600475 sustained in infringement suit against F. M. Locke and others and injunction granted.

MANUFACTURED BY
R. THOMAS & SONS CO.
Factory and Main Office
EAST LIVERPOOL, O.
Sales Office
39 CORTLANDT ST., N. Y.

—USE—
"Superior Graphite Paint"
ON
Car Roofs
Car Floors
Car Trucks

It is durable. Manufactured in standard colors.
It will protect Bridges, Buildings and Poles.

Detroit Graphite Manufacturing Co.
New York Detroit Chicago

DO YOU EXPECT TO BUILD A NEW ROAD OR EXTEND YOUR LINES?

If so, you will naturally consult the STREET RAILWAY JOURNAL'S advertising pages and classified directory when writing for estimates or placing orders. You will find it the most convenient and valuable reference manual for this purpose.

SECOND HAND EQUIPMENT

FOR SALE

New I Beams and Channels

Cut to lengths for prompt delivery

We are always in the market for Cylinder Boilers, Smoke Stacks, Flues and Second-hand Pipe. Also scrap iron and steel in any quantity.

HENRY A. HITNER'S SONS
Aramingo Ave. and Huntington St., Philadelphia

New Light Steel Rails For Sale.

IMMEDIATE SHIPMENT.

16, 20, 25, 30 and 35 lbs. steel "T" rails, with complete joints.

Clearfield Steel & Iron Co.
Mills at Clearfield, Pa.
Offices: German National Bank Building
PITTSBURGH, PA.

IRON BRIDGES FOR SALE!

On Missouri Pacific and Iron Mountain Railways

1 Thro. Pin Span	110 ft. 0 in.
2 " " "	100 ft. 0 in.
1 " " Wooden Stringers	105 ft. 0 in.
1 Thro. Pin Span (Dbl. Track)	131 ft. 8 in.
1 Deck Truss	125 ft. 0 in.
1 " " on Skew 36½ ft.	173 ft. 3 in.
1 Thro. Fixed Span	295 ft. 0 in.
1 " Draw "	308 ft. 10 in.
EAST OF MISSISSIPPI RIVER	
Thro. Truss Spans	75 ft. 0 in.
2 " " "	106 ft. 0 in.
1 " " "	100 ft. 0 in.
1 Plate Girder	51 ft. 8 in.

Bridges are in good condition, having been kept well painted and could be used to advantage as railroad bridges again, where light rolling stock or light locomotives are used, or for rapid transit suburban lines or for wagon bridges

I have a large quantity of 56 and 35-pound re-laying rails. If you are in the market, write for prices.

F. A. JOHANN, Railway Supplies,
Equitable Building, St. Louis, Mo.

STEAM SHOVELS

4-65 ton shovels, 2½ yd. dippers.
3-55 " " 2 " "
2 Marion 1¾ yd. shovels.
3 " A. 1½ yd. shovels.
4 Little Giants 1¼ yd. 1 Baby Giant ¾ yd.
We have 20 shovels to offer. Write for prices and descriptions if in want.

THE MALES CO.
256 Broadway, New York, N. Y. 713 Traction Bldg., Cincinnati, Ohio.

To the Point

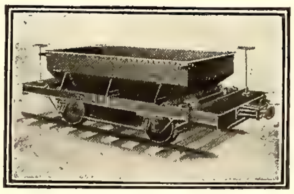
ARMATURE INSURANCE

ASSURANCE made doubly sure, honest and intelligent construction coupled with experience and modern engineering practice insures you good value. We offer for prompt shipment:

Westinghouse 38B Armature
" 12A "
" 3 "
" 12 "
" 49 "
" 68 "
" 64 "
" 56 "
General Electric 52
" 67
" 800
" 1000
" 57
Lorain 34
" 28

We sell Generators, Motors, Cars, Trucks, Controllers, Wheel Presses and Rails. Our prices and goods are necessarily of interest to Practical Railway Men.

THOMPSON-BONNEY CO.
45-47 York Street, Brooklyn, N. Y.



FOR SALE

30 BALLAST CARS, all steel, entirely new; capacity, 5 cu. yds. Standard gauge. These cars set very low to track and can be easily loaded by hand. Suitable for handling stone, rock, sand, etc. Shipment can be made within 30 days. For further information write The Atlas Car & Mfg. Co., Cleveland, O., Manufacturers of steel cars and Industrial railway equipment.

FOR SALE

at a very low figure,

1000 tons 60-pound Steel Relayers.

Walter A. Zelnicker Supply Co.
Dept. SS. IN ST. LOUIS.

FOR SALE

About 500 tons new 80-lb. T Rails A. S. C. E. Section, with joints, for immediate shipment from stock.

HENRY LEVIS & CO.,
PHILADELPHIA.

Tail Lamps

FOR SALE

138 Second-hand Tail Lamps for electric cars, Adams & Westlake and Armspear make, for sale. Good condition. Address, "LANTERN," care Street Railway Journal.

FRITZ GOLDSCHIENER,

BERLIN,

Uhlandstr 57.

Importer of all articles for **Street Railway and Railroad Cars.** Manufacturer **especially of Novelties** in this branch. Please give address and send catalogues and patterns. Best references.

WANTED:

Electrical Railway Contractor

To build 20-mile road. About 40 per cent. already provided.

Address GEO. W. SAUL,
100 Franklin Street, Boston, Mass

1000 BRIDGES

SPROUL & GREEN, Civil Engineers, 147 Columbus Ave., New York City

---

CAR BUILDING PLANT FOR SALE

MODERN Tram Car Building and Equiping Concern, 700 cars per annum capacity, worldwide connection, for sale by private treaty. Fully equipped works with up-to-date machinery, electrically driven, covering 8 acres with land up to 25 for extension. On main trunk line from London (England) in the heart of coal, iron and timber country. Canal and track into works. Good orders in hand. Can be had at once on favorable terms. Write

WHEATLEY KIRK, PRICE & CO.

46 WATLING ST., LONDON, ENGLAND

POSITIONS WANTED

POSITION WANTED—Master mechanic of 15 years' experience on city lines, thoroughly experienced on all kinds of armature work, including A. C. and D. C. machines. Capable of taking charge of station work and overhead work. Started in the business with T.-H. Company. Can furnish best of references from some of the largest street railway companies in the business. Address "No. 155," care STREET RAILWAY JOURNAL.

COMPETENT ENGINEER and CONSTRUCTION SUPERINTENDENT, Cornell M. E., experienced West and South, completing installation desires to arrange further engagement for construction or operation. References New York or Philadelphia prominent firms and past work will show successful consecutive conduct of work and ability to get results. Address "No. 154," care STREET RAILWAY JOURNAL.

WANTED—A position as superintendent or manager of electric road. Have had eighteen years' experience on steam and electric railroads. Understand track and overhead construction and all kinds of repairs, having served two years in repair shop; also familiar with power-house and railway generators. Am now superintendent of a road but desire a change. Would be pleased to take a road now not paying properly and endeavor to place it on a paying basis. Address "EXPERIENCE," care STREET RAILWAY JOURNAL.

A NEW YORK CITY CONTRACTOR AND ENGINEER, through force of circumstances due to unfortunate commitments seeks position of Superintendent with large contracting company or builders of electric railways. Has made electric railway work a specialty, though has built steam railroads, sewers, gas and water works; reliable, energetic exceptional executive ability, and within his special qualifications a most valuable man for someone in quest of such services. Address No. 131, care STREET RAILWAY JOURNAL.

TO OWNERS OF INTERURBAN PROPERTIES

A well-known and capable railway engineer, now earning $4 200 per year, is looking for an opportunity of employing his experience and ability in the management of a modest sized interurban property. Only a clean-cut and promising proposition, free from warring factions, will be considered. To the right parties advertisers will quote a reduced salary plus a percentage of results. Address "No. 156" care STREET RAILWAY JOURNAL.

TRAFFIC MANAGER:—A party with 20 years' experience on steam railroads, in many positions, from telegraph operator up and for the 12 years in a very responsible joint agency for two companies, where he has become proficient in all departments of traffic management. He is desirous of becoming identified with some interurban electric system, where his railroad experience will become profitable to the managers. The best of references as to character and thorough business qualifications. Address, "No. 158," care STREET RAILWAY JOURNAL.

A SUCCESSFUL and well known Street Railway Manager desires a change of location. Would be pleased to correspond with any one desiring such services. Address "No. 159," care STREET RAILWAY JOURNAL.

SITUATION WANTED—As Master Mechanic of small interurban Electric Railway. Age 30, with 11 years experience in repairing department. Good references. Address "J. L. S.", care STREET RAILWAY JOURNAL, 1140 Monadnock Block, Chicago.

POSITIONS VACANT

A GOOD POSITION is always open to a competent man. His difficulty is to find it. We have openings and receive daily calls for Secretaries and Treasurers of business houses, Superintendents, Managers, Engineers, Expert Bookkeepers, Traveling Salesmen; Executive Clerical and Technical positions of all kinds, paying from $1,000 to $10 000 a year. Write for plan and booklet. HAPGOODS (Inc.), Suite 511, 309 Broadway, New York.

WANTED TO LEASE

with privilege of purchase a city or interurban electric railway not paying interest on funded debt; or will make proposition to manage same on percentage basis and nominal salary. Am a practical manager with 20 years experience, having had charge of several large properties, and placed them on a paying basis.

Address, 445,
Care of STREET RAILWAY JOURNAL,
Monadnock Block, Chicago.

DON'T FORGET WHEN IN THE MARKET FOR CARS, MOTORS OR TRUCKS

to write me for what you want. I am more
than apt to have it, at inviting prices.

GILES S. ALLISON, 57 BROADWAY, NEW YORK.

FOR SALE

ONLY FOUR CARS: two measuring 20 feet and two 18 feet over corner posts. 20′ cars have cross seats, 18′ longitudinal. All with trucks, track scrapers, fenders and electric heaters complete except motor equipment. Write today for detailed description and price to ❧ ❧ ❧

ELECTRIC RAILWAY EQUIPMENT COMPANY, Philadelphia.

Charles E. Dustin Company

DIRECT CONNECTED RAILWAY UNITS

One 300 K.W. Siemens-Halske Generator with Tandem Compound Engine.
One 300 K.W. Westinghouse 8 pole Generator with Cross Compound Engine.

DIRECT CONNECTED ALTERNATING UNITS

Two 250 K.W. 2200 Volts, 60 Cycle, Two Phase Westinghouse Alternator with Cross Compound Engine.

BELTED RAILWAY GENERATORS

Two 500 K.W. General Electric 6 Pole.
Two 300 K.W. General Electric 4 Pole.
One 300 K.W. Westinghouse 6 Pole.
One 200 K.W. Westinghouse 6 Pole.
Two 200 K.W. General Electric 4 Pole.
Two 200 K.W. Edison Bipolar.
One 187 K.W. Westinghouse 4 Pole.
One 175 K.W. Edison Bipolar.
One 150 K.W. Westinghouse 6 pole.
One 110 K.W. Eddy 4 Pole.
Two 100 K.W. Westinghouse 6 Pole.
Three 100 K.W. General Electric 4 Pole.
One 100 K.W. Edison Bipolar.
One 100 K.W. Walker 4 Pole.
One 90 K.W. Thomson-Houston 4 Pole.
One 80 K.W. General Electric 4 Pole.
One 75 K.W. Westinghouse 6 Pole.
Two 62 K.W. Thomson-Houston Bipolar.
One 45 K.W. General Electric 4 Pole.

STREET RAILWAY MOTORS AND EQUIPMENTS

Ninety G. E. 1000 (35 H. P.) Railway Motors.
Six G. E. 58 (37 H. P.) two Motor Equipments complete with K-10 Controllers.
G. E. 800, 1200, 57 Motors.
Westinghouse 3, 12A and 38B 49 Motors.

WRITE FOR NEW BULLETIN JUST ISSUED

ELEVEN BROADWAY, NEW YORK **Factory *and* Storehouse, Orangeburgh, N. Y.**

AMERICA'S

A FEW NEW YEAR'S TRUTHS

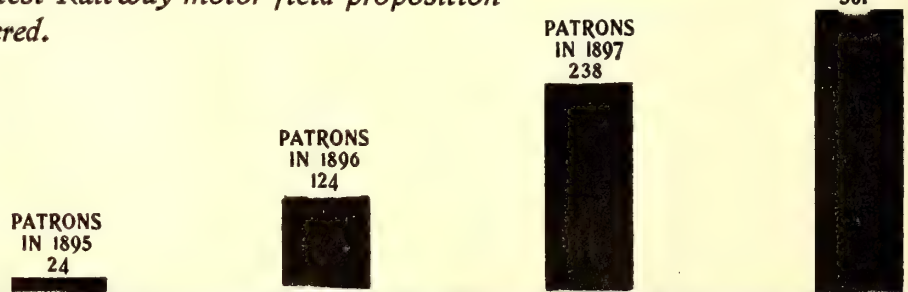
YES! We are very much pleased with our success for the past nine years. Hope it will continue for nine more.

OH, YES! We have trouble, everything we do is not right. Neither does everyone of our customers pat us on the back or encourage us to believe that we are the whole thing. Clouds roll over us about as heavy as they do anyone else. But we think the hard efforts we have put forth in bringing our business up to its present state has enabled us to minimize our troubles and deepen the silver lining to our clouds.

YES. We expect to have three times as many patrons if we live nine years hence as we have now. They say we are becoming weaker and wiser, consequently people will become less inclined to do their own work and will have more wisdom to figure out why it is cheaper to have us do their work than to do it themselves.

Armatures Complete, Armatures Rewound, Armatures Reshafted, Armature Coils, Commutators, New, Refilled and Assembled. The greatest Railway motor field proposition ever offered.

PATRONS IN 1898 361



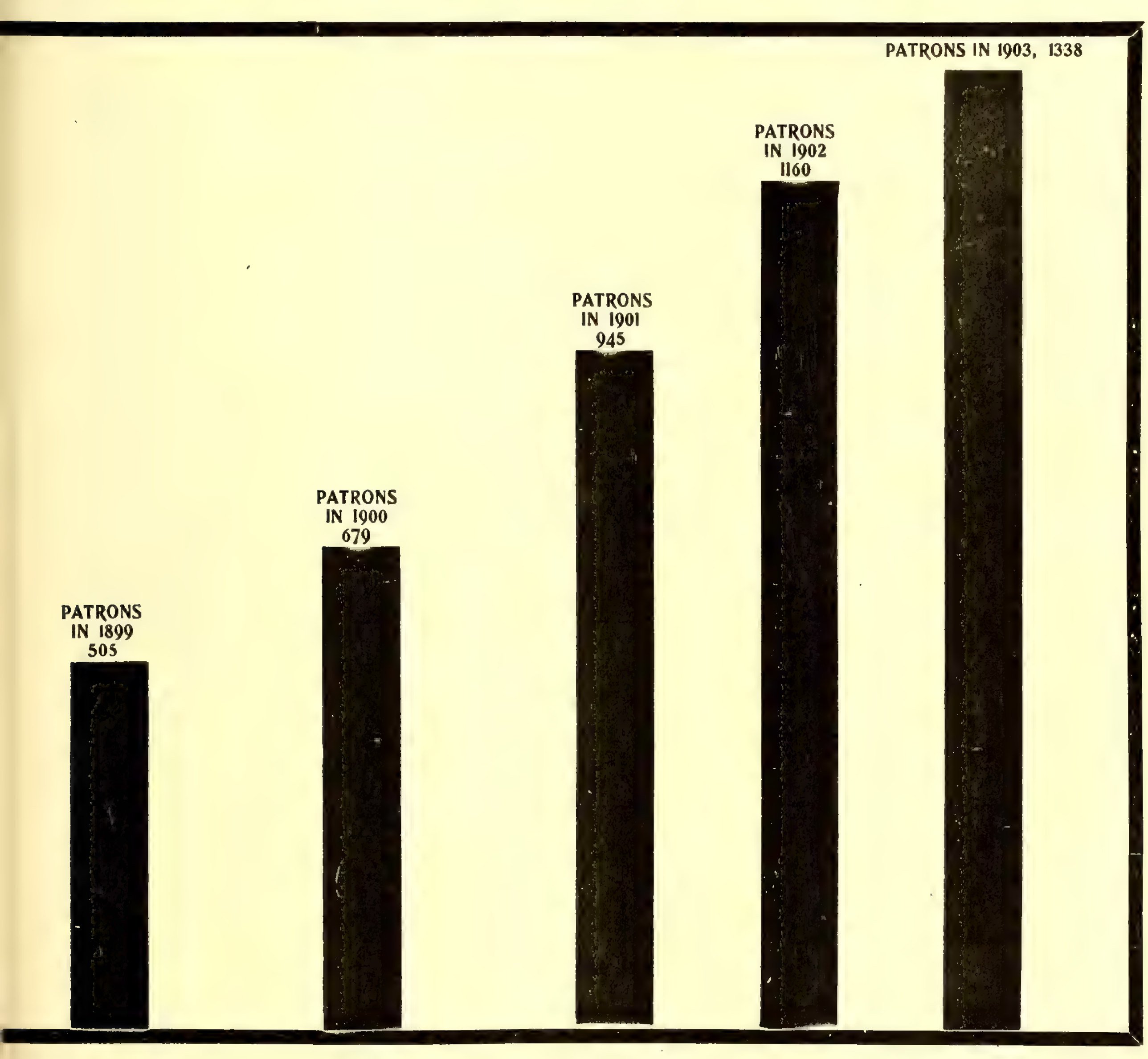
Don't be without a copy of our book PRACTICAL ELECTRICITY, Price $2.00 delivered

REPAIR

CLEVELAND ARMATURE WORKS

CLEVELAND, OHIO

GREATEST



If book is not satisfactory upon examination, will refund money cheerfully

WORKS

CLEVELAND ARMATURE WORKS

CLEVELAND, OHIO

AMERICA'S GREATEST

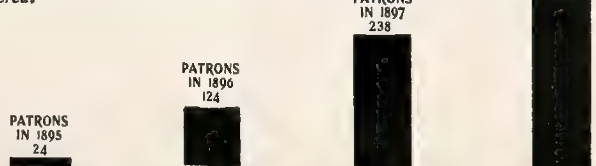
A FEW NEW YEAR'S TRUTHS

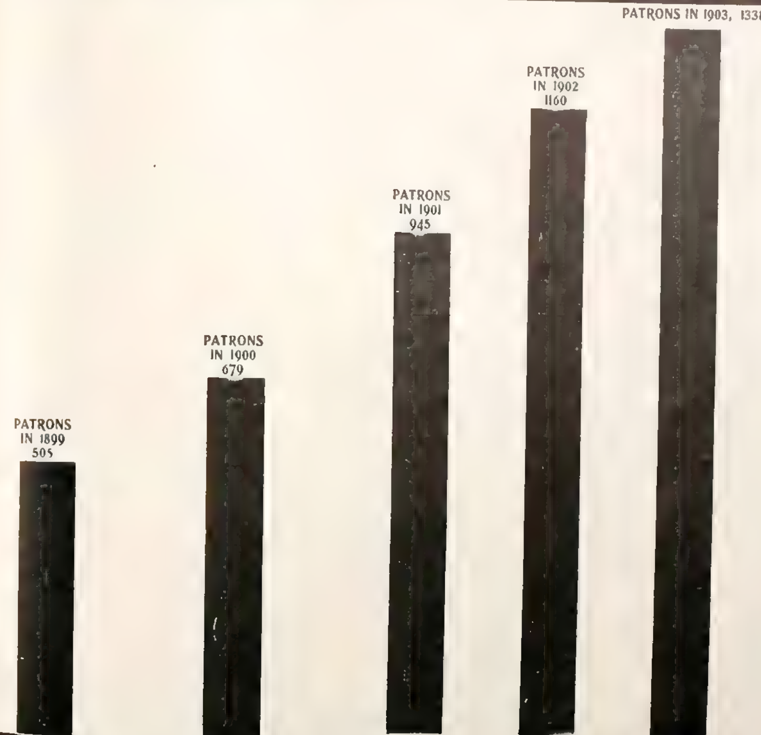
YES! We are very much pleased with our success for the past nine years. Hope it will continue for nine more.

OH, YES! We have trouble, everything we do is not right. Neither does everyone of our customers pat us on the back or encourage us to believe that we are the whole thing. Clouds roll over us about as heavy as they do anyone else. But we think the hard efforts we have put forth in bringing our business up to its present state has enabled us to minimize our troubles and deepen the silver lining to our clouds.

YES. We expect to have three times as many patrons if we live nine years hence as we have now. They say we are becoming weaker and wiser, consequently people will become less inclined to do their own work and will have more wisdom to figure out why it is cheaper to have us do their work than to do it themselves.

Armatures Complete, Armatures Rewound, Armatures Reshafted, Armature Coils, Commutators, New, Refilled and Assembled. The greatest Railway motor field proposition ever offered.





Don't be without a copy of our book PRACTICAL ELECTRICITY, Price $2.00 delivered

If book is not satisfactory upon examination, will refund money cheerfully

REPAIR WORKS

CLEVELAND ARMATURE WORKS
CLEVELAND, OHIO

CLEVELAND ARMATURE WORKS
CLEVELAND, OHIO

DIRECT CONNECTED RAILWAY UNITS—G. E. and Westinghouse

1 1650 Kw., with Allis engine.
1 500 Kw., with Allis engine
1 400 Kw., with Allis engine.
3 375 Kw., with Westinghouse engines.

1 300 Kw, with Pennsylvania Iron Works engine.
2 300 Kw., with Russell engines.
2 225 Kw., with Ball engines.
2 150 Kw., with Porter-Allen engines.

BELTED GENERATORS—Direct Current, 500-550 Volts

2 500 Kw. General Electric, type M. P. 4.
1 300 Kw. General Electric, type M. P. 6.
3 300 Kw. General Electric, type M. P. 4.
1 300 Kw. Westinghouse, 6-pole type.
1 200 Kw. Westinghouse, 6-pole type.

3 200 Kw. G. E., type M. P. 4-200-425 R. P. M.
1 200 Kw. B. P. Edison, with new armature.
2 150 Kw. Westinghouse, 6-pole type.

2 150 Kw. General Electric, type M. P. 6.
2 110 Kw. General Electric, type M. P. 6.
1 100 Kw Westinghouse, 6 pole
4 100 Kw. G. E., type M. P. 4-100-650 R. P. M.

DIRECT CONNECTED ALTERNATING UNITS

1 600 Kw. G. E., type A. T. B., 60 cycle, 3-phase, 605 volts.
1 800 Kw. G. E., type A. T. B., 60 cycle, 3-phase, 2300 volts.

1 500 Kw. G. E., type A. T. B., 25 cycle, 3-phase, 13,200 volts.
1 200 Kw. Westinghouse, 25 cycle, 220 volts, 3-phase.

ENGINES—Compound

2 24 and 44 x 48 tandem Cooper Corliss.
1 20 and 36 x 48 tandem Hamilton Corliss.
1 20 and 36 x 48 tandem Fitchburg Corliss.

1 18 and 34 x 48 tandem Cooper Corliss.
4 16 and 32 x 48 tandem Cooper Corliss.
1 16 and 3[illegible] x 48 cross comp'd Hamilton.
1 16 and 28 x 16 cross Erie Ball.

1 16 and 28 x 18 tandem Erie Ball.
1 16 and 26 x 17 tandem McIntosh & Seymour.
1 15 and 25 x 16 cross Erie Ball.

Simple

1 36 x 72 Corliss, 50 ton wheel.
1 28 x 60 Allis, 1890 frame.
1 28 x 36 Philadelphia Corliss.

2 24 x 48 Twin Hamilton Corliss.
1 52 x 42 Twin Hamilton Corliss.
1 21 x 18 Armington & Sims.
1 18 x 48 Knowlson & Kelly Corliss.

1 18 x 48 Allis Corliss.
3 18½ x 18 Armington & Sims.
1 26 x 36 Hamilton Corliss.
1 22 x 42 Harris Corliss.

Also large number of smaller engines, both Simple and Compound.

We have the following types of railway motors ready for immediate delivery, in almost new condition, either separately or as complete equipments:

8 Westinghouse No. 68 Equipments.
12 Westinghouse No. 38-B Equipments.
10 Westinghouse No. 49 Equipments.

8 Westinghouse No. 69 Equipments.
10 Westinghouse No. 12-A Equipments.

12 General Electric No. 52 Equipments.
8 General Electric No. 62 Equipments.
40 General Electric No. 800 Equipments.

SEND FOR NEW CATALOGUE

ROSSITER, MACGOVERN & CO.

Factories { Hudson & Morris Sts., Jersey City, N. J. St. Louis, Mo.

17 BATTERY PLACE, NEW YORK CITY, N.Y.

Branch Offices { St. Louis, Mo., Mo. Trust Bldg. Boston, Mass., 84 State St.

TROLLEY TIES AND POLES

PROMPT SHIPMENTS

Cross Arms, Brackets and Pins.

H. H. MAUS & CO.

420 Walnut St., PHILADELPHIA, PA.

WHITE CHESTNUT TIES

Sound, carefully measured and cut to exact dimension, and either 7 or 8 ft. in length, all ready to ship, and the lowest market prices consistent with first-class ties.

POLES, CHESTNUT BRIDGE PLANK

B. F. ORDWAY & CO. P. O. B. 727 Fitchburg, Mass.

For Immediate Shipment.

50,000 6 x 8 8-ft. Ties.
5,000 Piles 30 to 50 ft. long.
3,000 Second Growth Chestnut Poles, 30 to 65 ft.

Can load moment cars are placed.

THE ADVANCE LUMBER CO.,

CLEVELAND, O.

WANTED Copies of the Second (1883-4) ANNUAL REPORT of the AMERICAN STREET RAILWAY ASSOCIATION

Also, copies of the Eleventh (1893-4) and Seventeenth (1899-1900) ANNUAL REPORTS of the STREET RAILWAY ASSOCIATION of the State of New York

Address, STREET RAILWAY JOURNAL

114 Liberty Street, New York

Direct Connected Units

300 K. W. Westinghouse, 8 pole, 500-550 volt, and Cross compound, non-condensing engine.
2-300 K. W. Westinghouse, 60 cycle, 2 phase, 2200 volt, alternator & 4 valve cross compound, non-condensing engines, with exciters.

Railway Generators

1-300 K. W. Westinghouse, 6 pole.
1-200 K. W. Westinghouse, 6 pole.
1-200 K. W. Edison bipolar.
2-175 K. W. Edison bipolar.
1-150 K. W. Westinghouse, 4 pole.
2-125 K. W. Westinghouse, 4 pole.
1-110 K. W. General Electric, 6 pole.
2-100 K. W. General Electric, 4 pole.
4-75 K. W. General Electric, 4 pole.
1-75 K. W. Westinghouse, 6 pole.

Engines

3-17 x 28 x 18 Harrisburg tandem.
3-11 x 17 x 14 Harrisburg tandem.
1-24 x 48 St. Louis Corliss.
1-17½ x 32 Buckeye automatic.
1-20 x 20 Harrisburg standard.
2-18½ x 18 Ide automatic.
3-14½ x 16 Buckeye automatic.
2-17 x 24 Russell 4 valve.
2-15 x 20 Russell, 4 valve.
1-13 x 21 Buckeye, tangye bed.

Boilers

1-267 H. P. Abendroth & Root, 150 lbs.
2-156 H. P. Babcock & Wilcox, 150 lbs.
2-150 H. P. Sterling, 150 lbs.
2-113 H. P. Sterling, 125 lbs.
4-72 in. x 18 ft., return tubulars, 125 lbs.
2-72 in. x 16 ft. return tubulars, 125 lbs.
6-66 in. x 16 ft. return tubular boilers, 100 lbs.

Railway Motors

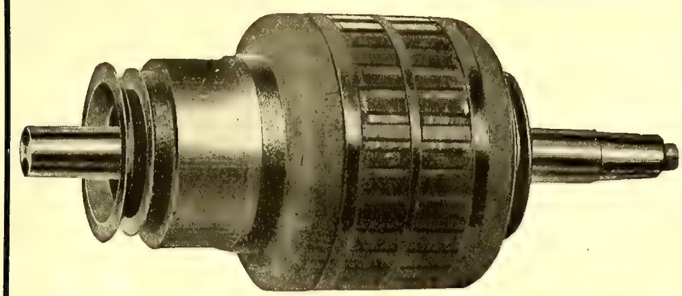
3 Double equipments, G. E. 1200 motors, K controllers, resistances cables, etc.
8-G. E. 800.
25-W. P. 50 & 30's.
16-Westinghouse No. 3.

Alternators

1-150 K. W. Warren, 60 cycle, single phase, 2,200 volts.
1-100 K. W. G. E., 3 phase, 60 cycle, 2,300 volts.
1-150 K. W. G. E., type A. M., 125 cycle, 2,300 volts.
1-100 K. W. G. E., type A. M., 125 cycle, 1,250 volts.
1-65 K. W. Stanley, 60 cycle, 2 phase.
1-60 K. W. G. E., type A, 125 cycles.

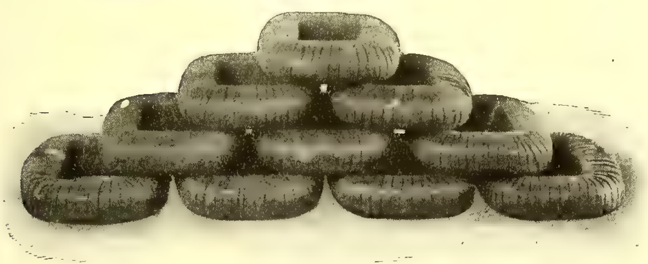
THOMPSON, SON & CO.

114, 116, 118 LIBERTY ST., NEW YORK
Works, 90 Verona St., Brooklyn, N. Y.



WE ARE FIXED TO MAKE STACKS OF FIELD COILS

Armature and Field Rewinding
Armature Coils, Field Coils
Commutator Building
Gears and Pinions



PIONEERS IN ELECTRICAL REPAIRING

The Elliott Bros. Electric Co.

970-972 Hamilton St., CLEVELAND, OHIO

Railway and Electric Equipment Co.

ELLWOOD C. JACKSON, President	**Philadelphia**	1341 Real Estate Trust Building
C. A. RALSTON, 1st Vice-President	**Chicago**	1414 Tribune Building
FRANK J. LEWIS, 2d Vice-President	**Cleveland**	Perkins Ave. and C. & P. Ry.
CHARLES F. JOHNSON, Gen'l Mgr. and Treas.	**Buffalo**	935 Ellicott Square

ADDRESS NEAREST OFFICE

Rails, Cars, Locomotives, Steam Shovels, Electrical Machinery, Engines, Etc., Bought and Sold for Cash

WRITE FOR OUR LIST. WHAT HAVE YOU FOR SALE

INTERCHANGEABLE BRAKE SHOES

HOMER OF CLEVELAND

The size or type of commutator matters little, if the orders reach

HOMER OF CLEVELAND

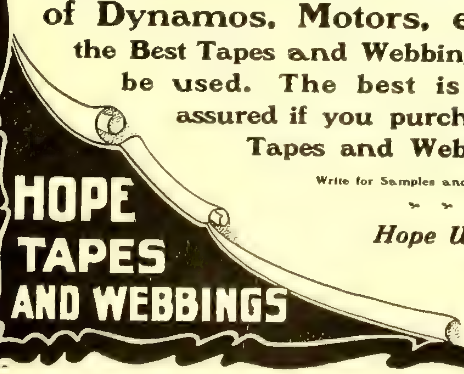
He builds well, new, refilled or special commutators . . . .

THE HOMER COMMUTATOR CO.,
CLEVELAND, OHIO, U. S. A.

COMMUTATORS

For the Construction and Repair of Dynamos, Motors, etc., only the Best Tapes and Webbings should be used. The best is always assured if you purchase Hope Tapes and Webbings.

Write for Samples and Prices.



Hope Webbing Co.
Providence,
R. I.

WANTED

Back Copies of the Street Railway Journal

For clean copies of the issues mentioned in the following list we will pay regular rates—35 cents each, except the smaller weekly issues mentioned, for which we will pay 10 cents per copy.

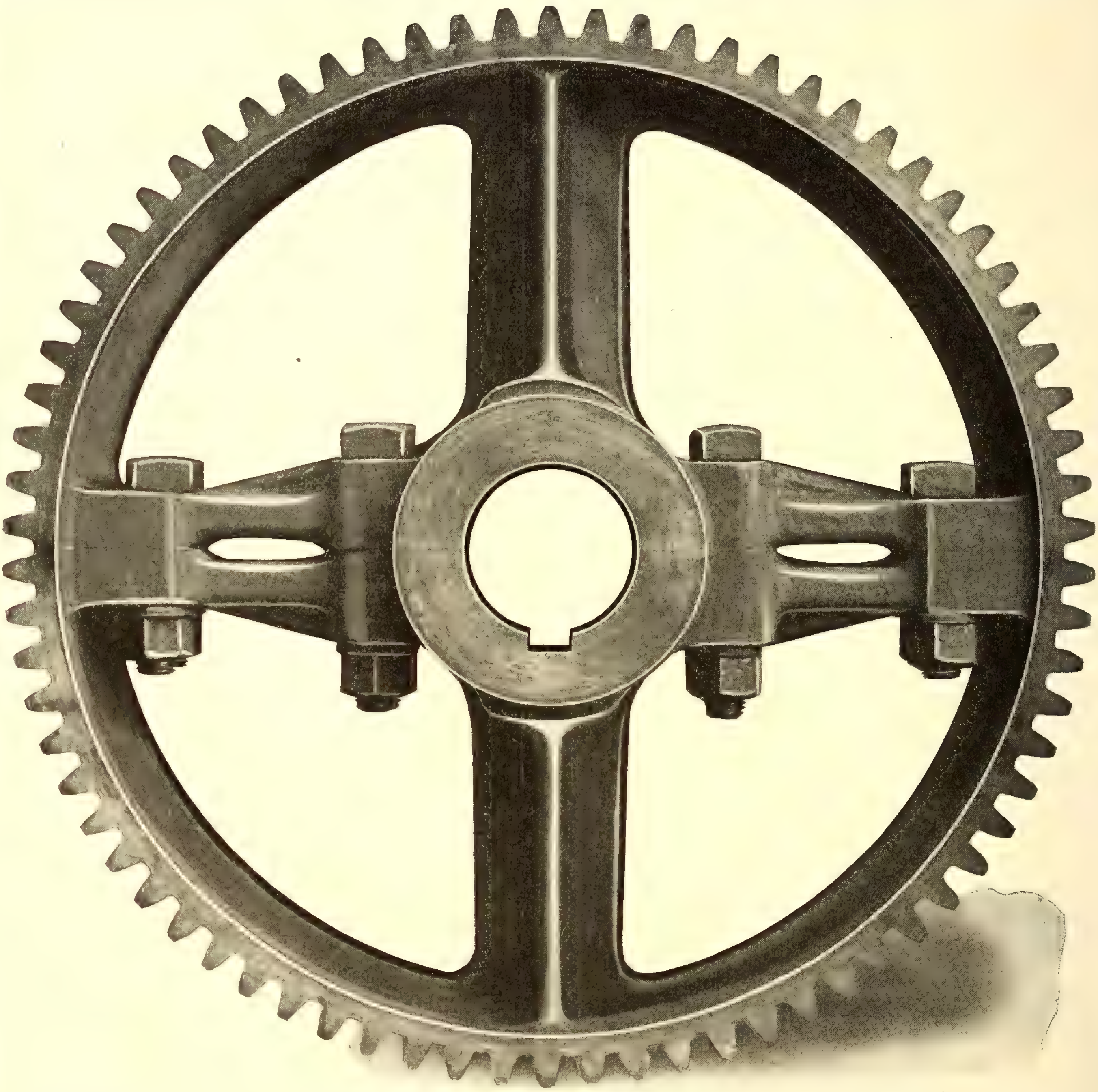
1884—December.
1885—March, May, June.
1886—March, April, June, July, August, September, October, November, December.
1887—February, April, May.
1888—January, February, June.
1889—January, March, June, October, November.
1890—June.
1892—January.
1894—November, December.
1895—August.
1898—International Edition; September.
1900—American Edition; January 13; February 10; March 4; April 21; May 5; August 25; September 1; November 3.
International Edition; April, June.
1901—American Edition; January 5; April 6, 20; May 4, 11; October 6.
1902—American Edition; May 3.

Street Railway Publishing Co.

114 LIBERTY STREET, NEW YORK

The VAN DORN & DUTTON COMPANY

CLEVELAND, - - OHIO



Open Hearth Steel **Gears** Hammered Steel **Pinions**

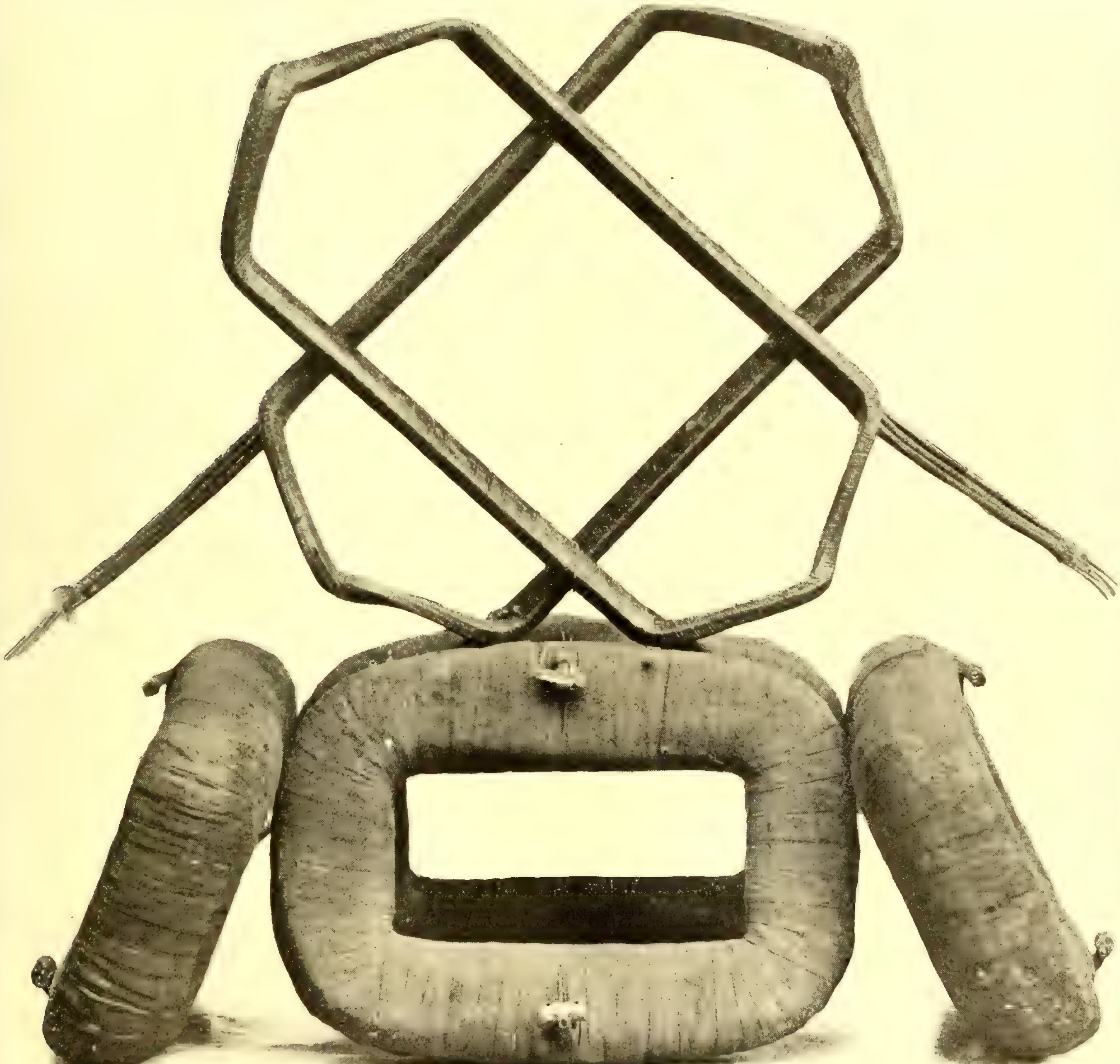
HIGHEST QUALITY HIGH IN CARBON

FOR ALL TYPES OF MOTORS

VAN DORN-ELLIOTT ELECTRIC COMPANY

Manufacturers of Field Coils, Armature Coils and Commutators

CLEVELAND, - OHIO



OUR CLAIMS FOR YOUR BUSINESS.

1ST. Van Dorn-Elliott coils are perfectly insulated.
2D. The workmanship is the highest type and absolutely correct.
3D. Van Dorn-Elliott coils fit perfectly the type of armature to which they belong.
4TH. Van Dorn-Elliott work is fully guaranteed.
5TH. Van Dorn-Elliott are prepared to make quick shipments.
6TH Van Dorn-Elliott prices are as low as is consistent with the best work.
7TH. Van Dorn-Elliott use Fish Paper, Mica and Empire Cloth insulation.

SEND FOR NEW NET PRICE LIST.

Wendell & MacDuffie

Long Distance Telephones:
2015 CORTLANDT
2016 CORTLANDT
6953 CORTLANDT

26 CORTLANDT ST.
NEW YORK, U. S. A.

Cable Address:
"WENMAC"
LIEBER'S AND PREMIER CODES USED

EXCLUSIVE EASTERN REPRESENTATIVES FOR:

THE FALK COMPANY
Milwaukee, Wis.

OPEN HEARTH STEEL CASTINGS

The "Falk" Cast welded Rail Joint. Street Railway Construction. Motor Gears and Pinions. Solid Cast-steel Hardened Center Special Work. Built-up Special Work.

THE TAUNTON LOCOMOTIVE MFG. CO.
Taunton, Mass.

Electric Street Railway Snow Plows and Sweepers. Baggage and Express Cars. Sprinklers and Electric Locomotives.

JEROME METALLIC PACKING
Chicago, Ill.

Metallic Packing for Steam Railroad Locomotives. Also Stationary Engines.

THE D. W. BOSLEY COMPANY
Chicago, Ill.

Wood and Metallic Weatherstrip for Steam and Electric Railroad Cars.

HANDY CAR EQUIPMENT CO.
Chicago, Ill.

"Snow" Wrecking Frogs. Handy Pilot Coupler.

ACME BALL-BEARING CO.
Chappaqua, N. Y.

Gaston's A B C Ball-bearing Jacks.

New York Representatives for

STAR BRASS WORKS, Kalamazoo, Mich.

"Kalamazoo" Wheels and Harps.

THE SEMI-SOLID PLUG BOND.

A PERFECT RAIL BONDING METAL,

APPLIED BETWEEN RAIL and ANGLE PLATE WITHOUT OPENING JOINT;

WILL SHEAR WITHOUT BREAKING CONTACT,

Made Solid by a Hammer Blow After Shearing.

HIGH IN CONDUCTIVITY.

WILL NOT CORRODE.

PRACTICALLY INDESTRUCTIBLE.

HAROLD P. BROWN, OF NEW YORK, MAKES THEM.

"With its head in the clouds."

PIKES PEAK.

One of the most famous mountains in America stands about midway between Denver and Pueblo. Forty years ago, it took as many days to reach it as it now takes hours, so improved are the transportation facilities.

THE NEW YORK CENTRAL LINES

and their connections offer fast and luxurious trains with only one change between New York or Boston and important points in Colorado.

A copy of "America's Winter Resorts," will be sent free on receipt of a two-cent stamp by George H. Daniels, General Passenger Agent, New York Central & Hudson River Railroad, Grand Central Station, New York.

CHASE=SHAWMUT CO.

NEWBURYPORT, MASS.

Manufacturers of

Electrical Specialties

RELIABLE DURABLE EFFICIENT ECONOMICAL

Type G. Applied to ball of rail.

"Shawmut" Flexible Rail Bonds
"Shawmut" Tested Fuse Wire and Links
"Shawmut" Enclosed Indicating Fuses
"Shawmut" Junction and Outlet Boxes
"Shawmut" and "Monadnock" Switches
"Chase" Nipples and Flexible Conduit Couplings
"Boston" Cable Hangers
"Cushing" Theatre Switchboard
"Cushing" Stage Lighting Appliances
Switchboards and Panel Boards
Electrical Repairing

NEW YORK
Wm. S. Brown, 39 Cortlandt St.

CHICAGO
Thos. G. Grier Co., 128 W. Jackson Boulevard

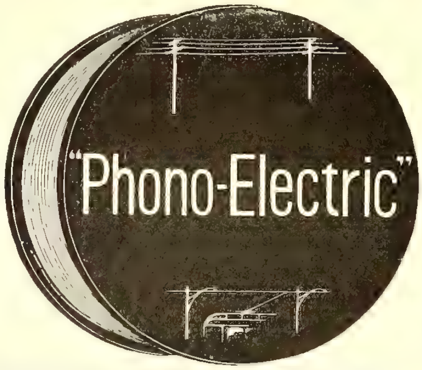
SAN FRANCISCO
John R. Cole, 33 Second Street

CLEVELAND
W. H. Kelsey, Electric Building

RAIL BONDS EXCLUSIVELY

Middle States Representative: C. J. HARRINGTON, 15 Cortlandt St., N. Y.

"PHONO-ELECTRIC" WIRE



"IT'S TOUGH."

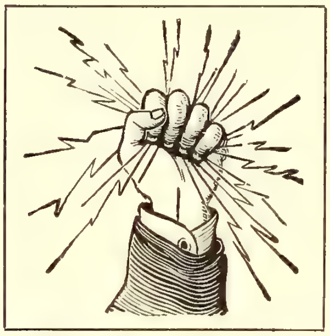
No breaks or interruptions of service when you use "Phono-Electric" Trolley Wire, but a permanent and reliable overhead construction.

SEND FOR "RED" BOOKLET. MAILED FREE

BRIDGEPORT BRASS CO.

19 MURRAY STREET, NEW YORK

AMERICAN ELECTRICAL WORKS



PROVIDENCE, R. I.

WIRES AND CABLES

Bare and Insulated Electric Wire
Railway Feeder and Trolley Wire
Electric Light Line Wire
Incandescent and Flexible Cords
Americanite, Magnet, Office and Annunciator Wires
Cables for Aerial and Underground Use

F. N. PHILLIPS, President
E. R. PHILLIPS, Vice-President
C. H. WAGENSEIL, Treasurer
C. R. REMINGTON, Jr, Secretary
E. F. PHILLIPS, Gen'l Manager

N. Y. Office, 26 Cortlandt St.
Chicago Store, 82 Lake St.

MONTREAL BRANCH
Eugene F. Phillips
Electrical Works

USE

ROEBLING Trolley Wire

MADE BY

J. A. ROEBLING'S SONS CO., Trenton, N. J.

The National Conduit and Cable Co.

MANUFACTURERS OF

BARE COPPER WIRE and CABLE
PAPER INSULATED CABLES

For Telephone, Telegraph, Electric Light and Power

CEMENT LINED PIPE FOR CONDUITS

Executive Offices, Times Building, NEW YORK, N. Y.

MAGNET WIRE CO.

80 WILLIAM STREET, NEW YORK

MAGNET

WEATHERPROOF AND TROLLEY WIRE

ALUMINUM RAILWAY FEEDERS

Aluminum feeders are less than one-half the weight of copper feeders and are of equal conductivity and strength.

Joints of aluminum feeders can be easily, cheaply and satisfactorily made.

If wire or cable is required to be insulated, high grade insulation is guaranteed.

Prices with full information furnished on application.

THE PITTSBURGH REDUCTION CO.

PITTSBURGH, PA.

OFFICES

PRINCIPAL OFFICE, PITTSBURGH, PA.

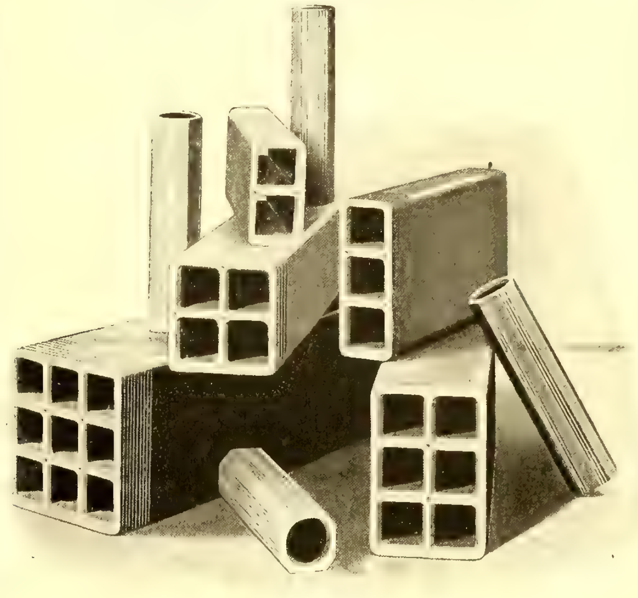
NEW YORK OFFICE 99 John St., Phelps-Dodge Building. WASHINGTON OFFICE Bond Building. CHICAGO OFFICE 190 E. Monroe St.

SALES AGENTS

CLEVELAND, O., Jas. A. Rutherford, Garfield Building.
PHILADELPHIA, PA., Electric R'y Equipment Co., Real Estate Trust Building.
BOSTON, MASS., Percy Hodges, 131 State St., Board of Trade Bldg.
SAN FRANCISCO, CAL., Jno. Martin & Co., 31 New Montgomery Street.
SEATTLE, WASH., Jno. Martin & Co., Pioneer Building.

Camp's Vitrified Clay Conduit

Possesses great strength and durability; high insulating properties; perfect resistance to all chemical elements.

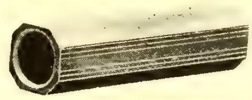


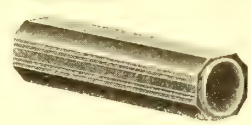
Our patent mandrel, used in connection with laying, furnished free to users of

CAMP DUCT.

The H. B. Camp Company,

170 Broadway, New York. 85 Hartford Bldg., Chicago.





Standard and Self-Centering Single Ducks in all sizes.

2, 3, 4 and 6-Way Multiplate Ducts.

Vitrified Clay Conduit

Quality Unequalled. Prompt Deliveries. Estimates for Conduits or Complete Subway Systems.

New England Agents
EASTERN CLAY GOODS COMPANY
65 Oliver Street, Boston, Mass.

STANDARD SEWER PIPE CO.,

ROCHESTER, N. Y.

YOU WILL SAVE THOUSANDS OF DOLLARS BY USING CREOSOTED MATERIALS

Wyckoff's Creosoted Conduits cheapest to lay. Millions of feet in use.

THE WYCKOFF PIPE & CREOSOTING CO., Inc.

Office: STAMFORD, CONN. SEND FOR CATALOGUE Works: PORTSMOUTH, VA.

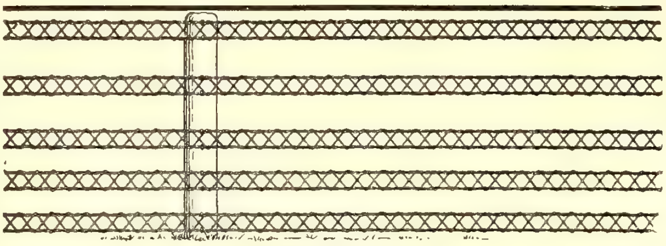
Poles, Cross Arms, Cross Ties for Electric R. R. will not rot.

BARE AND INSULATED COPPER WIRES AND CABLES

CHICAGO INSULATED WIRE CO.,

FACTORY SYCAMORE, ILL. ROOM 15 MARINE BLDG. CHICAGO.

A Great Saving



5 Strands 2-in. Wire

In Posts is Realized

BY USING TRUSS AND CABLE

WIRE BOARD FENCING

Because each strand is stiff and rigid, independent from the others, securely stapled to the posts, no stretching through the staples, no sagging, and the strands keep the posts up in good shape.

Therefore, Not as Many are Required

We have other savings to tell about. Ask us.

THE TRUSS AND CABLE FENCE COMPANY
Cleveland, Ohio, U. S. A.
SHIPMENTS MADE FROM
New York, Chicago, San Francisco, Boston, Atlanta
AND OTHER POINTS.

START RIGHT!

In underground electrical construction of street railway systems it is important that the proper kind of conduit should be selected. The question of the cost of maintenance should be given first consideration. It is false economy to use cheap and inferior ducts which will in time prove expensive because of repairs. Select material that is light, strong and durable; that is electrolysis, gas and water proof; that is easily and economically laid. That sort of material is

Bituminized Fiber Conduit

THE BOOKLET TELLS MORE ABOUT IT.

AMERICAN CONDUIT CO.
170 Broadway, New York
822 Manhattan Building, Chicago
336 Macy Street, Los Angeles

American Steel & Wire Co.

CHICAGO NEW YORK WORCESTER DENVER SAN FRANCISCO

ELECTRICAL WIRES
CROWN RAIL BONDS
SPRINGS
STEEL RAILWAY FENCES

No. 190 Bracket, 10 ft. long. No. 1130 Double Wire Straight Line Insulator, two 4/0 Round Trolley Wires

Creaghead Flexible Brackets
ARE STANDARD

Nearly 100 Different Styles

Pole Fittings
Line Material

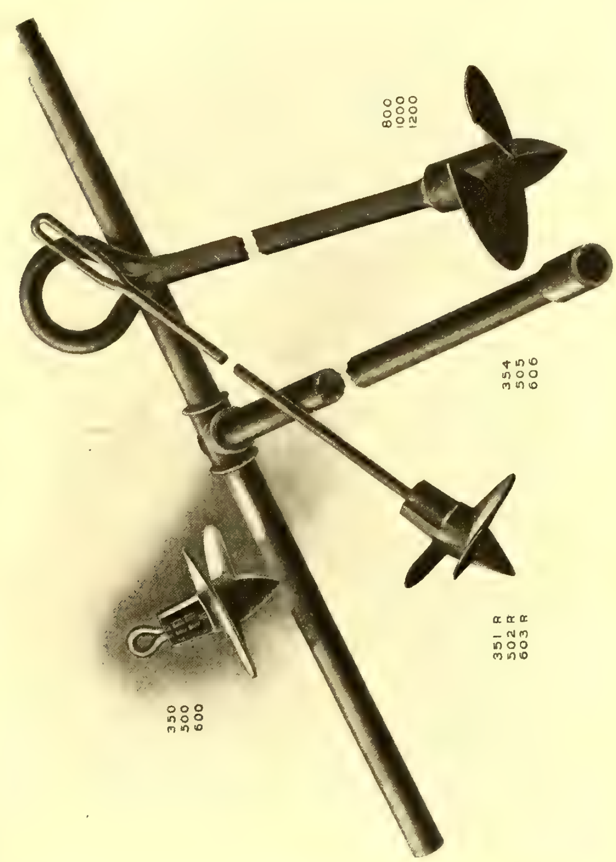
Complete Equipment for Overhead Construction

Write for Catalogue

The Creaghead Engineering Co. Manufacturers

315 Walnut Street, Cincinnati, O.

No. 190 Bracket, 10 ft. long. No. 439 Double Wire, Double Curve Insulators, two 4/0 Trolley Wires, Bourbon No. 2 Strain Insulators



STOMBAUGH GUY ANCHORS FOR STREET RAILWAY GUYING

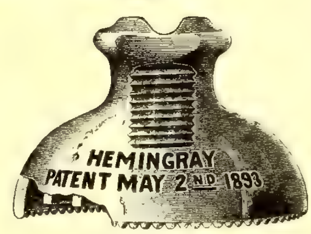
W. N. MATTHEWS & BRO., DISTRIBUTERS
606 CARLETON BUILDING, ST. LOUIS

STANDARD "HEMINGRAY" STANDARD

WE MANUFACTURE

STANDARD SCREW GLASS INSULATORS

FOR ALL PURPOSES



7 IN. MUNCIE TYPE
Guarantee 40,000 Volts

DEEP GROOVE DOUBLE PETTICOAT

STREET RAILWAY INSULATORS

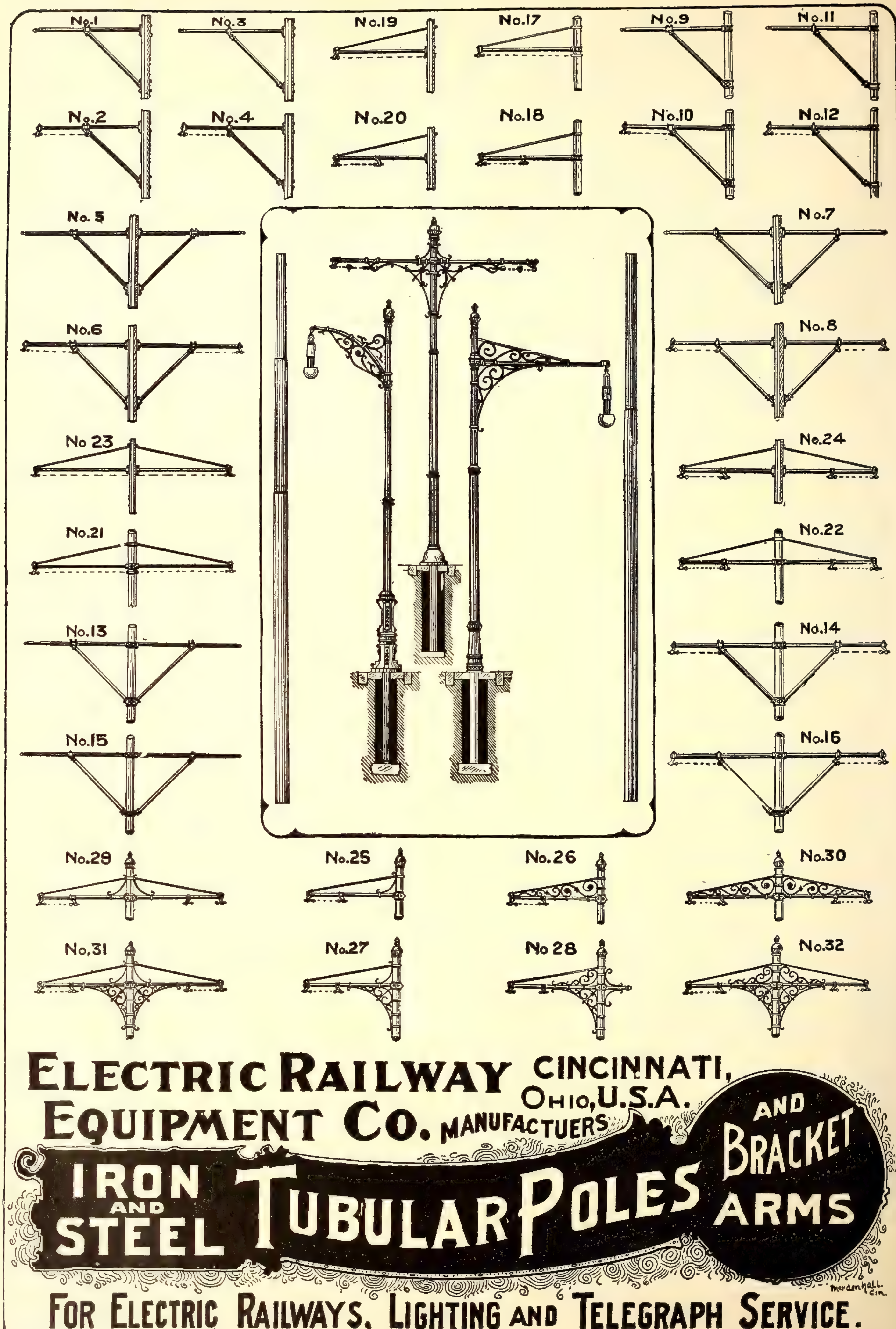
No. O PROVO TYPE
Guarantee 50,000 Volts

No. 1 HIGH VOLTAGE
Guarantee 10,000 Volts

POWER INSULATORS FROM 10,000 to 60,000 VOLTS

ESTABLISHED 1848 THE HEMINGRAY GLASS CO. OFFICE: COVINGTON, KY.

Factories, Muncie, Ind.



ASK FOR OUR NEW CATALOGUE No. 10.

POLES Chestnut, Pine and Cedar TIES. All Kinds of POLES. **TIES**

SHEPARD, FARMER & CO.

WILLIS G. BATES, Mgr. R. R. Supply Dept. Board of Trade Building, BOSTON, MASS.

CHESTNUT POLES

ANY QUANTITY—ALL SIZES—PROMPT SHIPMENT

WRITE FOR PRICES

Greenbrier Pole Co.

PRINCIPAL YARDS: RENICK and SEEBERT, W. VA.

1022 REAL ESTATE TRUST BLDG. PHILADELPHIA, PA.

BUY your Ties and Poles now. It will save you worry by and by, when the rush season is on. We can ship whenever you are ready, or perhaps a little ahead, to make sure. Prices are at the old level, where they are not lower.
Let us quote you.

MALTBY LUMBER COMPANY

209 Phoenix Block, Bay City, Mich.

Pittsburgh Agents, TIPPER & PATTON, 209 Empire Bldg.

IDAHO, WISCONSIN, MICHIGAN. **CEDAR POLES** For Telephone, Telegraph, Electric Light, Trolley.

POSTS, POLES, TIES AND EVERYTHING IN WHITE CEDAR.

YARDS IN IDAHO AND AT WASHBURN, PLUMMER AND BRULE, WIS

JOHN H. FOWLER Gen'l Office: 1705 Fisher Bldg., Chicago. Branch Offices: Washburn, Wis., and Spokane Wash. **FOWLER-JACOBS CO**

TIES Yellow Pine Stock, 100,000 6 x 8-8 ft. Chestnut and Oak, large stock, standard sizes.

POLES (Southern White Cedar) long leaf Yellow Pine octagonal and square, Chestnut and Cypress.

MANUFACTURED BY **ECCLESTON LUMBER CO.** 29 BROADWAY, NEW YORK

Prompt deliveries from stock, New York City yard, or direct from mills.

YELLOW PINE CROSS ARMS, PINS AND BRACKETS

IDAHO CEDAR POLES

Will make special price for immediate delivery.
We have also large stocks of Michigan White Cedar Poles.

Francis Beidler & Co.

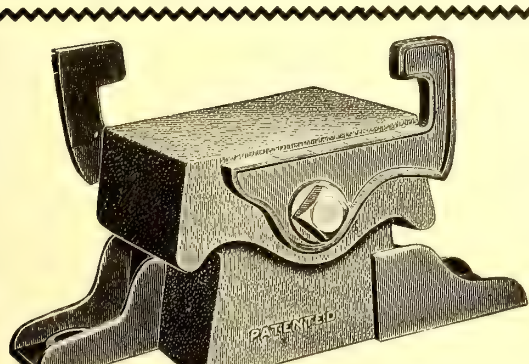
W. 22d and Loomis Streets Chicago, Ill.

TIES Yellow Pine Oak or Chestnut in Cargo Lots

Cross-Arms, Pins and Braces **D. W. PHELAN** 277 BROADWAY, NEW YORK

Octagonal or Round Yellow Pine, Chestnut or Southern Cedar ... **POLES**

WHEN WRITING TO ADVERTISERS in the STREET RAILWAY JOURNAL you will confer a favor on both publisher and advertiser by mentioning this paper.



350,000

RECONSTRUCTED GRANITE

Third-Rail Insulators

NOW IN USE

RECONSTRUCTED GRANITE CO., 14 Dey Street, NEW YORK

We Started the Wedge

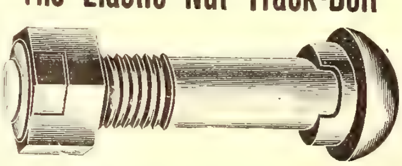
By telling you of our Juniper Poles and our Yellow Pine Cross Arms. We now drive it further in by informing you that we have established a warehouse at Greenpoint, Brooklyn, where we have a large stock of cross arms of all standard sizes, which we can ship at twenty-four hours' notice.

Standard Pole & Tie Co.
Front and Pine Streets
NEW YORK CITY

CEDAR POLES
FOR TRACTION PURPOSES
THE VALENTINE-CLARK COMPANY
234 La Salle Street, CHICAGO, ILL.

One Dollar Additional
with a new or renewal subscription to the STREET RAILWAY JOURNAL would entitle you to receive for one year, the
Electric Railway Directory and Buyers' Manual

The Elastic Nut Track-Bolt

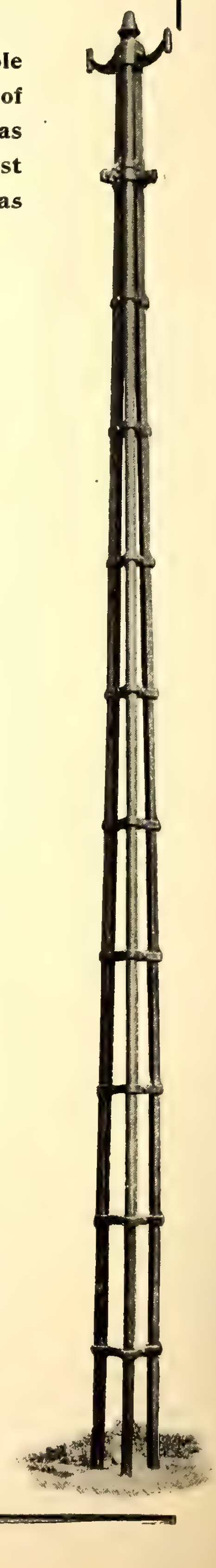


makes the best and cheapest rail-fastening. NUTS NEVER WORK LOOSE. Requires no nut-lock. Our Elastic Self-Locking Steel Nut always stays, and is superior for use on Cars, Track, Bridges, Machinery, etc. Write us for prices on Sq. and Hex. Nuts (Elastic or Common), Machine Bolts, Track Bolts, Rivets, etc.

NATIONAL ELASTIC NUT CO.,
Milwaukee, Wis.

Yours for Pole Betterness

THE
TRIPARTITE STEEL POLE



To-day you may go over the whole country and not find the equal of the Tripartite Steel Pole. It has been done—WE have done it, just to be certain that our claim was correct.

It's just a natural sequence—that's all. Each section of the pole is rolled to the required length of ONE PIECE; no building up, no bolt or rivet holes. The material is of high carbon-rolled steel, which will not deteriorate from rust as does soft steel or iron. There are 54 inches of metal contact at each spreader and collar, these being "set down" hard and fast by bolts, binding the leg positively and making a rigid pole much lighter and more effective than any other pole made.

It is elastic, taking care of all the slack, and adjusted to all strain requirements.

In price, cheaper than any other metal pole; slightly higher in price than the wood poles, but this is saved in freight.

Correspondence Solicited

The Franklin Rolling Mill and Foundry Co.
FRANKLIN, PA.
New York Office, 253 Broadway
Chicago Office, McClernan & Orr, Monadnock Block

A Set of Bound Volumes of the Street Railway Journal

Forms a complete and comprehensive history of the development of the Electric Railway Industry—an encyclopedia of valuable information concerning

Electric Railway

Engineering
Machinery
Management
Finance
Apparatus
Law
Accounting
Supplies
News
Associations
Men

It is a weekly record constantly kept up-to-date. Such a set of books never loses value.

Set of Last 17 Volumes for Sale

We have on hand one set of the STREET RAILWAY JOURNAL (January, 1889, to June, 1903), 17 volumes, bound in half morocco, for sale at

$111.75

Single Volumes for 15 Years

Complete volumes are offered for all years from 1889 to date. Prices for these volumes (unbound) are as follows:

1889 to 1891	$7.00	per year
1892 to 1896	6.00	"
1897 to 1901	5.00	"
1902 and 1903	4.00	"

These volumes may be had bound in half morocco at $1.75 per volume additional. Beginning with 1901 the STREET RAILWAY JOURNAL is published at two volumes to the year.

International Edition

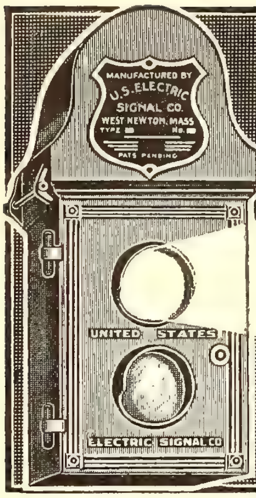
Bound or unbound volumes of the INTERNATIONAL EDITION (1898 to 1902, monthly, complete, with Digest of Contents printed in French and German) may be had at same rates as above, plus $2 per year to cover charges if delivered to foreign countries.

Binding of Current Volumes

Complete unbound volumes delivered to us, postage or express prepaid, and in good condition, with covers on, will be exchanged for the corresponding bound volumes and returned for $1.75 a volume—bound in half morocco. The volume contains twenty-six numbers. Back numbers such as we have in stock for filling out current volumes will be supplied at regular rates.

STREET RAILWAY JOURNAL

114 LIBERTY STREET NEW YORK



MANUFACTURERS OF HENDERSON'S CAR SIGN ILLUMINATORS

UNITED STATES ELECTRIC SIGNAL Co

20 WESTWOOD ST., WEST NEWTON MASS.

WRITE FOR CIRCULARS

REPRESENTED IN CHICAGO BY PORTER & BERG

AUTOMATIC ELECTRIC SIGNALS FOR STREET RAILWAYS

Eureka Automatic Electric Block Signals

Positive in Operation, Reliable in All Kinds of Weather, Proven Lightning and Fool Proof.

Regular cars need schedule and signals only. Extra cars can be sent out and called in without notice to other cars on line.

Numerous points of superiority over any other system in use.

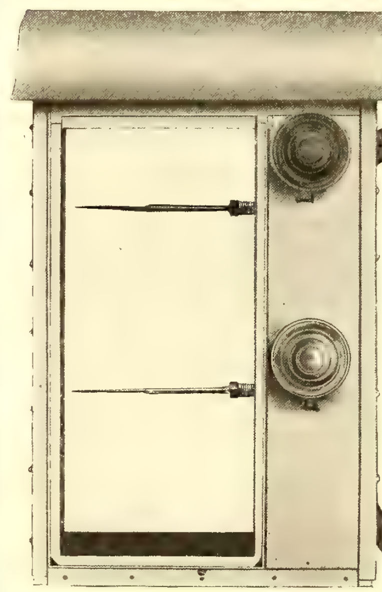
Simple, Practical, Durable

In use upon Tamaqua & Lansford Street Railway.

If interested, write for our booklet telling what Eureka Signals do and how they are made to do it.

Eureka Automatic Electric Signal Co.
LANSFORD, PA.

Why Worry Along With Unsatisfactory Signals



A CLEAR TRACK AHEAD.

When the American Automatic Switch and Signal will enable you to run your cars on a regular schedule, avoid delays and collisions, please your patrons and increase your dividends?

It operates regardless of speed of car and absolutely prevents head-on or rear-end collisions.

Our booklet tells more about it. Shall we send you a copy?

THE AMERICAN AUTOMATIC SWITCH and SIGNAL COMPANY

84-86 La Salle Street · Chicago, Ill.

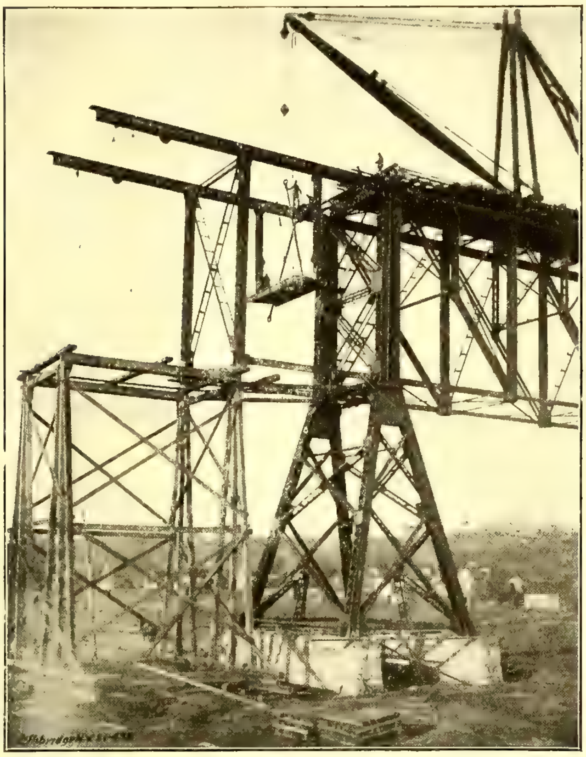
PAIGE IRON WORKS, ∴ CHICAGO. ∴
SPECIAL TRACK WORK

Pneumatic Railway Crossing Gates

(BOGUE & MILLS SYSTEM)

Buda Foundry & Mfg. Co., Makers HARVEY, ILL.

OFFICE: 427 Monadnock Block, CHICAGO, ILL.



C. G. W. RAILWAY VIADUCT, FORT DODGE, IOWA

Railway Bridges
Roof Trusses
Buildings

STRUCTURAL STEEL FOR EVERY PURPOSE

Engineers and Contractors

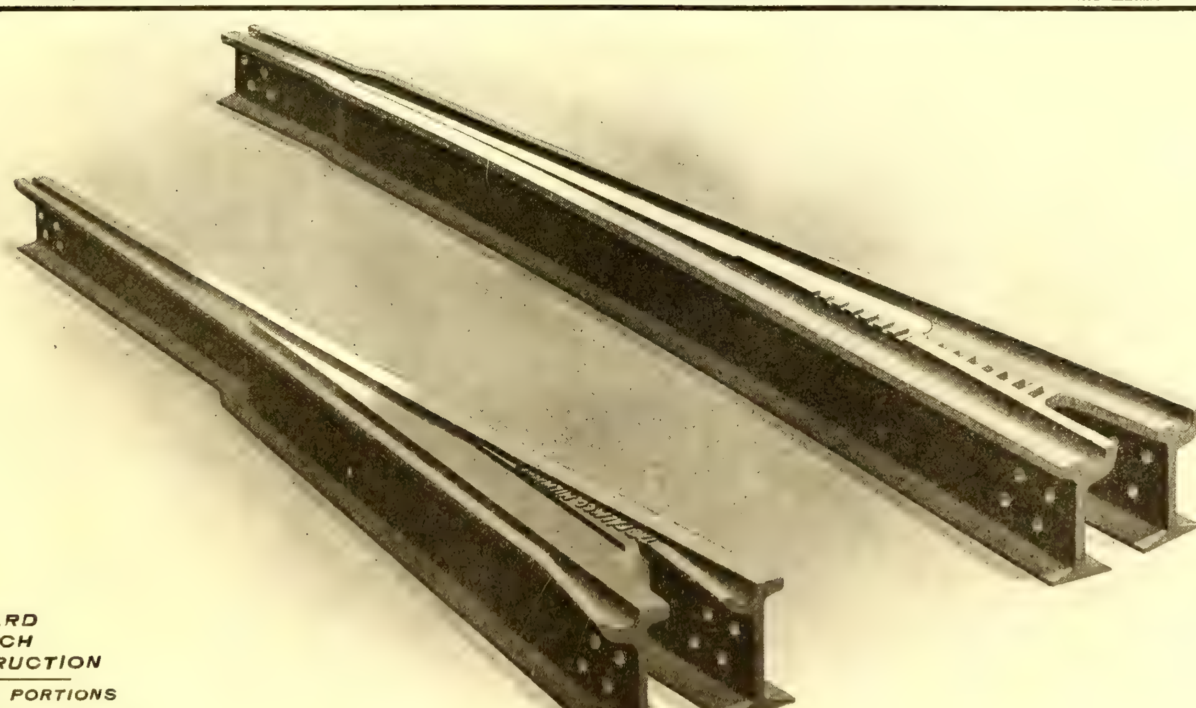
American Bridge Company of New York

OFFICES

EASTERN DISTRICT: 100 Broadway, New York City
PITTSBURG DISTRICT: Frick Building, Pittsburg, Pa.
WESTERN DISTRICT: 1315 Monadnock Block, Chicago, Ill.

SPECIAL WORK

BY OUR PROCESS WE ARE ENABLED TO HARDEN ALL PARTS SUBJECTED TO EXCESSIVE WEAR
NO PARTS TO BECOME LOOSE



STANDARD NINE INCH CONSTRUCTION

LIGHTER PORTIONS REPRESENT SPECIAL HARDENED SURFACES

OUR SPECIALTIES

CAST WELDED RAIL JOINTS
CAST STEEL AND BUILT-UP SPECIAL WORK
MOTOR GEARS AND PINIONS
OPEN HEARTH STEEL CASTINGS
COMPLETE ELECTRIC RAILWAY CONSTRUCTION

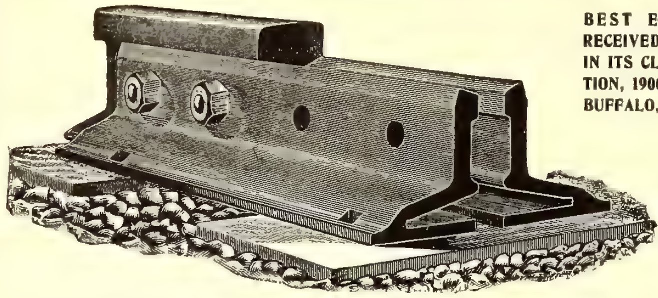
SELLING AGENTS

WENDELL & MacDUFFIE, 26 Cortlandt St., New York
IRA BISHOP, Hayward Building, - - San Francisco
ROBERT W. BLACKWELL & CO., - - London, Eng.
OSCAR FRANKENSTEIN, - - - - Berlin, Germany
SYNDICAT AMPERE, - - Paris and Lyons, France

THE FALK CO.

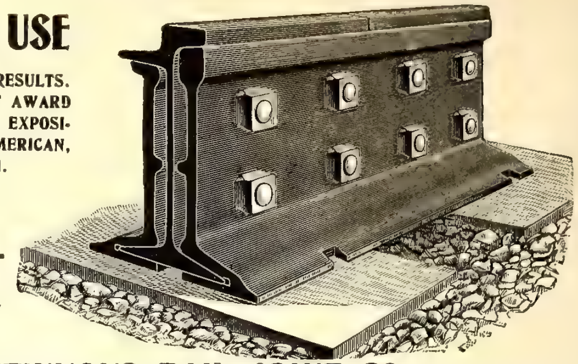
MILWAUKEE, WIS., U. S. A.

OVER FIFTEEN THOUSAND (15,000) MILES IN USE



BEST ECONOMICAL RESULTS. RECEIVED THE HIGHEST AWARD IN ITS CLASS AT PARIS EXPOSITION, 1900, AND PAN-AMERICAN, BUFFALO, U. S. A., 1901.

Manufactured Only By



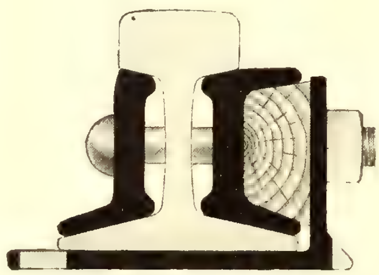
CONTINUOUS RAIL JOINT CO. of America
General Offices, Century Building, Newark, N. J.

CONTINUOUS RAIL JOINT CO. of Gt. Britain, Ltd.
20 King William Street, London, E. C., England

BRANCH AGENCIES { *Boston, Mass., John Hancock Bldg. Chicago, Ill., Monadnock Bldg. Montreal, Can., Temple Bldg. St. Louis, Mo., Commonwealth Trust B dg. San Francisco, Cal., Wells Fargo Bldg. St. Paul, Minn., Pioneer Press Bldg. Denver, Col.. Equitable Bldg.*

THE WEBER RAILWAY JOINT MANUFACTURING CO.

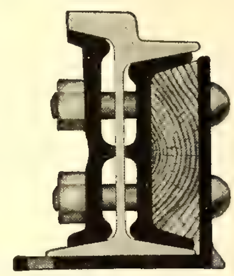
EMPIRE BUILDING, NEW YORK



STANDARD "T" RAIL JOINT

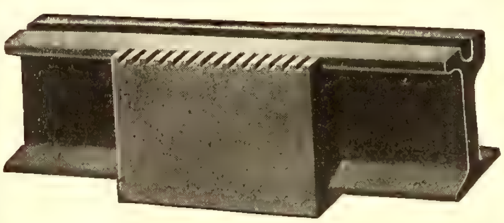
BRANCH OFFICES

BOSTON, 70 Kilby Street
CHICAGO, Old Colony Building
ST. LOUIS, Missouri Trust Building
ST. PAUL, 109 Endicott Arcade
DENVER, Equitable Building
OMAHA, 1212 Farnam Street



GIRDER RAIL JOINT

OUR CAST WELDED JOINT IS THE CHEAPEST AND MOST DURABLE IN THE MARKET



Makers of Smoke Stacks for Power Plants and also Steel Tanks for Gasoline, Oil, Water and Storage Purposes.

General Eastern Sales Agent, C. J. HARRINGTON, 15 Cortlandt St., New York
Pacific Coast Sales Agents, BROWN, BEAL & CO., Mills Bldg., San Francisco, Cal.
Agents for Western Europe, E. H. CADIOT & CO., Paris

HEIL RAIL JOINT WELDING COMPANY, Milwaukee, Wis.

THE

Cleveland Frog and Crossing Co.

MANUFACTURERS OF

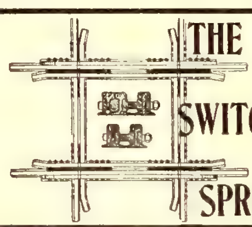
SPECIAL WORK

Porter's Patent Derailing Switches

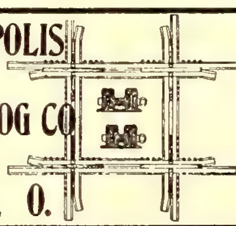
Crossings, Split Switches, Frogs and Track Supplies in General

CLEVELAND, OHIO

MAIN OFFICE AND WORKS: Bessemer Avenue and Erie R. R.
ENGINEER'S OFFICE: 614 Cuyahoga Building.



THE INDIANAPOLIS SWITCH & FROG CO SPRINGFIELD, O.



ELLIOT FROG AND SWITCH CO.

East St. Louis, Illinois.

Electric Railway Work

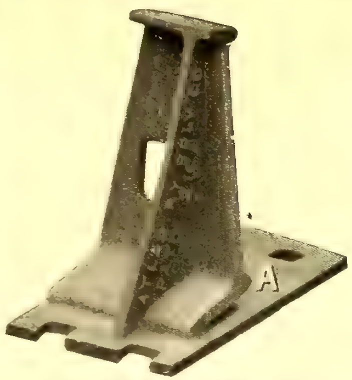
Electric Railway Special Work
FROGS, SWITCHES, CURVES, CROSSINGS, RAIL BRACES, ETC.

The Weir Frog Co., Cincinnati, O.
New York Agent, JILSON J. COLEMAN, 35 Nassau Street

THE AMERICAN FROG AND SWITCH CO. Hamilton, Ohio — SPECIAL TRACK WORK FOR ELECTRIC RAILWAYS

Rail Braces and Tie Plates

OF ANY DESIGN



ATLAS STANDARD GIRDER BRACE
and Used Instead of Tie Rods.

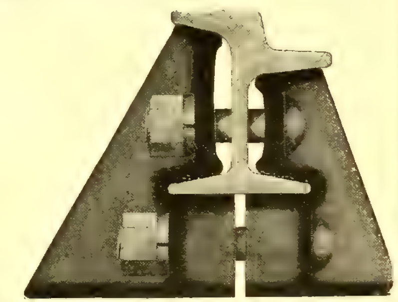
ASK FOR CATALOG H.

Use Atlas Primer and Surfacer for Cars and Locomotives
I-X-L for Wood and Iron Painting.

SECTION THROUGH AT TIE PLATE OF ATLAS JOINTS No. 1 or No. 7

ASK FOR CATALOG H.

☞ Joint No. 1 has a double truss; it is composed of two like sections, one on each side of the rail, and made to fit any rail or rails.



Cross Section Atlas Raised Joint—
Raises rail to any height,
saving old low rail

"Compromise" Joints or STEP JOINTS guaranteed to make a perfect fit with badly worn rails. Fit and strength guaranteed.

I-X-L PAINTS

For Wood and Iron Work

ATLAS PRIMER
Takes the place of oil or paste wood fillers

ATLAS SURFACERS
Take the place of lead and oil surfacers
FOR PASSENGER CARS

ATLAS RAILWAY SUPPLY COMPANY

CHICAGO
L. Dist. 'Phone: Harr. 2900
Suite 1523 MANHATTAN BLDG.

NEW YORK
150 NASSAU STREET
L. Dist. 'Phone: 3629-B-John

Frogs
Switches
Crossings

New York Switch and Crossing Co.

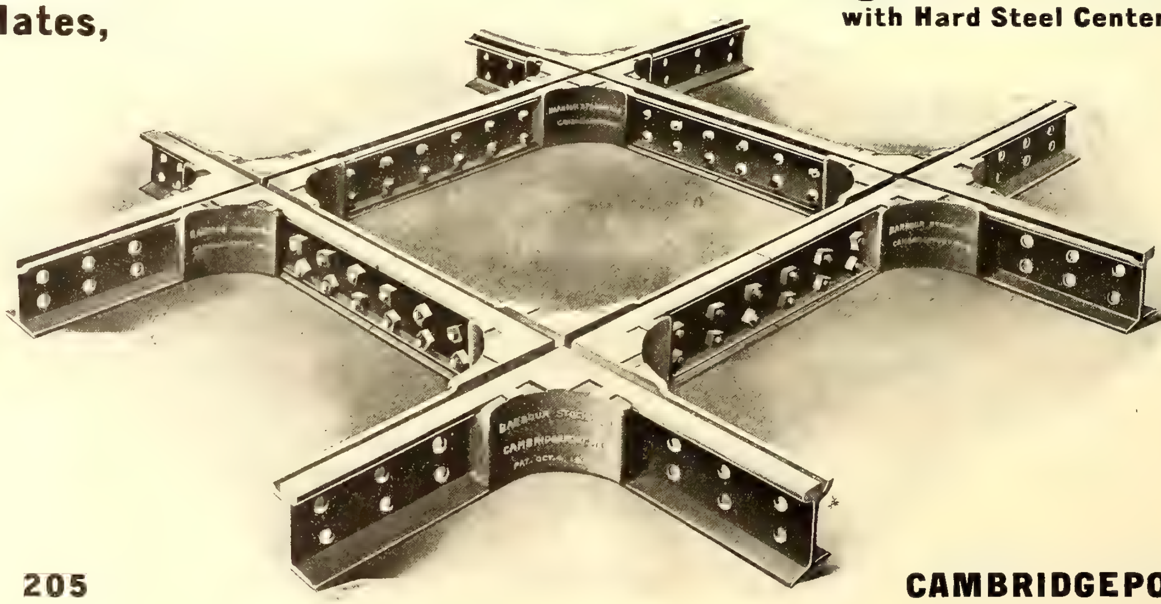
Hoboken
N. J.
U. S. A.

Special Track Work of Every Description

SPECIAL WORK for Street Railways

Switches,
Mates,

Frogs and Crossings
with Hard Steel Centers



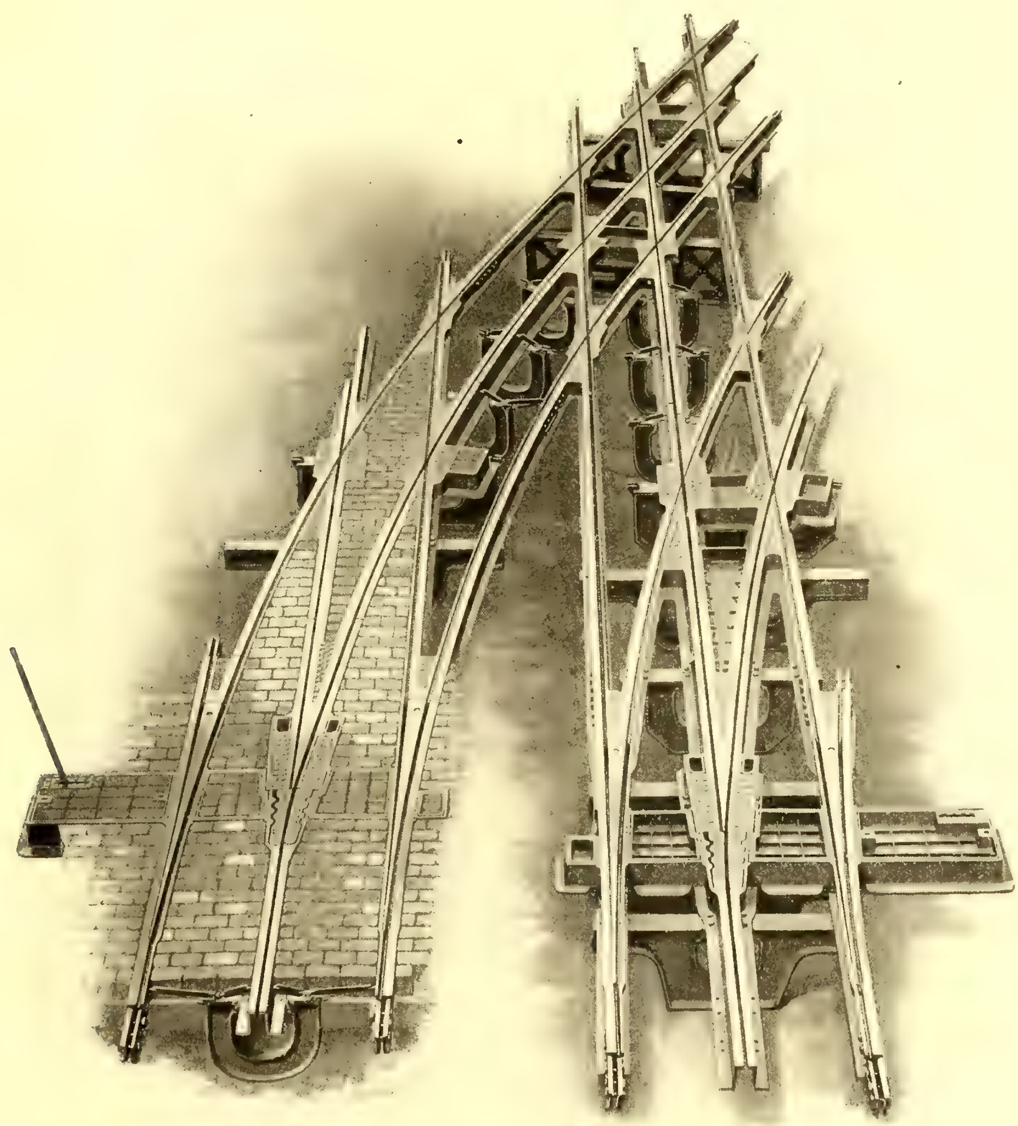
205
BROADWAY

CAMBRIDGEPORT,
MASS.

BARBOUR-STOCKWELL CO.

THE LORAIN STEEL COMPANY

Special Work for Street Railways



ELECTRIC CONDUIT CONSTRUCTION. RENEWABLE PLATES AT ALL INTERSECTIONS

WORKS AT JOHNSTOWN, PA.

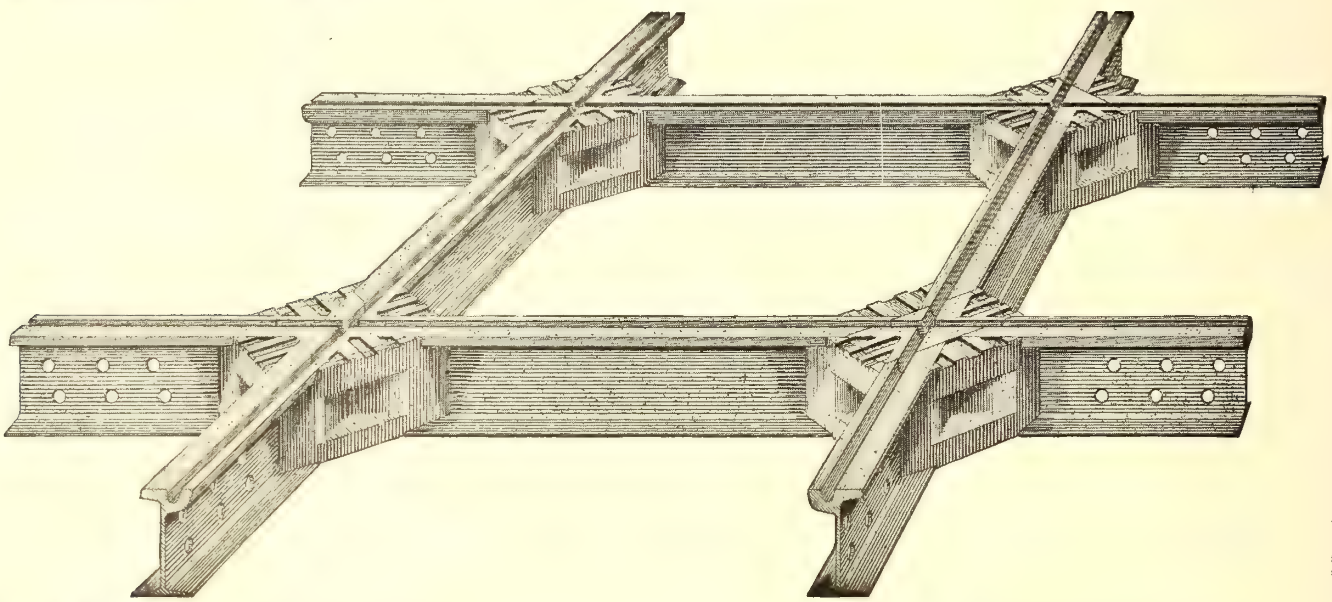
THE PENNSYLVANIA STEEL CO.

MANUFACTURERS OF

Steel Rails OF ALL SECTIONS AND WEIGHTS FOR BOTH STEAM AND ELECTRIC RAILWAYS.

Frogs, Switches, AND CROSSINGS FOR STEAM RAILROADS.

Special Work FOR STREET RAILWAYS.



Bridges. WE CAN BUILD AND HAVE BUILT THE LARGEST AND HEAVIEST.

Viaducts FOR STEAM RAILROADS AND ELEVATED RAILWAYS.

Steel Buildings. WE CAN FURNISH ALL THE FRAME WORK.

Steel Castings OF HIGHEST QUALITY.

Special Steels FOR ALL PURPOSES.

CALL ON OR ADDRESS OUR NEAREST AGENT FOR INFORMATION AND PRICES.

H. F. MARTIN, General Manager of Sales, Girard Building, Philadelphia, Pa.

PHILADELPHIA OFFICE,
Girard Bldg., Richard Peters, Jr., Sales Agt.
BOSTON OFFICE,
Rooms 11-12 Mason Bldg., Chas. S. Clark, Sales Agt.
BALTIMORE OFFICE,
Continental Trust Bldg., R. C. Hoffman & Co.
ST. LOUIS OFFICE,
Commonwealth Trust Bldg., Joseph G. Miller, Sales Agt.
NEW YORK OFFICE,
Empire Building, A. E. Aeby, Sales Agent.

CHICAGO OFFICE,
Western Union Building, Clifford J. Ellis, Sales Agent. Robert E. Belknap, Asst. Sales Agent.
SAN FRANCISCO OFFICE,
33-39 Fremont Street, Pacific Hardware & Steel Co., Sales Agents.
LONDON OFFICE,
110 Cannon St. E. C., Sanders & Co., Sales Agents.
STEELTON OFFICE,
C. W. Reinoehl, Sales Agent.

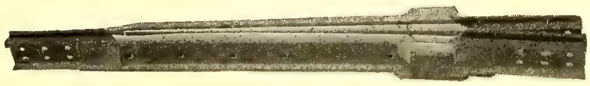
MILLS, SHOPS AND FOUNDRIES AT **STEELTON, PENNA.**
and SPARROW'S POINT, near Baltimore, Md.

CABLE ADDRESS

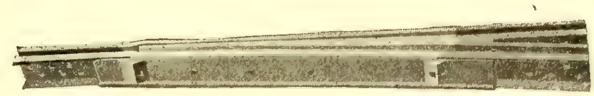
For the Penna. Steel Co., PENNSTEEL, PHILADELPHIA. For the Maryland Steel Co., PENNSTEEL, PHILA.

USE LIEBER'S CODE

SPECIAL WORK
FOR
STREET RAILWAYS

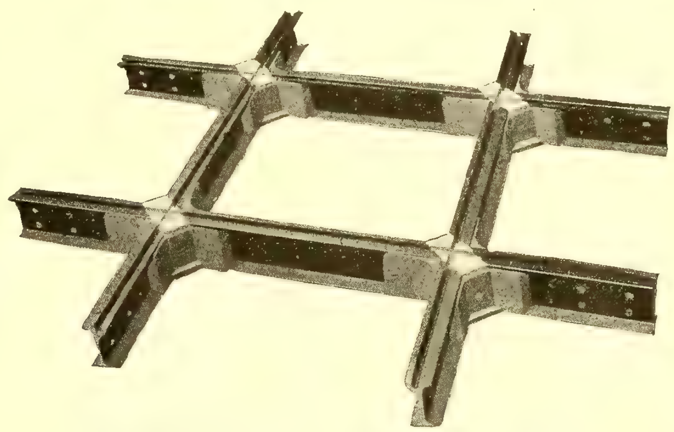


"Nichols" Protected Heel Switch—Patented 5-16-93, 6-5-94 9-3-95, 5-23-99, 5-7-01



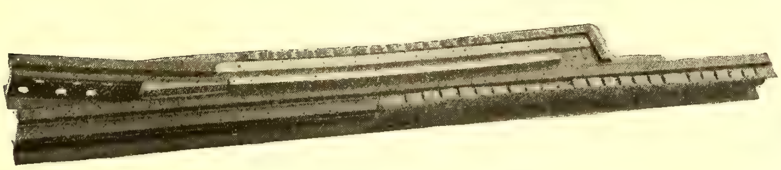
"Wharton" Standard Manganese-Steel Girder Rail Tongue Switch—Patented 5-16-93, 6-5-94, 9-3-95, 12-10-95, 7-20-97, 11-2-97

Manganese-Steel
is the
Supreme Metal
for
Points of Greatest Wear
in
Electric and Steam Railway
Track Work

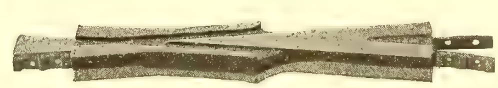


Manganese-Steel Girder Rail Crossing—Patented 5-16-93, 6-5-94, 9-3-95

"Wharton" Standard Manganese-Steel Girder Rail Frog—Patented 5-16-93, 6-5-94, 9-3-95



"Wharton" Unbroken Main Line Switch—Patented 9-12-93



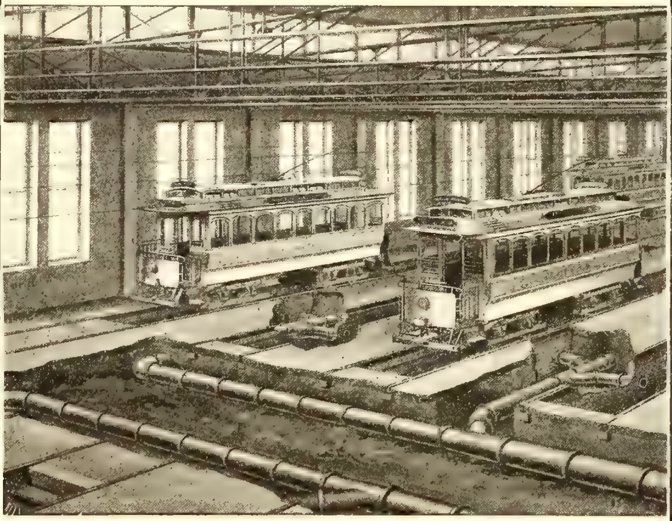
Solid Manganese-Steel T Rail Frog

WM. WHARTON, JR. & CO.

INCORPORATED — PHILADELPHIA, PA., U. S. A.

Girder Rails — Track Fastenings — Special Work for Steam Railroads
Steel Castings — Iron Castings — Brake Shoes, etc.

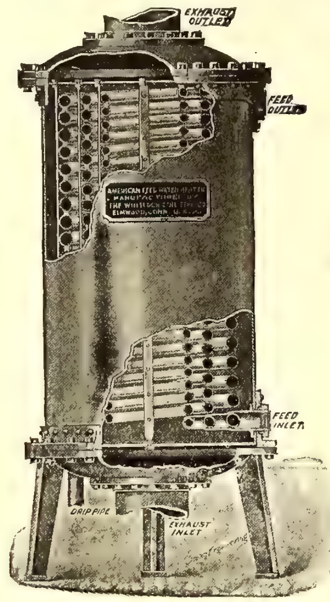
The Sturtevant System of Heating Car Barns



HEATS and VENTILATES the Car Barn and MELTS the SNOW and ICE from car trucks by a forced circulation of warm air.

B. F. STURTEVANT CO.
BOSTON, MASSACHUSETTS
NEW YORK PHILADELPHIA CHICAGO LONDON 341

The American Standard
—Copper Coil—
Feed Water Heater



Simplicity!
Strength!
Durability!
Efficiency!
Economy!
A Time Saver!
A Money Saver!

Because it never gets out of order, never requires a bit of attention, has no movable or adjustable parts and will not wear out.
It is now used in some of the largest and best Street Railway Power Houses in the World.

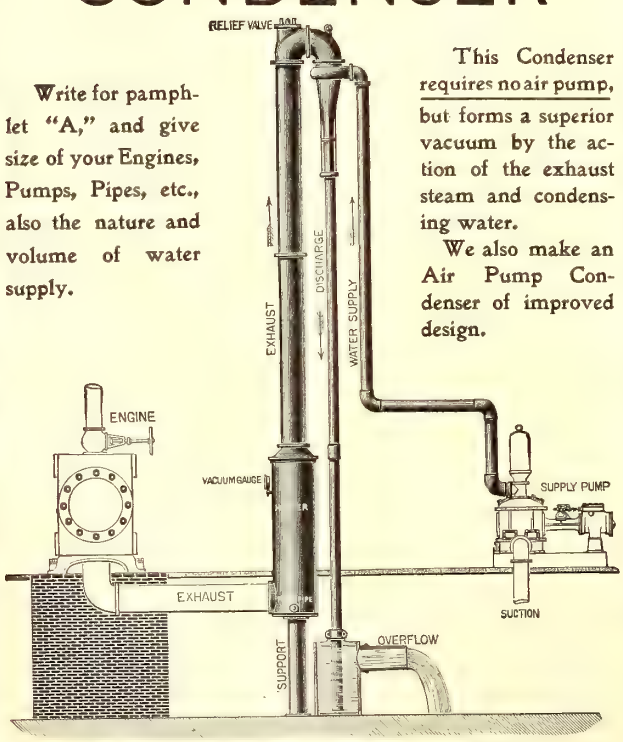
Send for Catalogue 22-H

The Whitlock Coil Pipe Co.
HARTFORD, CONN.
NEW YORK OFFICE - - - 85 LIBERTY STREET

The BULKLEY "Injector" CONDENSER

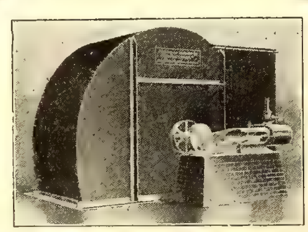
Write for pamphlet "A," and give size of your Engines, Pumps, Pipes, etc., also the nature and volume of water supply.

This Condenser requires no air pump, but forms a superior vacuum by the action of the exhaust steam and condensing water.
We also make an Air Pump Condenser of improved design.



HENRY W. BULKLEY,
New York Office, 145 Broadway. Orange, N. J.

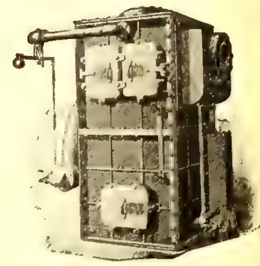
ABC
HEATING·VENTILATING·DRYING
MECHANICAL DRAFT APPARATUS



CATALOGUES UPON REQUEST
AMERICAN BLOWER CO.
DETROIT
NEW YORK CHICAGO LONDON

COCHRANE HEATERS

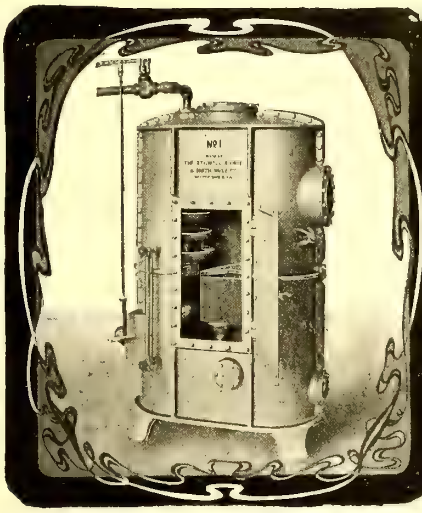
For Street Railway Plants



A COCHRANE FEED WATER HEATER will increase the efficiency and economical operation of an electric railway or lighting plant, even though the plant is run condensing, and the auxiliaries—the pumps and small engines—are now driven by belts or motors. The best practice, as proven by actual installations and tests, is to run these auxiliaries *non-condensing*, utilizing the exhaust steam from them for heating the feed water in an "open" feed water heater. If the auxiliaries are run condensing, about 15 per cent. of the steam required by them will be converted into work; the remaining 85 per cent. will be carried away and wasted in the condensing water (except the very small part that is saved if the feed supply is taken from a hot well). On the other hand, if the auxiliaries are run non-condensing, only about 5 per cent. of the steam will be converted into work, but the remaining 95 per cent. will be saved and returned to the boilers if the exhaust from the auxiliaries is utilized in a Cochrane Heater. If you are interested, we shall be p'eased to go into the whys and wherefores with you, and to submit a list of street railway plants in which Cochrane Heaters are used.

Harrison Safety Boiler Works, 3162 N. 17th St., **Philadelphia, Pa.**

MANUFACTURERS OF COCHRANE FEED WATER HEATERS, THE SORGE-COCHRANE SYSTEMS AND COCHRANE STEAM AND OIL SEPARATORS



A MATTER OF CHOICE

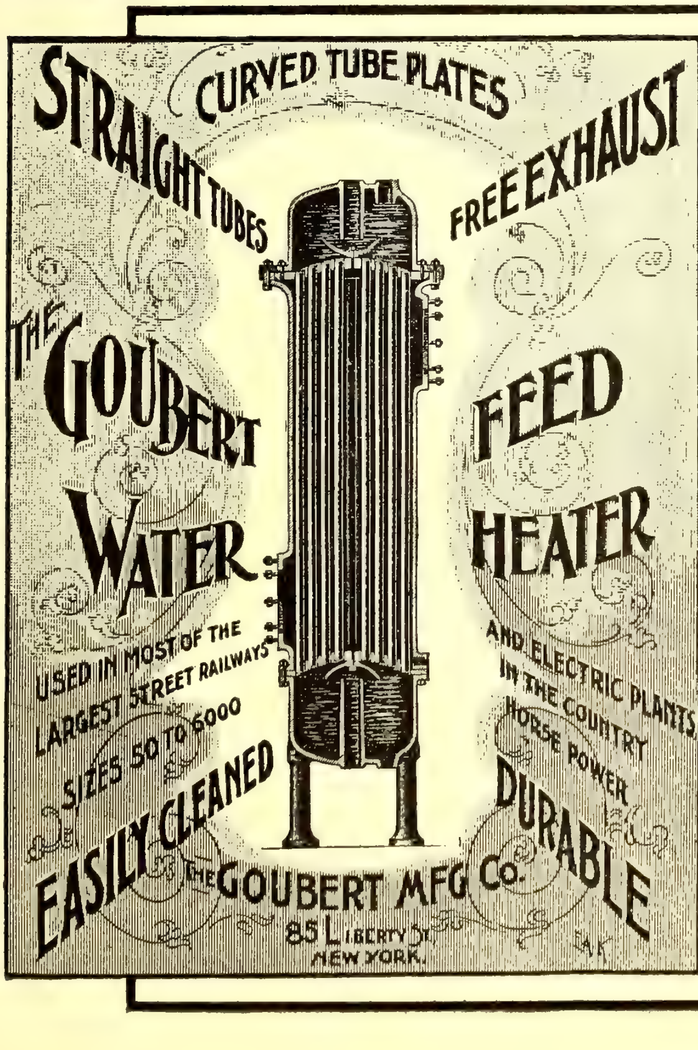
LOTS OF FUEL, LITTLE STEAM, MUCH WASTE AND DIRTY BOILERS	OR	LITTLE FUEL, LOTS OF STEAM, NO WASTE AND CLEAN BOILERS

ITS' UP TO YOU. THE LATTER IS ATTAINED BY THE USE OF STILWELL'S FEED WATER HEATER.

WRITE FOR INFORMATION

THE STILWELL-BIERCE & SMITH-VAILE CO.

M.O.B. 282 DAYTON, OHIO.



Wheeler Condenser & Engineering Co.

OFFICES:

120 LIBERTY ST., NEW YORK. 1642 MONADNOCK BLOCK, CHICAGO.
179 QUEEN VICTORIA ST., LONDON. E. C.

Water Cooling Towers

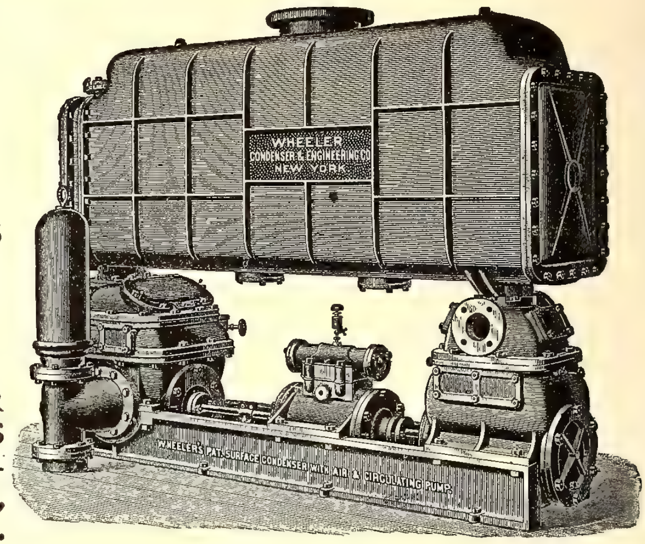
Wheeler Surface Condensers

Feed Water Heaters

Steam and Electric Pumps

Evaporators and Sugar Machinery

COMPLETE COOLING TOWER AND CONDENSING PLANTS FOR ELECTRIC LIGHT, RAILWAY AND POWER PLANTS, MILLS, MINES, ETC. .. ..



For the benefit of those contemplating the Installation or Alteration of steam plants, we shall be pleased to give advice and prepare plans and specifications.

PUMPING ECONOMY

IS ATTAINED BY USING

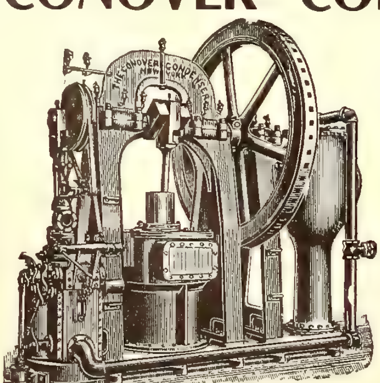
DEMING TRIPLEX PUMPS

THE ACME OF EFFICIENCY

MANY TYPES AND SIZES	*The* Deming Co. SALEM, OHIO	OPERATED BY ANY POWER

GENERAL AGENCIES
- HENSHAW, BULKLEY & CO., San Francisco, Cal.
- HENION & HUBBELL, 61-69 N. Jefferson St., Chicago
- HARRIS PUMP & SUPPLY CO., 320 2d Avenue, Pittsburgh, Pa.
- W. P. DALLETT, 49 North 7th St., Philadelphia, Pa.
- CHAS. J. JAGER CO., 174 High St., Boston, Mass.

CONOVER CONDENSERS



The Only Condensers sold under a

Duty Guarantee

Driven by Compound Corliss Condensing Engine, twelve expansions of steam, vertical air pumps, all brass lined. Also Combined Air and Circulating Pumps for surface Condensers. Send for catalogue.

THE CONOVER MFG. CO.

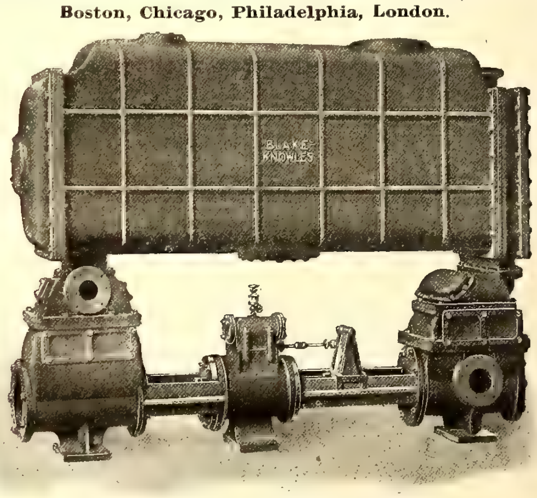
Office and Works
PRINCETON AVENUE
JERSEY CITY, N. J.

BLAKE-KNOWLES

STEAM PUMP WORKS

114-118 Liberty Street, New York City

Boston, Chicago, Philadelphia, London.



SURFACE CONDENSER

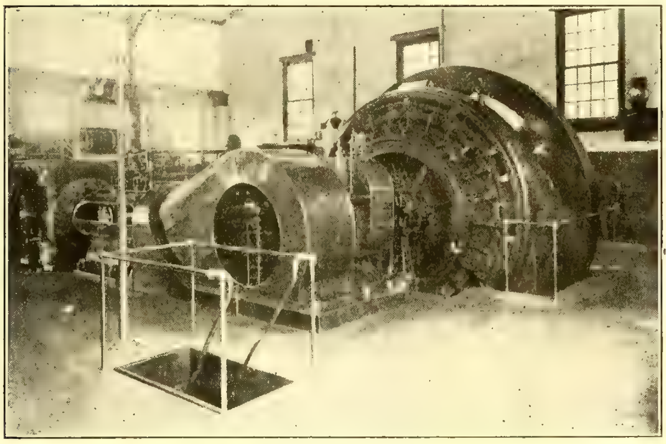
with Combination Air and Circulating Pumps.
ADMIRALTY.

We also make Suction-Valveless Air Pumps, Single and Double-Acting, Single, Duplex, Triplex, Vertical Simplex, Cross-Compound Steam-Driven, also Belt or Electric-Driven. Horizontal and Vertical, Steam or Power Rotative Dry Vacuum Pumps with Mechanically Operated Valves, Water-jacketed Cylinders, Meyer Cut-off and Corliss Valves. Automatic Exhaust Relief Valves. Independent Air Pumps with Jet Condensers. Spiro-Ejector Condensers. Vertical-Beam Air Pumps for Surface Condenser also with Jet Condensers. Feed Pumps. Steam and Power Pumps and Electric Pumps.

SEND FOR CIRCULAR B62R, JUST OUT.

63

The Best Way to Reduce Your Oil Bills is to Use Less Oil



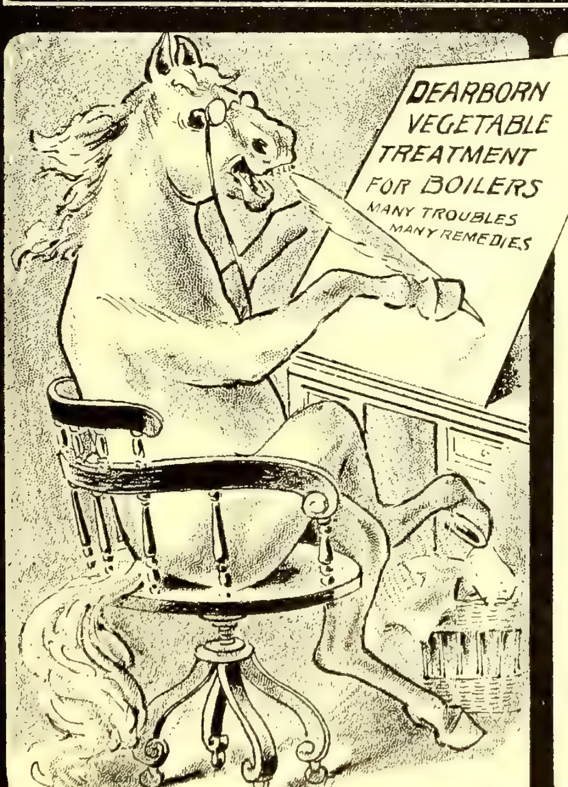
The best way to use less oil is to install in your Power Station a

Modern Oil-Collecting and Continuous Oiling System

The best way to learn the cost and advantages of a system that will meet your own particular requirements is to write for this information to

BINGHAM & COMPANY, CAMDEN, N. J.

PLAIN HORSE SENSE



will tell you that no one medicine will cure every known disease. Neither will any one so-called "Boiler Compound" cure every ailment in a boiler.

We handle boiler ailments in the same way that physicians handle human cases, *i. e.*, prescribe *specific* remedies for *specific* ailments after a complete analysis.

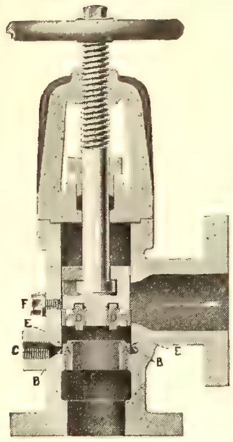
You cannot afford to risk the life of your boiler, nor can you afford to tamper with quack nostrums which claim to do everything and only succeed in perhaps a few isolated cases.

Send us a sample of water from your boiler for analysis.

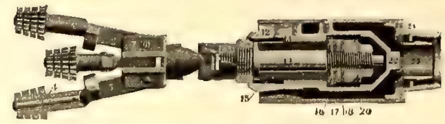
DEARBORN DRUG & CHEMICAL WORKS,

27, 28, 29, 30, 31, 32, 33, 34 Rialto Building,

CHICAGO.



Boiler Tube Cleaners
Blow-off Valves



THE FABER BLOW-OFF VALVE

washes its face every time it is opened and closed.

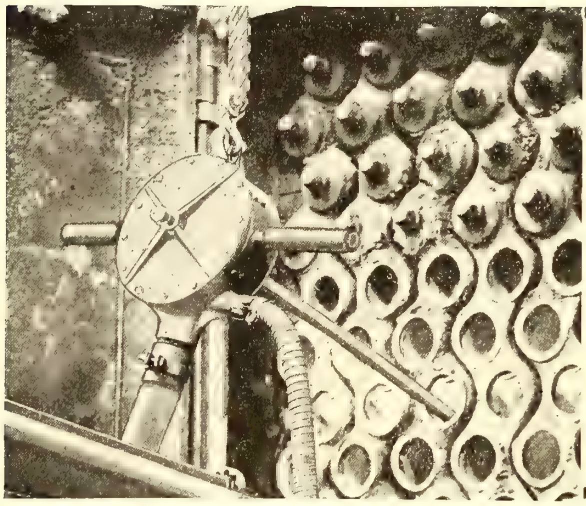
A steam jet blows all sediment from seat and disc just before closing. It may be opened and closed as many times as a steam valve without leaking.

THE LIBERTY BOILER TUBE CLEANER

is the most durable and efficient made. It will clean tubes more thoroughly, quickly and at less cost than can be done by other means. We continue to make THE CHICAGO and NIAGARA TURBINE CLEANERS. Our patents date back to 1893.

We have suit pending against a user of the Lagonda or Weinland Machine, and will prosecute all other infringers.

Liberty Manufacturing Company, 6909 Susquehanna St., Pittsburg, Pa.



THE WEINLAND DIRECT MOTOR TUBE CLEANER

Solves the Problem of Economical Boiler Cleaning

IT is a 12-inch water motor operated outside the tubes. This relieves it of friction and wear to which those working outside are subjected. Uses minimum amount of power but develops 5 to 8 horse power, which is applied directly to the cutter head. All parts of this head are very strong and remarkably durable, reducing the item of extra parts to the merest trifle. Will do as much work in any given time as five ordinary cleaners, easily outlasting twice that number.

We make other styles of cleaners; also Feed Water Regulators, Reseating Machines, etc. Send for catalogue and full particulars.

The Lagonda Mfg. Co., Boiler Cleaning Experts
SPRINGFIELD, OHIO

You have had trouble with your Coal. Why don't you try our Plymouth, Moshannon Vein, or Pilgrim, Miller Vein

SEMI-BITUMINOUS
COAL

We take special care in its preparation.

BORDEN & LOVELL

Miners and Shippers

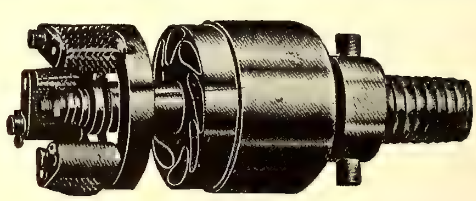
17 Battery Place, New York

Steam Sizes of Anthracite.

Boiler Scale is Costly

It means decreased efficiency of the boilers, and an increase in the coal supply. To avoid this remove the scale with

The Union Boiler Cleaner



or the Impulse Cleaner

They remove all adhering matter regardless of quality or thickness, leaving the tubes so clean that the original welds or die marks are clearly discernible.

Adapted to any style of boiler.

We would like to submit some statistics in this connection that will probably be interesting.

Gem Manufacturing Co.
Spruce, near 33d Street, Pittsburg, Pa.

American Steam Superheater Co.

MANUFACTURERS OF

THE AMERICAN SUPERHEATER

WELD BUILDING BOSTON, MASS.

FOSTER SUPERHEATERS.

Take care of PEAK LOADS

POWER SPECIALTY COMPANY,
126 LIBERTY ST., NEW YORK.

COOLING TOWERS (JENNISON PATENT)

Water at the Highest Degree of Heat Cooled to 80 deg. F.

Modern condensing plants installed.
See our adv. in Dec. 5th issue. Write for catalog B.

International Steam Engineering Co.

ATLANTA, GEORGIA 141 Broadway, NEW YORK

ALBERGER COOLING TOWERS

IMPROVED CONDENSING APPARATUS
VACUUM PUMPING MACHINERY
Send for Illustrated Catalogue

ALBERGER CONDENSER COMPANY

95 LIBERTY STREET, NEW YORK

WHEN WRITING TO ADVERTISERS in the STREET RAILWAY JOURNAL you will confer a favor on both publisher and advertiser by mentioning this paper.

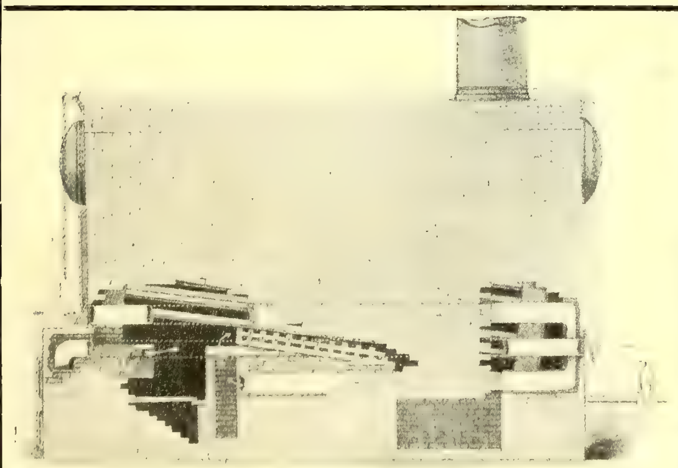
Dr. J. B. HARRIS' SYSTEM

ABSOLUTE COMBUSTION OF

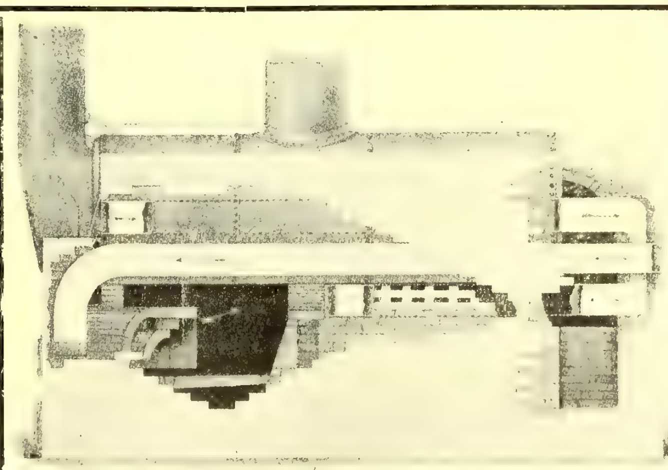
NO SMOKE

SOFT COAL IN STEAM BOILER FURNACES

Saves Fuel. Flues and Sheets Always Clean. Gives Higher Evaporation. Burns Any Kind of Fuel. Low in First Cost



Full Side Elevation of Cylindrical Horizontal Return Flue Tubular Boiler, showing the Harris Smoke Consuming Furnace. How Constructed



Full Side Elevation of Water Tube Boiler, showing the Harris Smoke Consuming Furnace. How Constructed

Repairs Nominal and Easily Made. Durable and Efficient. Burns Crude Oil Without Smoke or Odor

GENERAL AGENTS

INTERNATIONAL STEAM ENGINEERING COMPANY, New York: 1110 Washington Life Bldg., 141 Broadway. ATLANTA, GA., 528-9 Prudential Bldg. W. G. & G. GREENFIELD, Greenfie'd Steam Engine Works, 5th and Cross Streets, East Newark, N. J. ADAM DETRAMPE, 424 New Land Title Bldg., Philadelphia, Pa. STANLEY ADAMS & CO., 4 and 5 Board of Trade Bldg., Louisville, Ky.

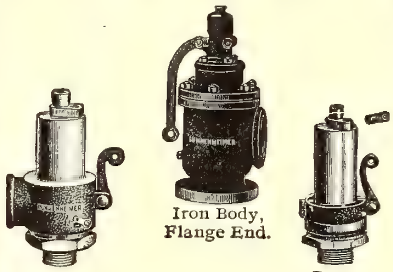
Catalogue Free of Nearest Agent, or Address

J. B. HARRIS, M.D., Inventor and Patentee

71 Arcade, NASHVILLE, TENN.

THE LUNKENHEIMER POP SAFETY VALVES

for STATIONARY, PORTABLE & MARINE STEAM BOILERS



Brass, Side Outlet. Iron Body, Flange End. Brass, Top Outlet.

Are made of the best materials, provided with large springs, have full relieving capacity and always prompt and reliable in operation. In brass top or angle outlet, 3/8 inch to 3 inches; in iron, brass mounted, screw or flange ends, 2 inches to 6 inches. Also furnished with nickel seats, if desired. All valves rigidly tested and inspected and warranted to satisfy. Specify *Lunkenheimer* make and order from your dealer.

Write for catalogue of Superior Brass and Iron Engineering Appliances.

THE LUNKENHEIMER CO.
SOLE MAKERS AND PATENTEES.
Main Offices and Works,
CINCINNATI, OHIO, U. S. A.
Branches { New York: 26 Cortlandt St. London: 35 Great Dover St.

Saving Water

Fresh water for steam boilers not only costs money to heat, but in cities the cost of water itself is an important item.

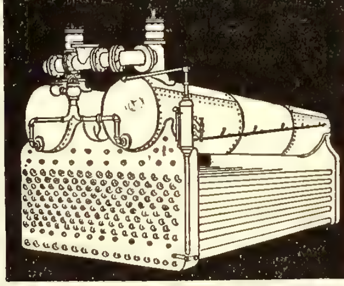
Webster Feed-Water Heaters and Purifiers

utilize all available drips from drying kilns, heating coils, etc., which are suitable for boiler feed or other purposes, and thus automatically save water as well as heat. Their economy of both is remarkable.

Ask the best engineers, and send for booklet.

Warren Webster & Co.
Camden, N. J.

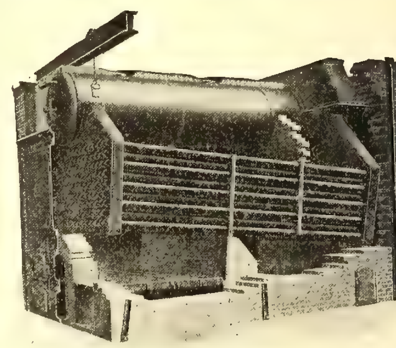
WATER TUBE STEAM BOILERS



MANUFACTURED BY
HEINE SAFETY BOILER CO.
421 Olive St., St. Louis, U. S. A.
—ARE—
ECONOMICAL, SAFE AND DURABLE

E. R. MARSHALL ADV. ST. LOUIS

Water Tube Boilers



Simple in construction. Rapid in steam generation. Dryness of steam. Economy of maintenance. Ask for Catalog J.

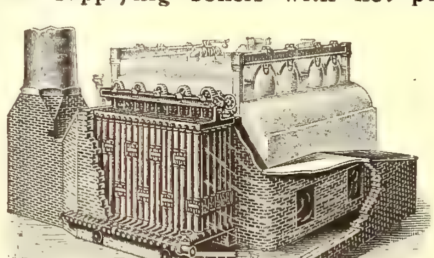
E. KEELER CO.
Williamsport, Pa.

American Street Railway Investments

The "RED BOOK" is the most complete and valuable manual of street railway statistics published. Shall we send you the 1903 edition? **$5.00** per copy.

McGRAW PUBLISHING CO., 114 LIBERTY ST., NEW YORK.

In supplying boilers with hot purified water, thus keeping a larger heating surface, as well as meeting sudden demands for power, the



GREEN'S ECONOMIZER

is but beginning its savings to Plant owners. What has been, and possibly will again be, cost of fuel—one of the greatest expenses of a Plant—is reduced from 10 to 20 per Cent. ELECTRIC LIGHT AND POWER PLANTS having a Green's Economizer realize the greatest saving. We will be pleased to send our free booklet showing construction and how applied.

THE GREEN FUEL ECONOMIZER CO., Sole Manufacturers in the U. S. A. **Matteawan, N. Y.**

THE BABCOCK & WILCOX CO.

85 LIBERTY ST.
NEW YORK

CABLE ADDRESS NEW YORK "GLOVEBOXES"
ALL FOREIGN OFFICES "BABCOCK"

STEAM

WATER TUBE BOILERS

SEND FOR OUR BOOK "STEAM"

BRANCH OFFICES

BOSTON 35 FEDERAL ST.
PHILADELPHIA NORTH AMERICAN BLDG.
SAN FRANCISCO 32 FIRST ST.
CHICAGO 1215 MARQUETTE BLDG.
NEW ORLEANS 339 CARONDELET ST.
PITTSBURGH FRICK BUILDING.
ATLANTA, GA. 817 EQUITABLE BLDG.
CLEVELAND NEW ENGLAND BLDG.
MEXICO. CITY 7 AVENIDA JUAREZ
HAVANA, CUBA 116½ CALLE DE LA HAVANA

THE BABCOCK & WILCOX COMPANY STEAM

Partial List of BABCOCK & WILCOX BOILERS Sold for Electric and Cable Railways.

			H.P.
Metropolitan St. Ry. Co., New York	12 orders,	'94-'00	59,100
Manhattan Elevated Ry. Co., New York		'99	33,500
Boston Elevated R. R. Co., Boston, Mass	12 orders,	'89-'99	22,500
Union Traction Co., Philadelphia, Pa	9 orders,	'93-'95	21,675
Brooklyn Rapid Transit Co., Brooklyn, N. Y	13 orders,	'91-'97	20,000
Union Elevated R. R. Co., Chicago, Ill	1 order,	'96	6,400
Northwestern Elevated R. R. Co., Chicago, Ill	1 order,	'96	6,400
Metropolitan West Side Elevated R. R. Co., Chicago, Ill	2 orders,	'94-'98	6,000
Consolidated Traction Co., Pittsburg, Pa	2 orders,	'97-'99	6,000
North Jersey St. Ry. Co., Jersey City, N. J	6 orders,	'93-'99	6,000
South Side Elevated R. R. Co., Chicago, Ill	2 orders,	'97-'98	4,800
Metropolitan St. Ry. Co., Kansas City, Mo	6 orders,	'86-'96	4,696
Buffalo St. Ry. Co., Buffalo, N. Y	3 orders,	'90-'93	4,500
Louisville Ry. Co., Louisville, Ky	3 orders,	'96-'00	4,062
United Rys. & Elect. Co., Baltimore, Md	1 order,	'99	4,000
Lynn & Boston R. R. Boston, Mass	3 orders,	'99-'92	4,000
Cincinnati St. Ry. Co., Cincinnati, O	5 orders,	'90-'93	3,300
Citizens St Ry. Co., Detroit, Mich	3 orders,	'95	3,500
Denver City Tramway Co., Denver, Colo	3 orders,	'89-'91	2,686
United Traction Co., Pittsburg, Pa	2 orders,	'99	2,436
Union Traction Co., Anderson, Ind	2 orders,	'98-'99	2,400
Cleveland Elect. Ry. Co., Cleveland, O	2 orders,	'98-99	2,378
Market St. Cable Ry. Co., San Francisco, Cal	3 orders		2,208
Virginia Ry. & Dev. Co. Richmond, Va	1 order,	'00	2,080
St. Joseph Ry. Light, Heating & Power Co., St. Joseph, Mo	3 orders,	'98-'99	2,057
Union R. R. Co., Providence, R. I	2 orders,	'92-'93	2,000
United Traction Co., Albany, N. Y	5 orders,	'89-'99	2,000
Springfield St. Ry. Co., Springfield, Mass	4 orders,	'94-'00	2,000
Columbus St. Ry. Co., Columbus, O	4 orders,	'90-'93	1,807
Charleston Consolidated Ry., Gas & Elect. Co., Charleston, S. C	3 orders,	'97-'00	1,800
N. Y. & Brooklyn Bridge, Brooklyn, N. Y	5 orders,	'92-'96	1,786
Dayton, Springfield & Urbana St. Ry. Co., Dayton, O	2 orders,	'99	1,702
Florence & Cripple Creek Ry. Co., Goldfield, Col	1 order,	'98	1,584
Duluth St. Ry. Co., Duluth, Minn.	4 orders,	'90-'93	1,312
Richmond Passenger & Power Co., Richmond, Va	2 orders,	'90-'00	1,339
Detroit, Ypsilanti & Ann Arbor St. Ry. Co., Ypsilanti, Mich	2 orders,	'98	1,380
Pittsburg & Birmingham Traction Co., Pittsburg, Pa	2 orders,	'90-'00	1,528
Rochester St. Ry Co., Rochester, N. Y	3 orders,	'91-'94	1,143
Atlanta Ry. & Power Co	2 orders,	'00	2,400
Union R. R. Co., New York	2 orders,	'91-'92	1,500

Note the number and size of the renewal orders.

BABCOCK & WILCOX Boilers sold for Street Railway Purposes amount in the aggregate to over 400,000 H.P.

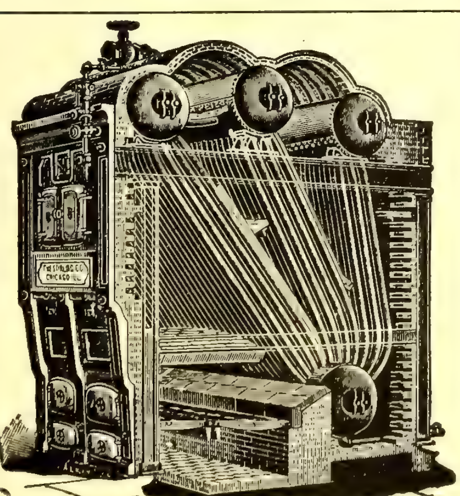
"CAHALL"

VERTICAL and HORIZONTAL WATER TUBE BOILERS

Repeated Orders anuary 1st, 1894, to September 30, 1903. 264 Firms placed 1,002 orders for Cahall Boilers Aggregating 938,028 H. P. Nearly 2,000,000 H. P. in use.

SEND FOR ILLUSTRATED CATALOGUE

CAHALL SALES DEPARTMENT, Farmers' Bank Building, Pittsburg, Pa.



The STIRLING BOILER

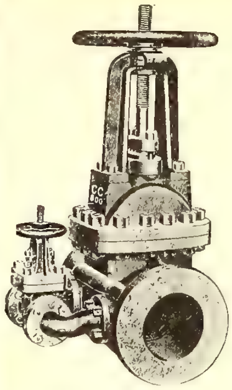
The only Water-tube Boiler made which Combines Extreme Simplicity with Every Essential to Safety, Durability and Efficiency. Wrought Metal throughout. No gaskets or ground joints. ***Four*** Manholes give access to every tube. Peculiarly adaptable to the use of low grade fuels.

THE STIRLING COMPANY

General Offices: Pullman Building

CHICAGO

New York	Boston	Pittsburg	New Orleans	Atlanta
Philadelphia	Cincinnati	San Francisco	Toledo	Houston



CRANE HIGH PRESSURE VALVES

Recommended for 250 lbs. steam working pressure. Tested to 800 lbs. Hydraulic pressure. In Brass or Iron. Each one rigidly tested and inspected before shipment. Iron valves made screwed or flanged, with stationary or rising stems and hard metal seats. Sizes 7 inches and larger made with by-pass.

We take contracts from drawings for complete piping equipments for power plants, cut, fitted and tested, ready for erection.

WRITE FOR COMPLETE POCKET CATALOGUE

NEW YORK, PHILADELPHIA, CINCINNATI, KANSAS CITY, SIOUX CITY, ST. PAUL, DULUTH, OMAHA

CRANE CO.
CHICAGO
ESTABLISHED 1855

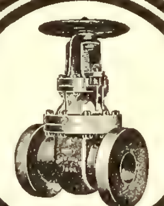
SEATTLE, ST. LOUIS, MINNEAPOLIS, LOS ANGELES, SAN FRANCISCO, SALT LAKE CITY, WATERTOWN, S. D., PORTLAND, ORE.

BEST MFG. CO.

PIPING "ENGINEERS"

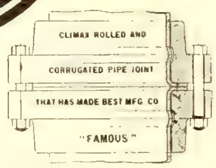
FURNISH AND ERECT
STEAM, WATER AIR OR HYDRAULIC
PIPING SYSTEMS.

THE BEST



GATE VALVE

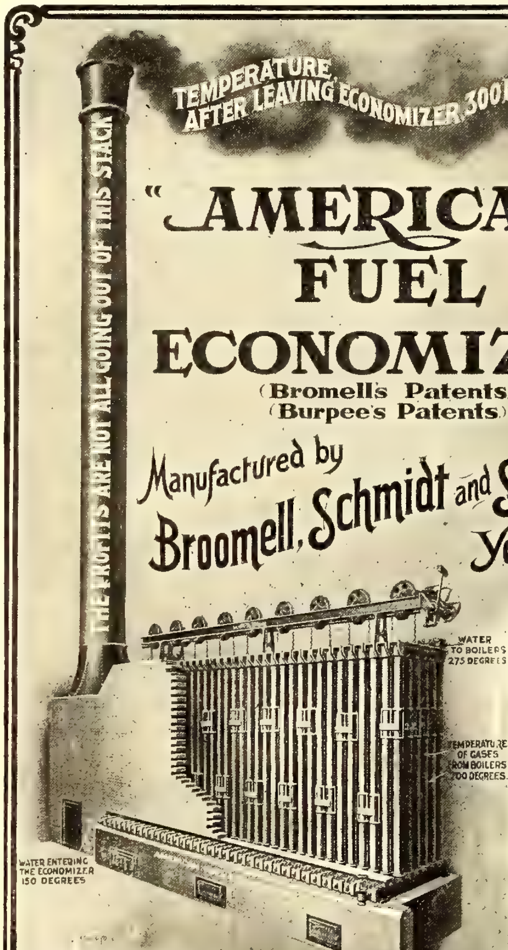
Best Gate Valves.
Climax Globe and Angle Valves.
Climax 3 and 4 Way Hydraulic Valves.
Gulland Float Valves.
Gulland Non-Return Valves.
Centrifugal Separators.



Valves, Fittings and Piping for Superheated Steam

PIPE BENDING A SPECIALTY.

PITTSBURG, PA.
Philadelphia, New York.



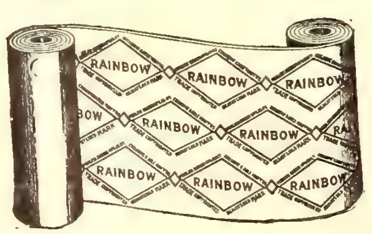
"AMERICAN" FUEL ECONOMIZER

(Bromell's Patents)
(Burpee's Patents)

Manufactured by
Broomell, Schmidt and Steacy Co.
York, Pa.

A large body of very hot water always ready for use is of great advantage in keeping regular steam pressure. Boilers are supplied with purified water, fewer boilers are required and much less repairs—all from waste heat.

THE BEST FLANGE PACKING MADE



Rainbow Packing

MAKES A STEAM, FLANGE, AND HOT WATER JOINT INSTANTLY

Don't have to use wire and cloth to hold Rainbow. Can't blow it out.
Thousands of imitators. No equal. Will hold highest pressure.

THE COLOR OF RAINBOW PACKING IS RED, three rows of diamonds extending throughout the entire length of each and every roll of Rainbow Packing.

Steam heating companies can make thousands of joints in new plants without the use of steam, with the assurance and guarantee that when steam is applied every joint will be perfectly tight, saving the labor of baking and following up, etc., as is the case when usudurian or plumbago packings are used, thereby saving from 100 to 300 per cent. of labor and time.

Manufactured, Patented and Copyrighted Exclusively by

THE PEERLESS RUBBER MFG. CO. - 16 Warren St., New York

16-24 Woodward Ave., Detroit, Mich. 202-210 S. Water St., Chicago, Ill. 17-19 Beale St. and 18-24 Main St., San Francisco, Cal.

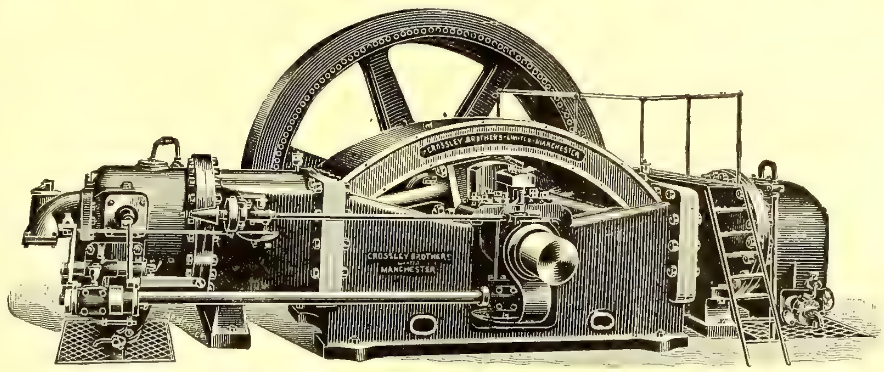
LOOMIS-PETTIBONE GAS MACHINERY CO.

Gas Power for Electric Railways

Mining and Smelting Plants,

Manufacturing Plants,

Electric Light Plants



CROSSLEY GAS ENGINE, 500 BRAKE HORSE POWER

Gas for Furnaces, Annealing, Forging, Welding, Melting, Etc.

Loomis-Pettibone Gas Generating System
Crossley Gas Engines

OUR GUARANTEE: 1 POUND OF COAL, OR

1 BRAKE HORSE-POWER 2½ POUNDS OF WOOD

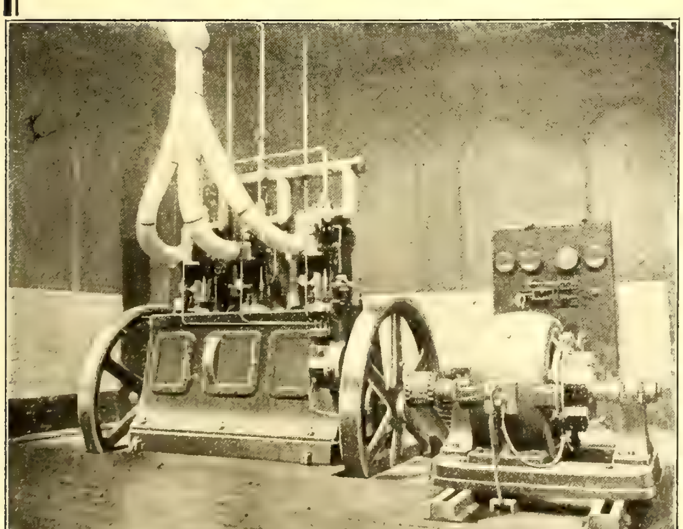
46,000 Crossley Engines Now in Operation

WRITE FOR FULL INFORMATION

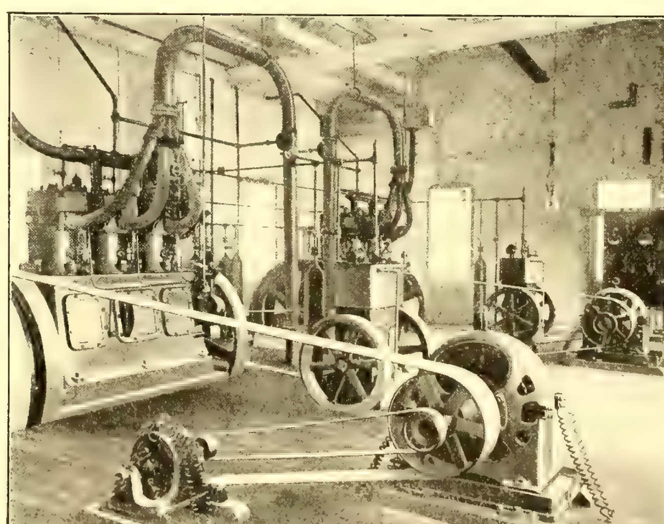
New York Office: 52-54 WILLIAM STREET

Pittsburg Office: FARMERS' BANK BUILDING

DIESEL OIL ENGINES



75 HP. ENGINE OPERATING DYNAMO WITH CHAIN DRIVE
GUARANTEED CONSUMPTION OF CRUDE OR FUEL OIL
NOT TO EXCEED 9 GALLONS PER 100 HP. HOURS.



2-75 HP. ENGINES, DRIVING 2-50 KW. GENERATORS.
COST OF POWER, FULL LOAD, 7.5 MILLS PER KW. HOURS
" " " 1-3 " 1.5 CENTS " " "
(Including labor and supplies)

FOR FURTHER PARTICULARS APPLY TO

AMERICAN DIESEL ENGINE COMPANY

11 BROADWAY, NEW YORK

The Warren Rotary Engine

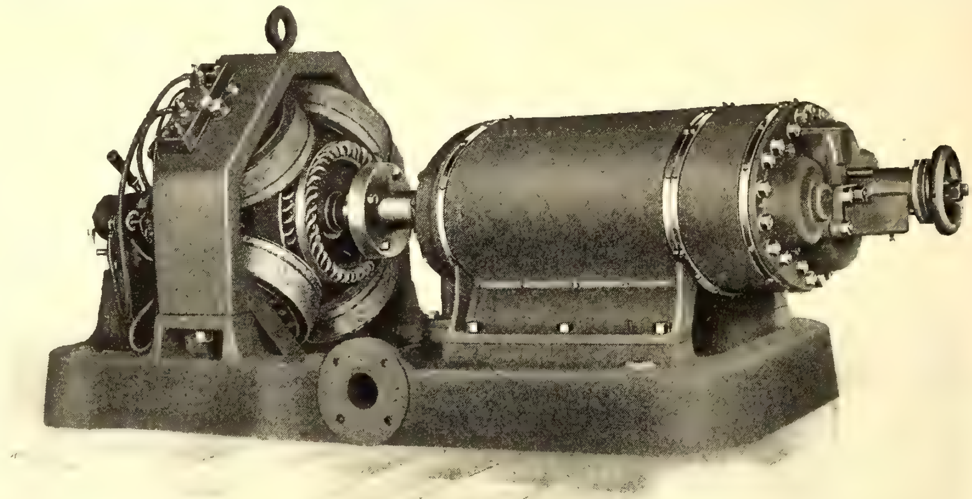
An ENGINE—Not a Turbine

The New Prime Mover, "built around a Principle"

No such TIMELY occurrence as the present commercial introduction of the Perfected Rotary Engine has ever before marked the history of Steam Engineering.

The need for a "Rational" Prime Mover was never more imperative.

The Warren Engine furnishes the solution of the pressing problem of modern power generation.



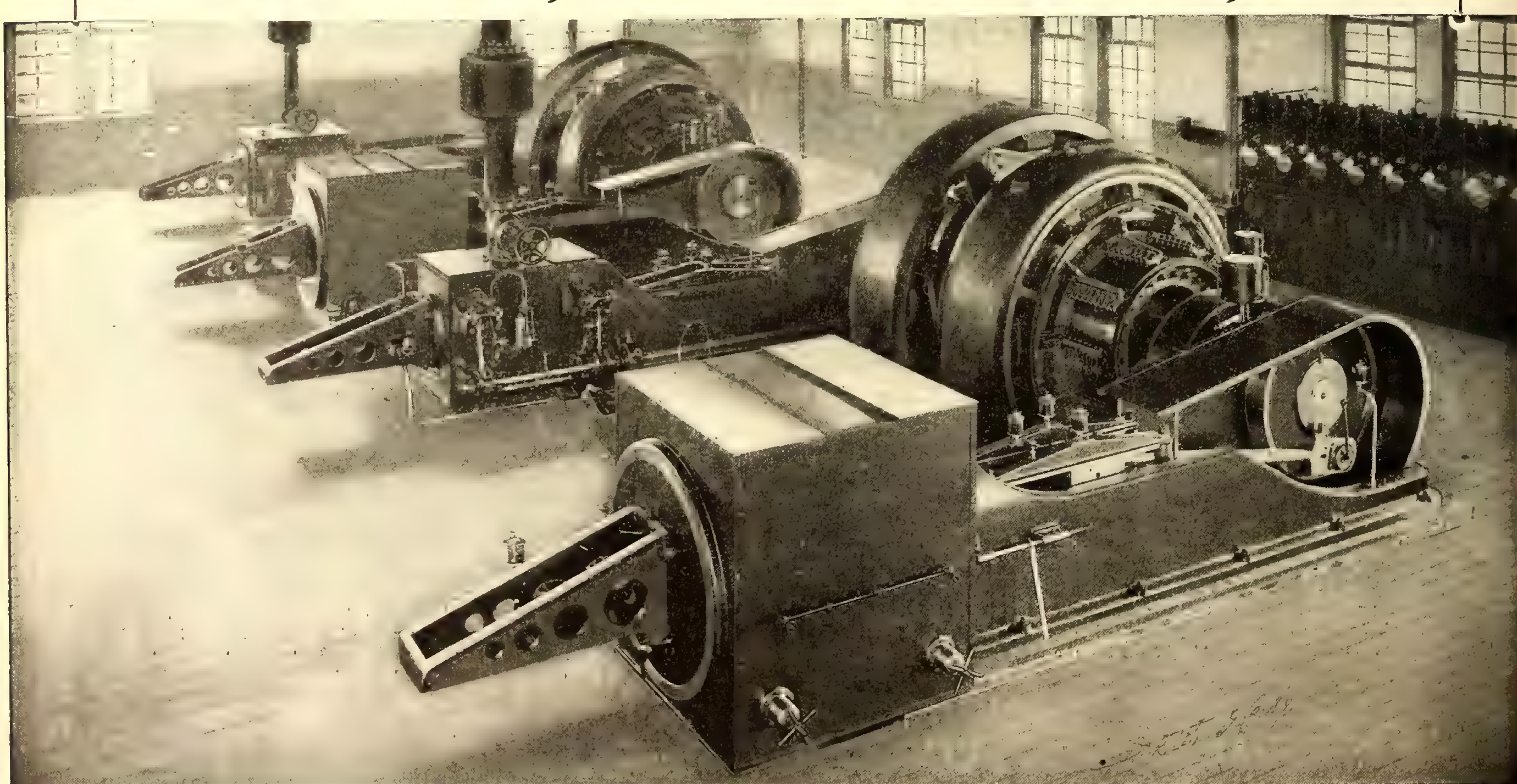
We can now make early delivery of the "Rotary" Generating Units in all sizes from 12½ to 200 K. W. and will soon be prepared to enter the field of large powers.

We are mailing an interesting bulletin, which explains.

ROTARY ENGINE COMPANY

Keystone Telephone Building, 135 South Second Street, PHILADELPHIA

McINTOSH, SEYMOUR & CO., Auburn, N.Y.



All Sizes and Types SPECIAL ENGINES to Meet Requirements

New York	Boston	San Francisco
McINTOSH, SEYMOUR & CO.	J. A. GRANT & CO.	CHARLES C. MOORE & CO
26 Cortlandt St.	Tremont Building	63 First Street

ALLIS-CHALMERS CO.

SUCCESSOR TO

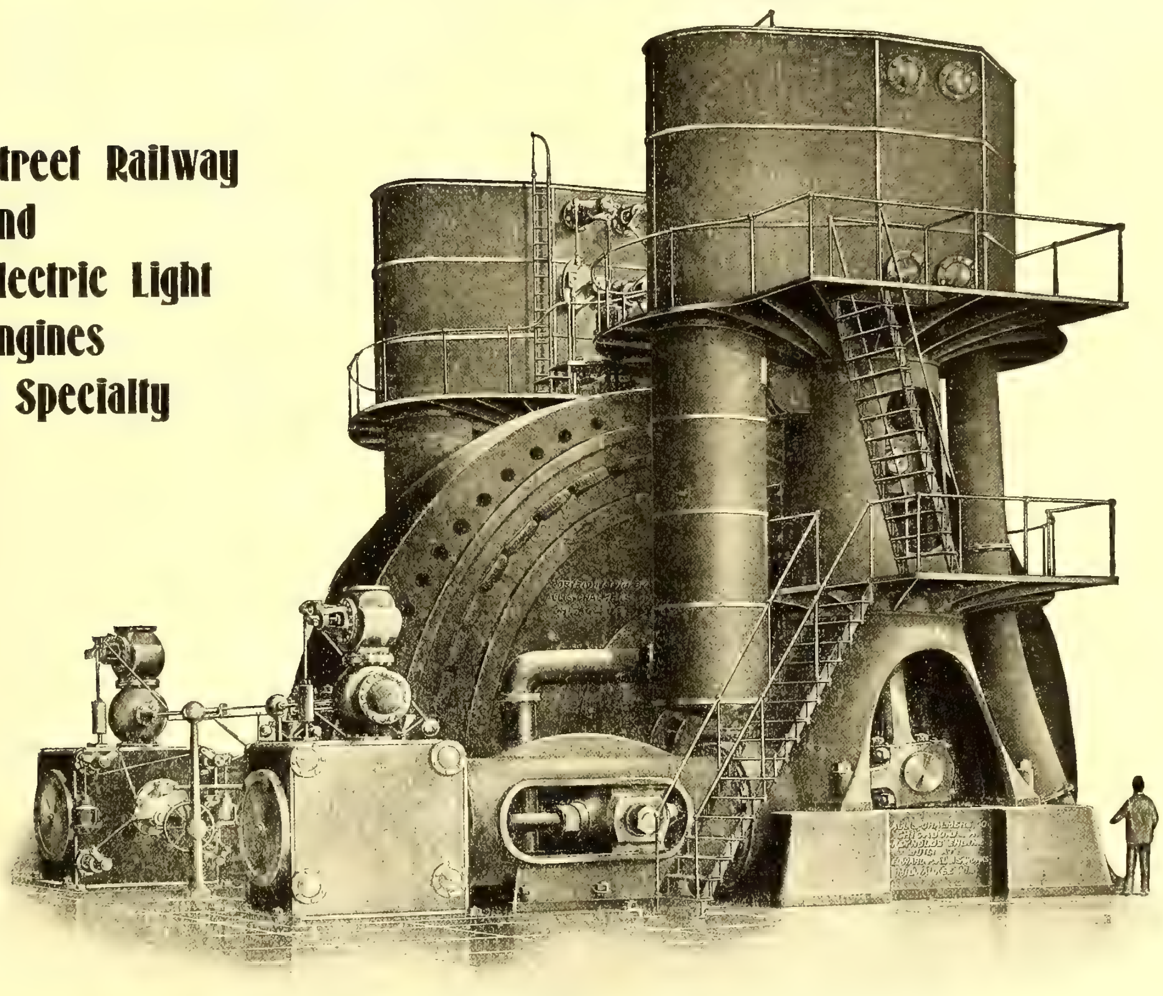
THE EDWARD P. ALLIS CO., MILWAUKEE, WIS. | FRASER & CHALMERS, CHICAGO, ILL. | GATES IRON WORKS, CHICAGO, ILL. | DICKSON M'F'G CO., SCRANTON, PA.

SOLE BUILDERS OF

Reynolds-Corliss Engines

FOR ALL POWER PURPOSES

Street Railway and Electric Light Engines a Specialty



Reynolds' Combined Vertical and Horizontal Electric Light and Street Railway Engine

We have furnished sixteen of the above engines for the Interborough Rapid Transit Co., New York, which company operates the Manhattan Elevated and Subway Systems. Each engine is rated at 8,000 H. P. for its most efficient load, and is capable of operating continuously under a load of 12,000 H. P. We have recently secured an order for an additional engine of this same type, making seventeen engines furnished the Interborough Rapid Transit Co. We have also furnished one engine of the above design to the Southern Electric Co., Philadelphia.

This design permits the installation of large units keeping the flywheel weight within reasonable limits for the reason that steam is taken four times during each revolution, but not having the usual objection of numerous journals and pins necessary with the ordinary three or four cylinder engine. It is particularly desirable for a high frequency generator.

Sole Builders of NURNBERG GAS ENGINES

BRANCH OFFICES:
NEW YORK, Empire Bldg.
BOSTON, Board of Trade Bldg.
PITTSBURG, Frick Building
MINNEAPOLIS, Corn Exchange Bldg.
DENVER, 1649 Tremont Street
SALT LAKE CITY, 209 S.W. Temple St.
SPOKANE, Washington

GENERAL OFFICE
CHICAGO, ILL., U.S.A.
ALLIS-CHALMERS 1860 1901 COMPANY
LONDON, ENG., 533 Salisbury House
JOHANNESBURG, South Africa

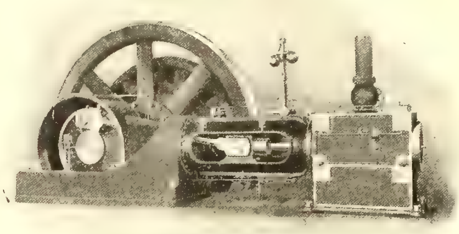
BRANCH OFFICES:
SAN FRANCISCO, Hayward Bldg.
SEATTLE, Lumber Exchange Bldg.
CHARLOTTE, N. C., Trust Bldg.
NEW ORLEANS, Hennen Bldg.
ATLANTA, GA., Equitable Bldg.
BUTTE, MONT., 51 E. Broadway

The C. & G. Cooper Co.

MOUNT VERNON, OHIO

High Grade Corliss Engines

ALL SIZES AND TYPES



DIRECT=CONNECTED RAILWAY and LIGHTING ENGINES A SPECIALTY

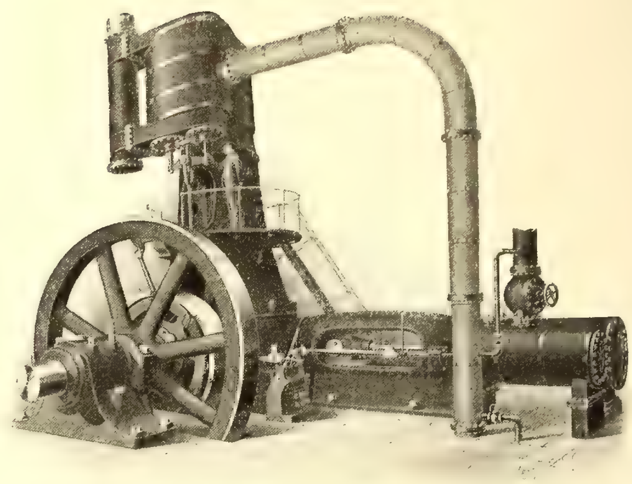
Branch Offices:

NEW YORK, - 1022 Havemeyer Building
BOSTON, - - - - 411 Weld Building
ATLANTA, - - - - 8 Austell Building
CHARLOTTE, N. C., - - O. A. Robbins
CHICAGO, J. Holt Gates, 1436 Monadnock Block

The WM. TOD CO.

Builders of Corliss and Medium Speed Automatic Engines for Electrical Purposes

ESTABLISHED 1856



Main Office and Works

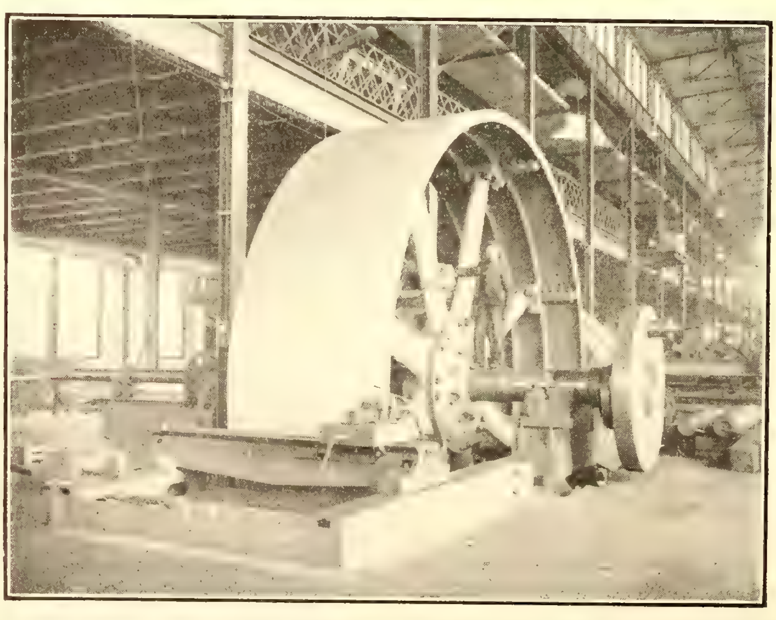
YOUNGSTOWN, OHIO

BROWN CORLISS ENGINE CO.

CORLISS, WIS.

Builders of... **Heavy Duty and Girder Frame Corliss Engines**

Rolling Mill and Blowing Engines



A Full Line of Saw Mill Machinery

Wilkin Gang, Band and Power Set Works, Hoohoo Nigger

AGENCIES

Woolston & Brew, 39 Cortlandt Street, New York

Woolston & Brew, 176 Federal Street, Boston, Mass.

Jas. Pierpoint & Co., 517 Arcade Building, Philadelphia, Pa.

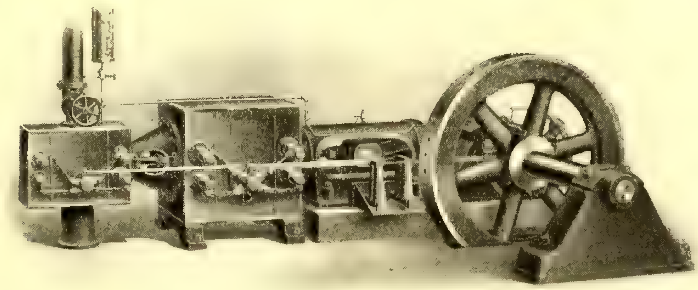
Henry R. Cornelius, 832 Frick Building, Pittsburgh, Pa.

Brown, Spear & Co., San Francisco, Cal.

Southern Car Manufacturing & Supply Co., Beaumont, Texas

AUTOMATIC CUT-OFF STEAM ENGINES

All Sizes and Types. Especially Designed for Railway and Lighting Service



Some Important Advantages

Unexcelled economy, obtained by minimum clearance spaces and correct distribution of steam. Moderately high rotative speed. Superb regulation.

A cut-off valve gear giving rapid cut-offs and wide opening of ports at all points from zero to three-quarter stroke. Simplicity and silence in operation.

Special adaptation to driving direct connected dynamos.

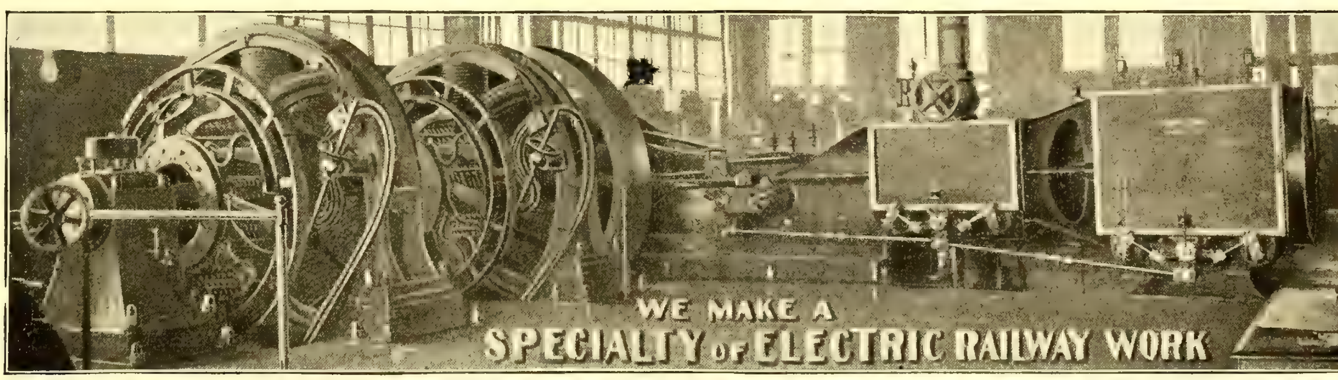
CATALOGUE ON APPLICATION

THE BALL & WOOD COMPANY

Whitehall Bldg., 17 Battery Place, New York

1247 Marquette Bldg., Chicago — 97 Queen Victoria Street, London

THE RUSSELL ENGINE CO., Massillon, Ohio, U. S. A.



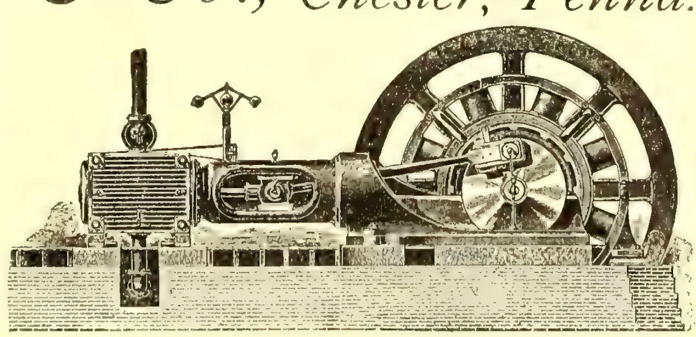
Simple and Compound. **BUILDERS OF ENGINES OF THE SINGLE AND FOUR VALVE PATTERNS.** Belted and Direct Connected.

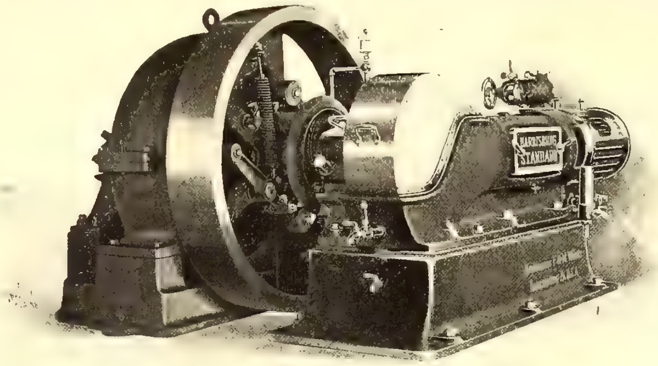
Robt. Wetherill & Co., *Office and Works,* *Chester, Penna.*

Electric Railway Power Plants...

Power Machinery,

Corliss ENGINES. — *Berry Safety* BOILERS.





SIMPLE STYLE DIRECT CONNECTED ENGINE.

Fleming Harrisburg Engines

BUILT 16 STYLES. 900 SIZES.

For driving Direct Connected or Belted Machinery at uniform speeds, high efficiency and with minimum attention and repair. Offered to discriminating purchasers who seek careful investment in steam power.

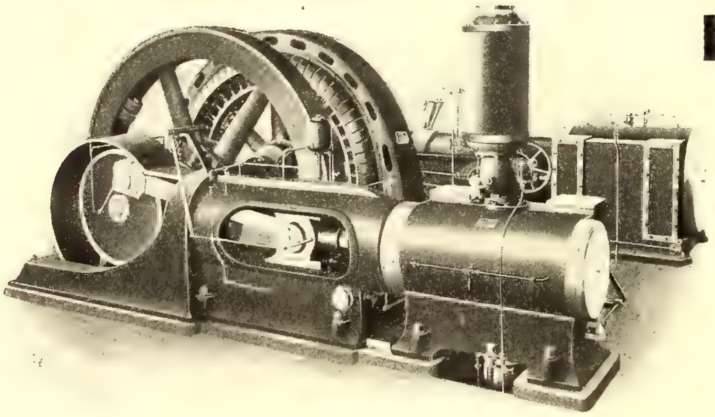
GENERAL OFFICES AND FACTORY:

HARRISBURG FOUNDRY and MACHINE WORKS

HARRISBURG, PA.

BRANCH OFFICES:

BOSTON, PITTSBURG, NEW ORLEANS, DENVER, NEW YORK, BALTIMORE, CHICAGO, SALT LAKE CITY, PHILADELPHIA, ATLANTA ST. LOUIS, SAN FRANCISCO, LOS ANGELES, SEATTLE.



Heavy Duty Engines for Street Railway Service

Modern in every detail. Regulation Unsurpassed.

Built in all sizes and styles.

Operating Economy the highest and **Guaranteed.**

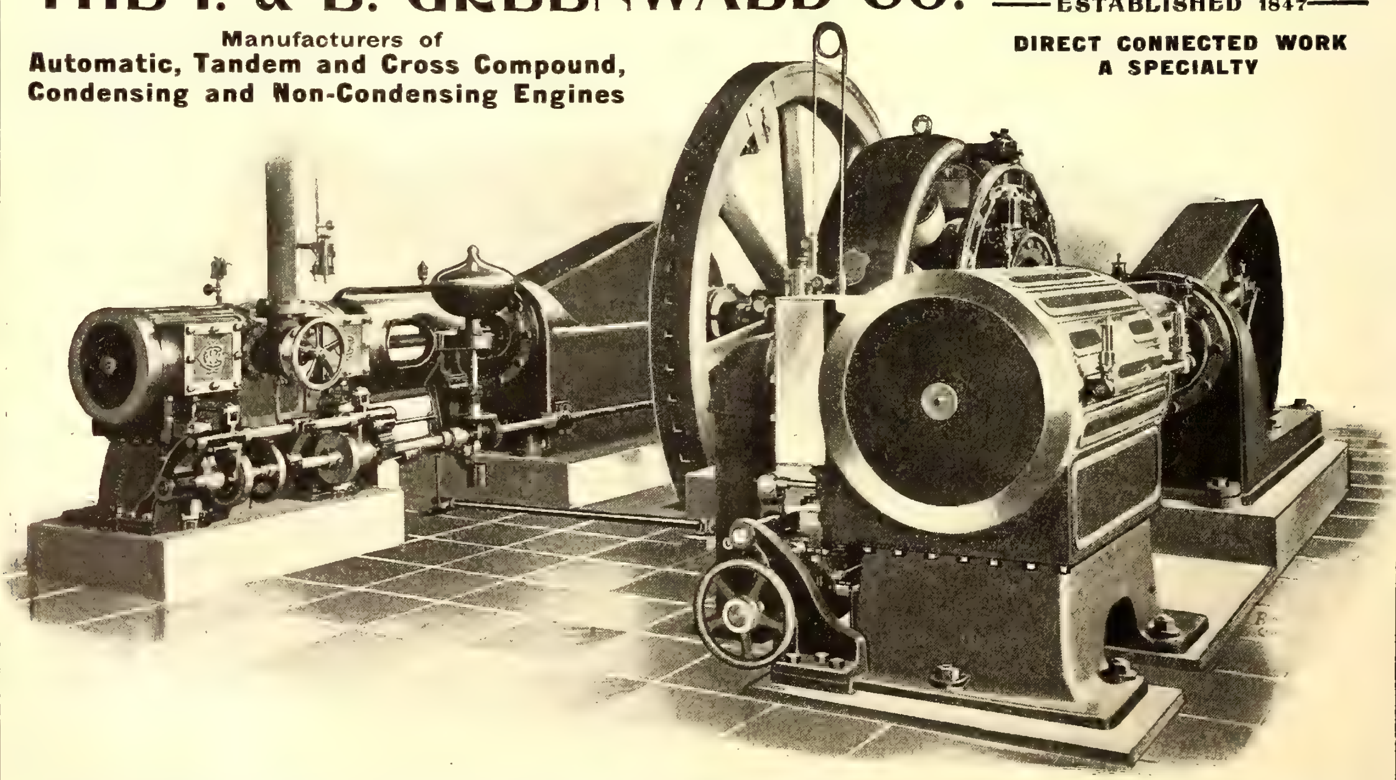
THE IRONTON ENGINE CO.
IRONTON, OHIO

THE I. & E. GREENWALD CO.

CINCINNATI, OHIO, U. S. A.
ESTABLISHED 1847

Manufacturers of
Automatic, Tandem and Cross Compound, Condensing and Non-Condensing Engines

DIRECT CONNECTED WORK A SPECIALTY



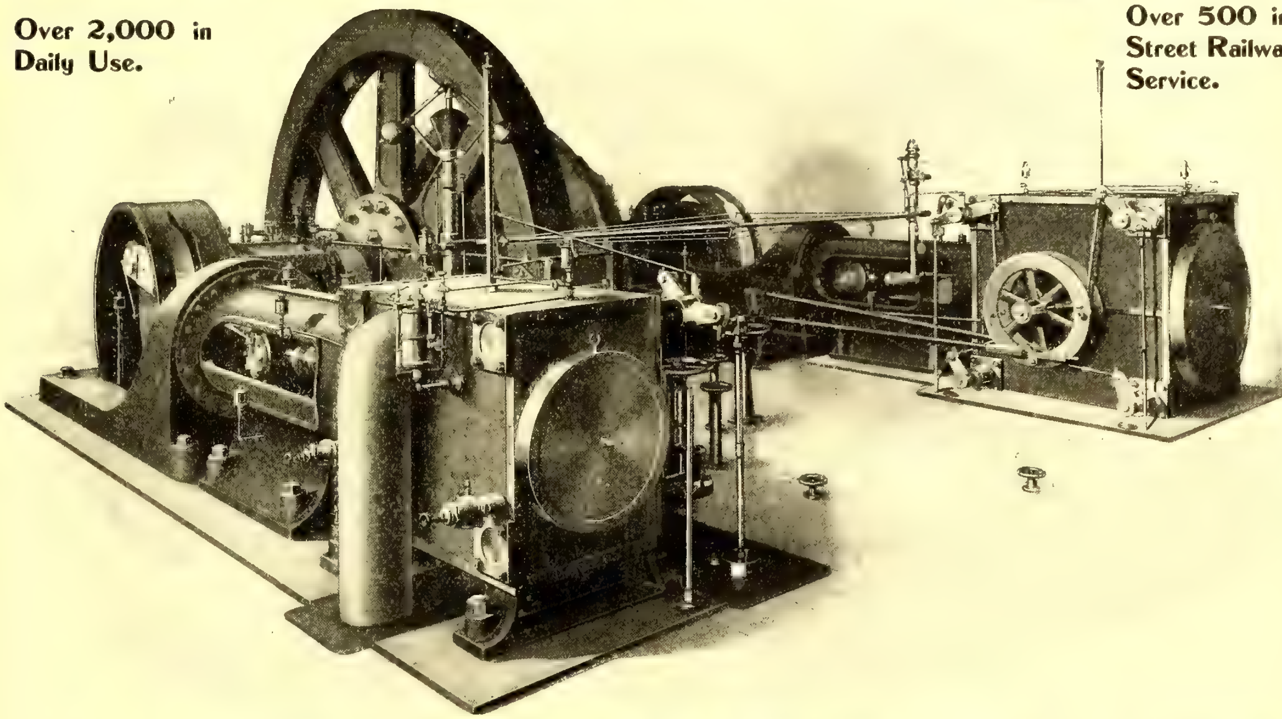
THE type of engine above shown was designed to meet the demands for an engine adapted to the severe service of electric street railway and rolling mill work. The design is a distinct departure from anything heretofore produced, and will commend itself to all users of steam engines where high economy and close regulation are required. The type of bed plate is believed to be of the best design up to date, giving perfect support to the main journal and entirely eliminating all strain so common to other types of engines. The parts have all been strengthened and enlarged, and iron distributed throughout the engine where it will do the most good, thereby preventing vibrating and springing so often found in engines when working under high steam pressure. The journals, wrist pins and all reciprocating parts are of ample size, and the engine is constructed throughout to work continuously under a steam pressure of 165 pounds. The engine will stand the closest investigation, and we can recommend them to anyone desiring a high class engine.

We build these engines in direct connected units for electric service, also direct connected to centrifugal pumps for irrigation purposes. We build simple, tandem or cross compound, condensing or non-condensing engines. *Write for prices and catalogue.*

Hamilton Corliss Engines

Over 2,000 in Daily Use.

Over 500 in Street Railway Service.



The Hooven, Owens, Rentschler Co. Hamilton Ohio

FOR QUICK DELIVERY

Three Engines,	- 50 H. P.,	Delivery, 2 Weeks	
Three Engines,	- 100 H. P.,	Delivery, 3 Weeks	
Three Engines,	- 150 H. P.,	Delivery, 4 Weeks	
One Tandem Compound,	250 H. P.,	Delivery, 2 Weeks	

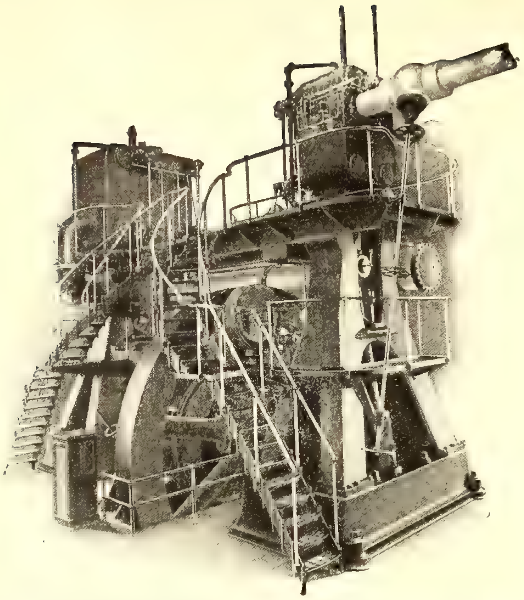
These engines are all enclosed, self-oiling, right hand and belted. Can be furnished direct connected. The simple engines are center crank; the compound side crank.

We also have a 75 H. P. tandem compound non-condensing, second-hand belted engine, of our own make, in good running order.

Also a 20½ x 18 simple engine, designed to operate under 130 lbs. initial steam pressure, and develop 400 H. P. Prices furnished on application.

PHOENIX IRON WORKS CO.

MEADVILLE, PA.

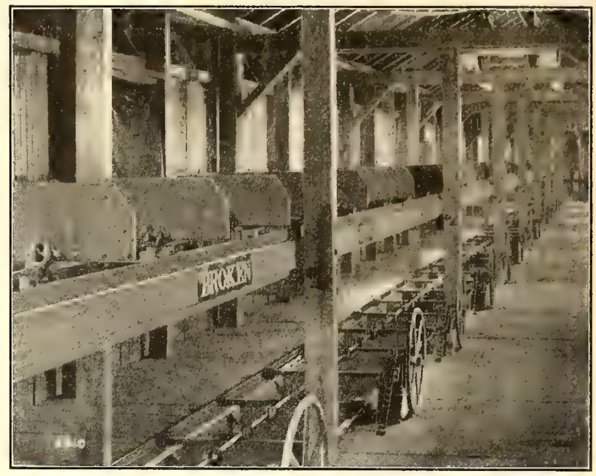


RICE & SARGENT AND IMPROVED GREENE **ENGINES**

LEAD in results obtained on railway and electric light work.
EXCEL in the operation of direct and alternating current generators in parallel.
GUARANTEE unequalled speed regulation for textile and other plants. Revolutions from 80 to 150 per minute.

PROVIDENCE ENGINEERING WORKS
PROVIDENCE, R. I.

American Licensees for Schmidt System of Superheated Steam. Great Economies Guaranteed.



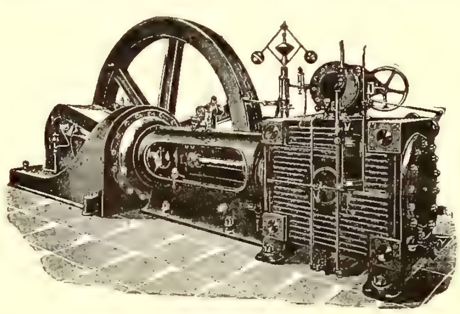
MONOBAR COAL CONVEYOR—part of 3000-ton Wholesale Storage Pocket, designed and equipped for Baltimore Storage & Distributing Co., Baltimore, Md.

LINK-BELT ELEVATORS, CONVEYORS
FOR COAL HANDLING

SOME DETAILS
of successful Link-Belt installations may help you to a quicker, cheaper, more efficient method. Give us a hint of your requirements—we'll gladly send some of our recent literature.

Link-Belt Engineering Co.
NICETOWN, PHILA.
New York, 49 Dey St. Pittsburg, Park Bldg. Chicago, Link-Belt Machinery Co,

ST. LOUIS CORLISS ENGINE



Special Heavy Duty Engines for Electric Railways, Rolling Mills, etc.
For Direct Connecting or Belting, Simple or Compound
COMPLETE PLANTS DESIGNED, BUILT AND INSTALLED
Builders
St. Louis Iron and Machine Works, St. Louis, Mo.

EASTERN AND FOREIGN SALES REPRESENTATIVE;
G. F. Tremain
135 BROADWAY, NEW YORK

Monthly List of Engineering Books

McGRAW PUBLISHING CO.
Publishers, Importers and Booksellers
114 Liberty Street, New York

FOR the information of buyers of engineering books, we publish a monthly list of all new books in all branches of engineering, which appear during the previous month. We will send this regularly to any book-buyer upon receipt of his request to that effect.

Our first number of this Monthly List is now ready for distribution. It includes nearly 400 titles of engineering books published from January 1st to October 1st, 1903. Send for it.

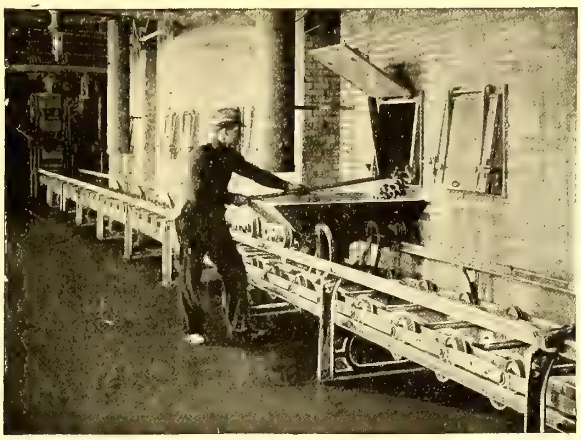
AULTMAN

Handling and Transporting Material--Cheaply.

THAT is the problem which confronts many producers today. For handling and transporting material in any form economically, our appliances are particularly applicable. Especially so, where large quantities are handled: as in a boiler room for example.

We work out problems—gratis: for engineers and prospective customers, submitting designs and estimate for approval.

The Aultman Company, Canton, O.
Eastern Office—PHILADELPHIA, PA.



JOHN A. MEAD & CO.

11 Broadway, New York City

COAL HANDLING MACHINERY

We have equipped some of the largest Electric Railway Power Stations in the world with McCaslin Conveyors, Crushers and Automatic Shovels, including the stations of

Metropolitan Street Railway Co., N. Y.
Northwestern Elevated, Chicago.
Milwaukee Elec. Ry. & Light Co.
Manhattan Elevated R. R., N. Y.
St. Louis Transit Co. (3 Stations).
Chicago City Railway Co.
South Side Elevated, Chicago.
Omaha & Council Bluffs Ry.
Old Colony Street Ry. Co.
Metropolitan W. Side Elev., Chicago.
B'klyn H'ghts R.R. Co. (Kent Av. Sta.)
Union Traction Co. of Indiana.
Toledo Traction Co.
Denver Tramways Co.
St. Louis & Suburban Ry.
Twin City Rapid Transit Co.
Metropolitan St. Ry. Co., Kansas City.
Undergr'nd Elec. Rys. Co., Lon., Eng.

BROWNHOIST CRANES ANY TYPE

THE BROWN HOISTING MACHINERY COMPANY

NEW YORK CLEVELAND PITTSBURG

Shall we send you a copy of our

Classified Catalogue of Engineering Books?

McGRAW PUBLISHING COMPANY,
Book Department. 114 Liberty St., New York.

JEFFREY

Elevating, Conveying, Power Transmission, Screening, Crushing, Dredging, Coal Cutting, Hauling, Drilling, Washing Machinery.

The Jeffrey Mfg. Co.,

Send for Catalogues. New York, Denver. COLUMBUS, OHIO, U. S. A.

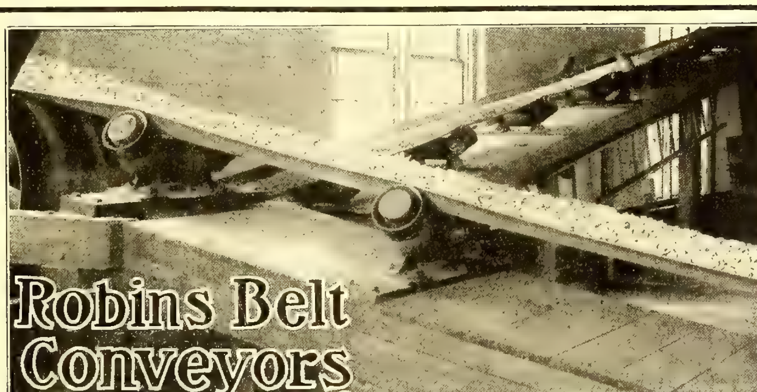
Electric and Hand Traveling

High Grade CRANES for Power Stations a Specialty

CRANES

Catalog free on request

Northern Engineering Works, 14 CHENE STREET, DETROIT, MICH.



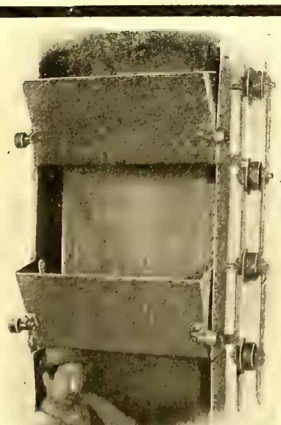
ROBINS CONVEYING BELT CO., 17-21 PARK ROW NEW YORK

Do you want a book on any Engineering Subject?

WE CAN FURNISH IT.

McGraw Publishing Co.

BOOK DEPARTMENT,
114 Liberty Street, New York.



COAL AND ASH HANDLING EQUIPMENT FOR POWER STATIONS

SEND SKETCH OF THE AVAILABLE SPACE, WITH THE CAPACITY REQUIRED, FOR DESIGN AND ESTIMATE. . . . .

Steel Cable Engineering Company

Manufacturers of Conveying and Elevating Machinery, Etc.

General Office and Works, BOSTON, MASS.

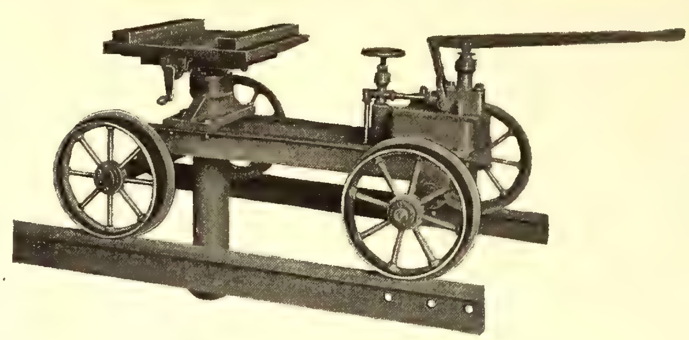
NEW YORK, 120 Liberty St. CHICAGO, 1233 Monadnock Building

The "Cleveland" Motor Lift.

CAPACITY, THREE TONS.

Has a revolving table with side adjustment. Built for any gauge.

THE PRICE IS RIGHT.



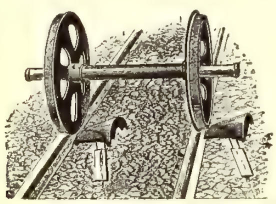
A Hydraulic Pit Jack used by many prominent roads. Easy to operate. Never known to break or get out of order.

For further description address

City Machine Co.

25-31 MICHIGAN ST.,

CLEVELAND, OHIO.



DON'T WORRY ABOUT DERAILED CARS

Use Tilden Replacing Frogs and your troubles will cease

In use on over 350 street railways.

B. E. TILDEN CO.

634 Manhattan Bldg. CHICAGO, ILL.

AMERICAN STREET RAILWAY INVESTMENTS

"The Street Railway Red Book." . .

The Standard Manual of Street Railway Statistics. . . . . .

PRICE, $5.00.

STREET RAILWAY PUBLISHING CO.,

114 LIBERTY STREET, NEW YORK.

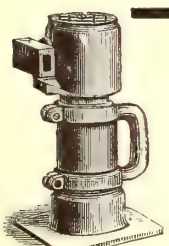
BARRETT JACKS

ARE THE **STANDARD**

Jacks for railway purposes. They are Easily and Quickly Operated, Durable, Powerful, Efficient for car, car barn and construction work. They are indispensable and save time, labor and money.

THE DUFF MFG. CO.

WORKS: ALLEGHENY, PA. OFFICE; PITTSBURG, PA.



We build Hydraulic Jacks that are reliable and that will give service under most exacting conditions, but they are not the only Hydrostatic Tools we make.

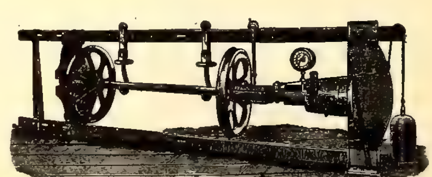
Our line shows Pumps, Presses, Valves, Street Car Motor Lifts, Car Wheel Presses, Web Punches and many special tools for the railway field.

SEND FOR ILLUSTRATED INDEX NO. 65.

WATSON-STILLMAN CO.

453 The Rookery, Chicago

203 E. 43d Street, New York



CIRCUIT COURT OF THE UNITED STATES.

FOR THE DISTRICT OF INDIANA.

THE CONSOLIDATED CAR FENDER CO., Plaintiff
VS.
TERRE HAUTE ELECTRIC COMPANY, Defendant

THE PRESIDENT OF THE UNITED STATES OF AMERICA
TO
TERRE HAUTE ELECTRIC COMPANY, Defendant, its Officers, Clerks, Attorneys, Agents, Servants and Workmen and each and every of them.

GREETING :

WHEREAS, it has been represented to us in our Circuit Court of the United States, for the District of Indiana, on the part of the complainant herein that letters patent of the United States, No. 502959 were issued in due form of law on the eighth day of August, 1893, to Millard F. Field, for improvements in Car Fenders, and that Letters Patent of the United States No. 574833 were issued in due form of law on the fifth day of January, 1897, to the Consolidated Car Fender Company, for Improvements in Life-Guards for Street Cars, and that the Consolidated Car Fender Company, the complainant, herein has become, and now is the proprietor of said Letters Patents, No. 502959 and No. 574833. And it being further represented to us that you, the said Terre Haute Electric Company, the said defendent, have infringed upon said Letters Patents, No. 502959 and No. 574833, by making, using, and vending to others to be used, Car Fenders containing, using and employing the above mentioned improvements, or substantial and material parts thereof without right or license and which are an infringement upon said Letters Patents, No. 502959 and No. 574833, and that your actions and doings are contrary to equity and good conscience.

WE, THEREFORE, in consideration of the premises, and the same appearing to us to be true, do strictly and fully command and perpetually enjoin you, the said Terre Haute Electric Company, the defendant, and your officers, servants, agents, attorneys, workmen and clerks, that each and every of you do henceforth entirely and perpetually desist and refrain from directly or indirectly making, constructing, using, vending, delivering, working or putting into practice, operation or use, or in any wise counterfeiting or imitating the said inventions, and improvements, or any part thereof, or any car fenders, containing, using or employing said inventions or improvements, or any part thereof, or made in accordance therewith, or like or similar to those which you have heretofore made, used, or sold, or cause to be made, used or sold, in infringement of said Letters Patents, No. 502959 and No. 574833 or the rights of the complainant under the same.

Witness the Honorable MELVILLE W. FULLER, Chief Justice of the Supreme Court of the United States, at the City of Indianapolis, in the District of Indiana, this 4th day of December, 1903.

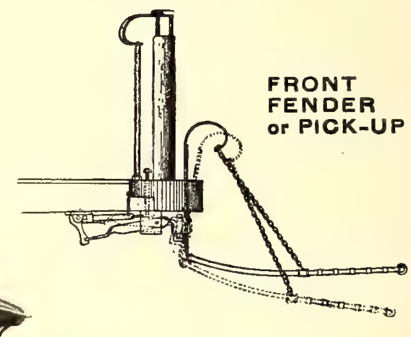
NOBLE C. BUTLER
Clerk of the Circuit Court of the
United States for the
District of Indiana.

The Life Saving Devices Which Have Never Been Known To Fail

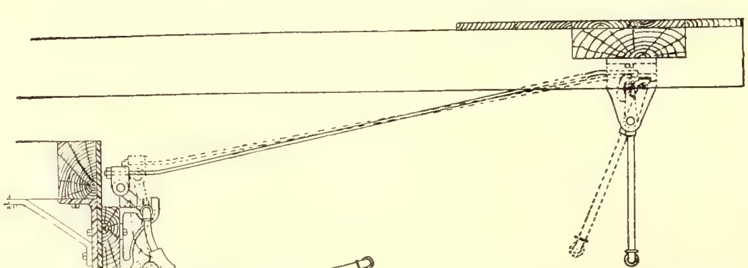
PARMENTER

FENDERS AND WHEEL GUARDS

The Fender can be dropped to the roadbed at the will of the motorman either by foot or knee as desired; readily folded or transferred from one end of the car to the other built of best material; light, effective and durable . . . .



FRONT FENDER or PICK-UP



WHEEL GUARD

The Wheel Guard is entirely automatic and can be used in connection with Fenders or independently; easily adjusted; built of best material . . . .

A full investigation of both Fender and Wheel Guard solicited

PARMENTER FENDER & WHEEL GUARD COMPANY

Successors to GEO. A. PARMENTER

409 INDIA BLDG.
84 STATE STREET
BOSTON, MASS.

13

Thirteen human lives saved in six months on one Street Railway System by the Eclipse Life Guards.—An unlucky number, did you say? Yes, for other fender devices, but lucky for us, and more than lucky for the 13 whose lives were saved—and don't you think it was

Lucky for the Railway Company?

Do you read the Fender advertisements?

It will pay you to read on the next page.

There is more between the lines than there is in the words.

THE ECLIPSE CAR FENDER COMPANY

Manufacturers of the

ECLIPSE LIFE-GUARD

Cleveland, O.

The Brooklyn Rapid Transit Company have adopted the Eclipse Life Guards, and are having them placed on their new cars being built by the Kuhlman Co., at Cleveland, O.

RESULTS—

ARE WHAT YOU WANT

What do you put any fender device on the front end of cars for? To pick up the unwary pedestrians? To save the front end of your car from collisions with vehicles, or to comply with the law?

The **ECLIPSE LIFE-GUARD** does all of these and more. It is strong and durable and will stand more hard knocks than any other device made for similar purpose, but what is

MORE TO THE POINT

it will pick up uninjured every time the unwary individual who may have been careless enough to get in front of any car so equipped, no matter what speed the car is going up to 20 miles an hour. It has done this hundreds of times and never fails provided you keep your equipment in proper order, as you should do both from the standpoint of safety and economy.

OUR LONG SUIT IS RESULTS

for the Railway Company in saving both life and limb, and thereby saving dollars for the company in eliminating damage suits.

OUR SHORT SUIT

is in working legislation in our behalf. We were never in politics, and therefore have to depend upon the merits of our device to get your business.

WE WANT YOUR BUSINESS

but we are not going to spend our good money to pay any one to try to force you into line.

THE SUPERINTENDENT

of one of the largest Street Railway systems in the United States said to our President several months ago: "When the Street Railway men throughout the country really get to know what your Life-guard will do, you will have more orders than you can fill." That prediction has already commenced to be verified, and we are hardly seven months old.

IT IS A MATTER OF EDUCATION

You will learn of it through some other source than our advertising and then you will want to try our Life-guard. One Railway Manager writes for descriptive catalogue, saying: "Judging from what I hear, your Life-guard will pick up anything from a poodle dog to an elephant without injury."

STRANGE AS IT MAY SEEM

this is almost literally true, as we have picked up not only children and men and women, but dogs and horses and cows without injury, and

IF A BEAR

happened to be on the track it would not be knocked twenty feet but would be picked up safely without putting either the Life-guard or the bear out of commission. We know of no other device that will do this if all we read about is true.

AS AN UP-TO-DATE RAILWAY MANAGER

you cannot afford to be ignorant of the merits of the Eclipse Life-guard any longer

Don't Accept Our Testimony

but write us for further information, and we will refer you to a score of the best known railway officials in the country who have tried our Life-guard and will verify all we claim for it.

We are now making up a special Life-guard adapted for interurban cars.

ECLIPSE CAR FENDER COMPANY

Manufacturers of the Eclipse Life-guard

267 St. Clair Street **Cleveland, Ohio**

1904

WILL GIVE YOU OUR NEW COMPLETE CATALOG

While waiting for it, start the year right by ordering

INTERNATIONAL and NEW HAVEN REGISTERS and FITTINGS
NEW HAVEN TROLLEY and BELL CORD
INTERNATIONAL PUNCHES
HEEREN BADGES
and Miscellaneous Railway Supplies

We have at present in stock some 4-inch New Haven Sleet Trolley Wheels which we will sell until closed, at 50c. each

The International Register Co.

124 WEST JACKSON BOULEVARD, CHICAGO, ILL.

A Good Investment

"BULL" MOVEMENT IN "SECURITIES"

..A Few of the Reasons

Security Register Co.
Enter order for 11 additional Double Self Recording Registers.
NEW JERSEY & PENNA. TR

Security Register Co.
Please send us at earliest possible date: 1,000 Single Security Registers.
ST. LOUIS TRANSIT CO.

Security Register Co.
Please enter our order for 161 Numeral Registers.
BOSTON ELEVATED RAILWAY CO.

Security Register Co.
Ship promptly the following: 16 Single Numeral Registers.
BLUE HILLS

...y Register Co.
Enter for prompt delivery our order for 50 Single Numeral Registers.
ST. LOUIS CAR CO.

Security Register Co.
Deliver as soon as possible: 4 ...Registers.
ST. LOUIS CAR CO.

Security Register Co.
At the earliest date possible, send us 10 Double Self Recording Registers.
...IDS & MARION CITY RY. CO.

Security Register Co.
Ship us as soon as possibl... Single Security Registers.
LOS ANGELES R...

Security Register Co.
You may enter our order for 200 Single Numeral Registers.
PITTSBURG RAILWAYS CO.

Security Register Co.
Please ship promptly: 2 Single Registers.
WINNEBAGO TRA...

...egister Co.
...lease send us: 2 Double Self Recording Registers.
IOLA ELECTRIC R.R. CO.

Security Register Co.
Enter for prompt shipment order as follows: 50 Single Numeral Registers.
AMERICAN CAR CO.

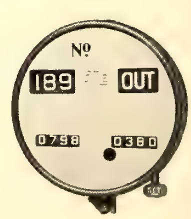
Security Register Co.
Enter for prompt shipme... 50 Double Self Recording Registe...
HOUSTON ELECTRIC CO.

...y Register Co.
...ly enter the following order ...prompt shipment: 12 Double Numeral Registers.
J. G. BRILL CO.

OUR FOREIGN FRIENDS
have ordered from us
52 Single Security Registers.

Largely Improved Facilities Insure the Deliveries you want

SECURITY REGISTER CO.



714 ST. CHARLES STREET, ST. LOUIS, MO.

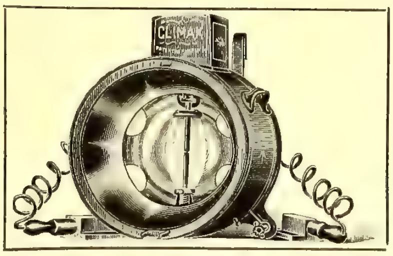
GILES S. ALLISON,

General Eastern Office, 57 Broadway, New York

WHY DO YOU USE OIL HEADLIGHTS?

Are You Satisfied With Your Arc Headlights?

The Globe Combination Headlight will overcome all defects.



Sample Headlights sent on thirty days, trial, subject to your approval.

For prices and further information write

GLOBE ELECTRIC MFG. CO.
CLEVELAND, O., U. S. A.

The Street Railway Roadbed....

By MASON D. PRATT .....and C. A. ALDEN

An essential feature of a well-equipped street railway is a good track, and in this book are brought together and illustrated the various modern types of track material and methods of construction, with their good and bad features indicated. The authors are engineers of the Pennsylvania Steel Company, one of the largest manufacturers of rails and "special work" in America, and are therefore particularly well equipped to treat of the subjects of which they write. All the various features of street railway roadbed construction are carefully described, with illustrations where necessary, the latter including sections of rail, of roadbed, views of special joints, diagrams, etc. Rules and tables are also given for running curves, laying out crossings, turnouts, etc.

135 Pages, 157 Illustrations. Price, $2.00.

—PUBLISHED BY THE—

McGraw Publishing Company, BOOK DEPARTMENT, 114 Liberty Street, New York

---

SAVE TIME AND MONEY BY USING THE

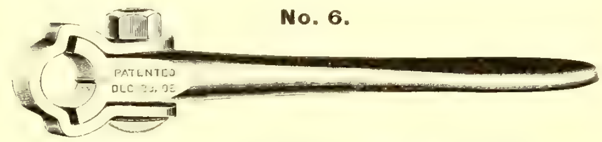
Never Slip Detachable Register Rod Handles

On the new cars you are going to have built and put them in stock to replace the old set-screw handles, when they work loose.

Do you realize what a powerful grip this handle has?

Made in any shape to suit you.

No. 6.

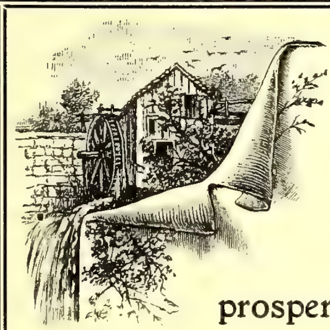


DO YOU NOTICE THE KEY?

The International Register Co., and Sterling-Meaker Co., furnish them with their registers if you only say so.

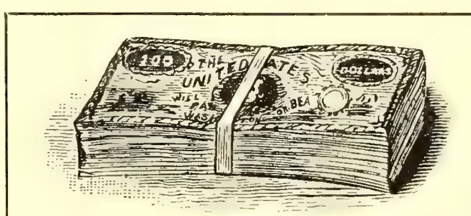
SEND FOR SAMPLE AND SEE FOR YOURSELF

C. O. OBERG & CO., Sole Manufacturers
OFFICE AND FACTORY
102 Pearl Street BOSTON, MASS.



THE old year is gone, and, like the water that turns the old mill wheel and has run on to the sea, it will never return with its many opportunities, but a new, and, we trust, a better year has dawned with more opportunities, and we hope that it will bring increased prosperity to all.

We insure to every street and interurban railway company, adopting the Ohmer Fare Register and System, increased receipts. Our machines print complete records of all the various fare collections at the time the fares are paid by passengers, thus preventing forgetfulness and carelessness, and providing for a strictly just and honest accounting. The registers themselves, and the dials throughout the cars, give visible receipts for all money, tickets, transfers, and other mediums of exchange received by conductors.

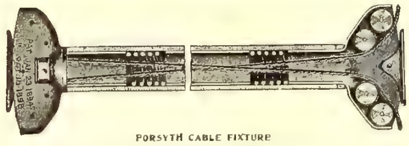


We will equip the cars you run, regularly, at our own expense.

Write to us for catalog, our system, and other information.

Ohmer Fare Register Co., Dayton, Ohio, U. S. A.

CAR CURTAINS OF ALL KINDS

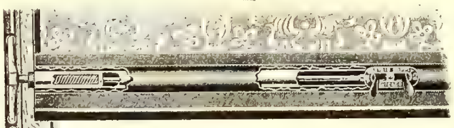


FORSYTH CABLE FIXTURE

No breaking or fraying of cables. Spring-pressed shoes hold curtain. Adapted for convertible or open cars. Can't bind or stick in grooves.

THE CURTAIN SUPPLY CO.

CHICAGO 85-93 OHIO ST. NEW YORK 2131 PARK ROW B'LD'G



FORSYTH No 86 ROLLER TIP FIXTURE.

New adjustment, simple and automatic. Fewer parts. Impossible to lose tips or handles. Won't creep up. Curtain securely held. Self-righting and remains in grooves.

OWNERS FOUNDATION CURTAIN FIXTURE PATENTS

WALKOVER
TRADE MARK
CAR SEAT

Gives more room, more comfort, and more money value, than any other seat made.

98-A
IN RATTAN

Notice its superior construction and substantial appearance. Specify our product for your new Electric Cars.

The Hale & Kilburn Mfg. Co.

PHILADELPHIA, PA.

No 42 C.

HEYWOOD BROTHERS AND WAKEFIELD CO.

WAKEFIELD, MASS.

"The best is the cheapest in the long run"

The Distinguishing Characteristics of our Car Seats are

First—The smoothest operating and most simple mechanism on the market, of both the slideover and turnover types.

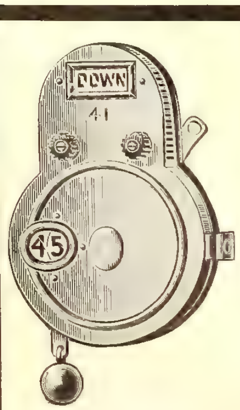
Second—Steel top spring construction, and upholstery of a high order, which is second to none on the market.

Third—Pedestal base, adjustable footrest, grab handle, and all other desirable features which go to make up a first class modern car seat.

Fourth—Comfort, durability and general satisfaction as a result of the above.

The fact that the largest, best equipped and most successful roads are using our seats is the most conclusive confirmation of the above statements

No. 97 B.



MODEL REGISTER

RAILWAY REGISTER MFG. CO.

SOLE MANUFACTURERS OF

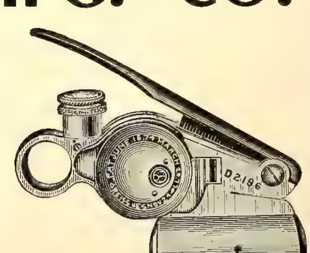
THE ALARM REGISTERING PUNCH
MODEL AND OTHER FARE REGISTERS

For further particulars, prices, catalogues, etc., address all communications to

EDWARD BEADLE, Mgr.

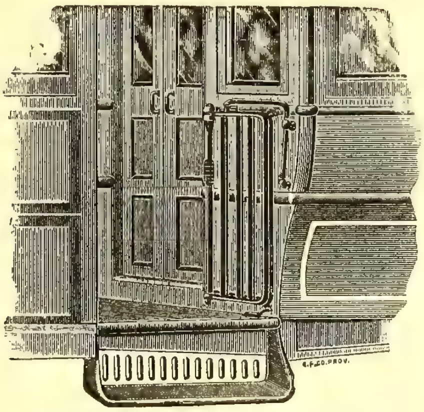
1193 Broadway, N. Y., U. S. A.

Special attention paid to Export Orders



ALARM REGISTERING PUNCH

Specially adapted for any number of rates of fare



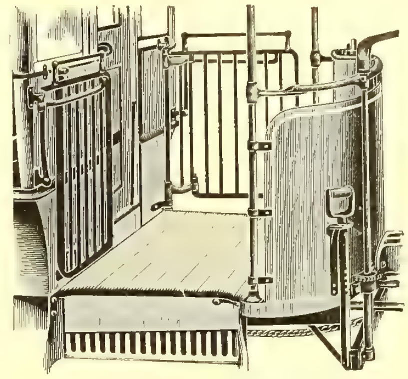
Folding Gate for Double-Door Cars

SPECIFY
Wood's Gates

FOR ALL NEW CARS AND PROTECT YOUR PATRONS BY EQUIPPING YOUR OLD CARS . . . .

15,000 CARS EQUIPPED
SEND FOR PRICES

The R. Bliss M'f'g Co.
PAWTUCKET, RHODE ISLAND



Standard Gate for Single-Door Cars

YOU NEED THE
UNIVERSAL SAFETY TREAD
ON YOUR CAR STEPS, PLATFORMS AND FLOORS

Clean, Safe, Durable. Outwears all other forms of Tread.
SAMPLES AND PRICE LIST FURNISHED.
UNIVERSAL SAFETY TREAD CO.,
45 BROADWAY, NEW YORK, N. Y.

THE SIMPLEX ELECTRIC HEATING CO.,
MANUFACTURERS,
Under the patents of the American Electric Heating Corporation, of
ENAMEL CAR HEATERS AND COIL SPRING CAR HEATERS.
A Variety of Designs to Meet All Requirements. Send for Catalogue.
The Simplex Electric Heating Co.,
Chicago Office: Monadnock Block. Cambridgeport, Mass.

COTTON DUCK
and CURTAIN STRIPES
JOHN BOYLE & CO.
199-207 Fulton St., New York and 7th St. and Lucas Ave., St. Louis
Samples and Prices on Application.

Practical Electric Railway Hand Book

BY ALBERT B. HERRICK

Handsomely bound for the pocket, with flap. 450 pages. Numerous illustrations.

CONTENTS

Section I.—General Tables. Section II.—Testing. Section III.—The Track. Section IV.—The Station. Section V.—The Line. Section VI.—The Car House. Section VII.—The Repair Shop. Section VIII.—The Equipment. Section IX.—The Operation. Appendices: I.—Storage Batteries. II.—Conduit Systems.

Price, $3.00 Postpaid

IN compiling this manual, the pertinence of the material selected to the subject in hand has been carefully considered, and all matter not of vital importance has been excluded. It has thus been possible to produce a book which can be conveniently carried about, and yet, which will give to the street railway engineer an immense amount of valuable data, consisting of engineering facts, figures and dimensions, and showing appliances, structures and methods which have been adopted in practice by the electric railways of the United States. The section on testing will be found of particular value, many of the methods being new. One appendix treats of the storage battery in its power house applications; another contains details of underground conduit systems.

Published by the McGRAW PUBLISHING CO., Book Dept.

114 LIBERTY STREET, NEW YORK

GOLD CAR HEATING AND LIGHTING COMPANY

BRANCH OFFICE:
ROOKERY CHICAGO ILL.

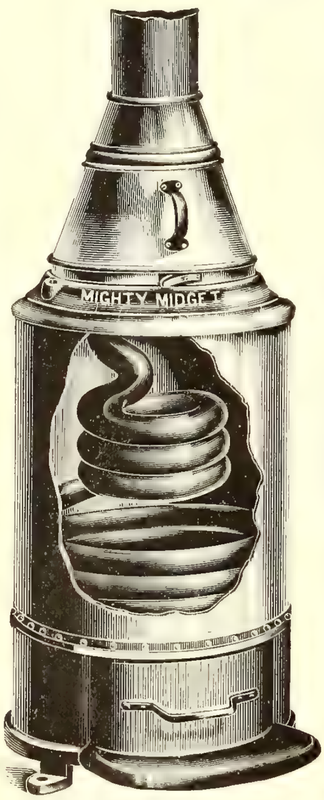
MAIN OFFICE
FRANKFORT AND CLIFF STREETS,
NEW YORK.

CATALOGUES AND CIRCULARS
CHEERFULLY FURNISHED.

MANUFACTURERS OF ELECTRIC, STEAM AND HOT WATER HEATING APPARATUS FOR RAILWAY CARS.

BAKER HOT WATER HEATERS

FOR ELECTRIC CARS



Type of Baker Heater used in large Electric Cars.

Positively Non-Freezing

Cheaper, more constant, satisfactory and agreeable than electricity. Simple but perfect in operation.

They have been tested to keep car perfectly comfortable with temperature 50° below zero. Not being overcrowded with too much pipe in the coil, circulation is perfect. Great saving in coal.

Special pipe and fittings for Baker Heaters.

In Use on

Cincinnati Traction Company
Detroit, Ypsilanti, Ann Arbor & Jackson Ry.
Rapid Railway System.
Erie Traction Company
Hudson Valley Railroad
Lake Shore Electric Railway
Milwaukee Electric Railway & Light Company
Michigan Traction Company
Muncie, Hartford & Fort Wayne Railway
Oneonta, Cooperstown & Richfield Springs Ry.
Sheboygan Light, Power & Railway Co.
Twin City Rapid Transit Company
Union Traction Company of Indiana
Waterloo & Cedar Falls Rapid Transit Company
Winnebago Traction Company

WILLIAM C. BAKER
143 Liberty St., New York, U.S.A.

The Peter Smith Heater

Advantages

—OF—

Hot Water System Over Electric:

Saving in First Cost of Power and Feeder Equipment, especially in long transmissions.

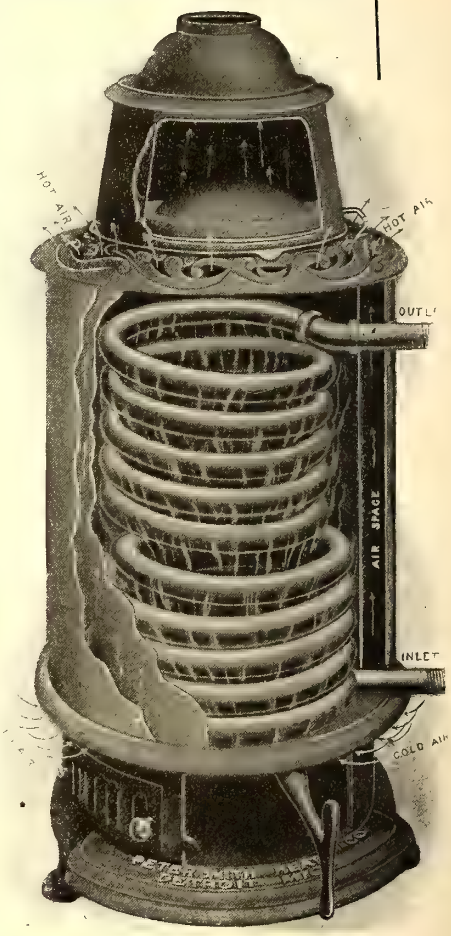
Economy in Operation

More Hygienic, Pleasant and Uniform Heat

MANUFACTURED BY

THE PETER SMITH HEATER COMPANY
DETROIT - MICH.

GENERAL SALES AGENTS
George S. Hastings & Co.
CLEVELAND, OHIO.



ELECTRIC HEATERS

Theoretically / Practically } Perfect

Sold under a FIVE YEAR guarantee

RECORD: Heating equipments after eight years service are still Efficient and Satisfactory

ADOPTED BY THE MANHATTAN RAILWAY, NEW YORK CITY

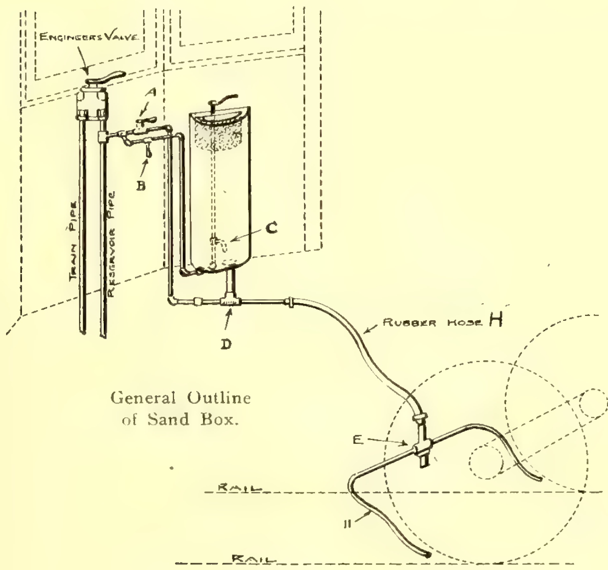
CONSOLIDATED CAR-HEATING CO., ALBANY, N. Y.

The Newark Air Sand Box Co.

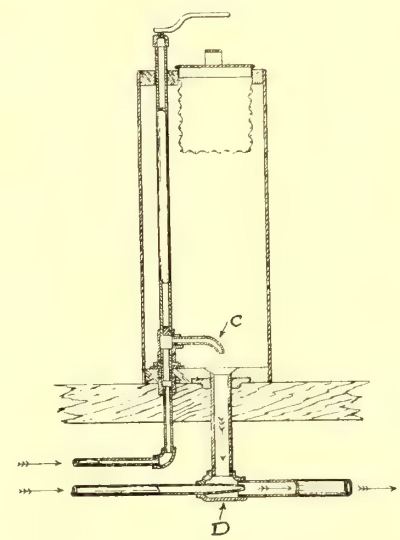
MANUFACTURERS OF

THE DE FRANCE AIR SAND BOX

FOR ALL CARS EQUIPPED WITH AIR BRAKES



General Outline of Sand Box.



Detail of Sand Box, Showing Mixer.

Another One of Our Many Testimonials

A Few of the Roads that are Using the DE FRANCE AIR SAND BOX

INDIANAPOLIS & NORTHWESTERN TRACTION CO.

CLEVELAND, PAINESVILLE & ASHTABULA RAILWAY CO.

COLUMBUS, BUCKEYE LAKE & NEWARK TRACTION CO.

COLUMBUS, NEWARK & ZANESVILLE ELECTRIC RY.

NEWARK & GRANVILLE ST. RAILWAY CO.

COLUMBUS, DELAWARE & MARION ELECTRIC RAILWAY CO.

INDIANAPOLIS, COLUMBUS & SOUTHERN TRACTION CO.

TOLEDO & INDIANA RAILWAY CO.

WASHINGTON & CANONSBURG RAILWAY CO.

THE
COLUMBUS, BUCKEYE LAKE & NEWARK
TRACTION COMPANY.

CITIZENS 233.
BELL, MAIN 142

General Manager's Office

NEWARK, O. 9/18/03.

W. B. Fingerter, Secy.,
Newark Air Sand Box Co.,
Newark, Ohio.

Dear Sir:-

In reply to your inquiry of the 16th inst. relative to your DeFrance Patent Sand Box, I am pleased to state that this Air Sander was installed on our care #50 on the Newark & Granville road, which runs between Newark and Granville. I have made inquiry from our Superintendent as to the satisfaction that it is giving, and he informs me that he is very much pleased with it in every way.

I can cheerfully recommend this Sander to street railway man, and will esteem it a privilege to furnish any further information that may be desired.

Yours truly

J. R. Harrigan

Gen. Mgr.

WRITE US TO-DAY FOR FULLER DETAILS

Newark Air Sand Box Co., Newark, Ohio, U. S. A.

THE KNUTSON TROLLEY RETRIEVER IS ABSOLUTELY AUTOMATIC

Look into all other catchers, and you will find that they require the touching of a button on machine, or some such scheme, before the locking device can be set—they are only partly automatic.

UNION TRACTION COMPANY OF INDIANA.
General Offices, Anderson, Ind.
August 1, 1903.

The Trolley Supply Co., Canton, Ohio.

Gentlemen—Yours 31st ult. We have approved the bills for the retrievers sent here for trial, and will hereafter specify "Knutson" on future orders.

Yours respectfully,
JOHN L. MATSON,
Supt. Motive Power.

The Knutson Trolley Retriever will unfailingly catch the trolley pole as it leaves the wire, pull it down four to six feet, and hold it there out of harm's way.

Fuller information in our little booklet.

TROLLEY SUPPLY CO.
CANTON, OHIO U. S. A.

THE MAYER & ENGLUND CO., Eastern Agents, Philadelphia Pa.

THIS IS THE TIME SOMEONE ELSE TELLS OUR STORY

THE OLEAN STREET RAILWAY COMPANY.
OF OLEAN, NEW YORK.

WILSON R. PAGE, President and Treasurer
J. W. MILLER, Secretary and Superintendent

Olean, N. Y. 11/20/03.

Collins, Bouchard & Emery,
Bradford, Pa.

Gentlemen:-

We have had much trouble in finding a trolley wheel that would stand our work, and have made diligent effort to obtain the best - one that would stand the wear and not be too harsh on the trolley wire.

We take pleasure in advising you that after giving your self-oiling trolley wheels a thorough trial, we find them to be the best wheels that we have ever used, and have adopted them on our road. In a test which we recently made we found that when worn out, the bushing was as good as when put on.

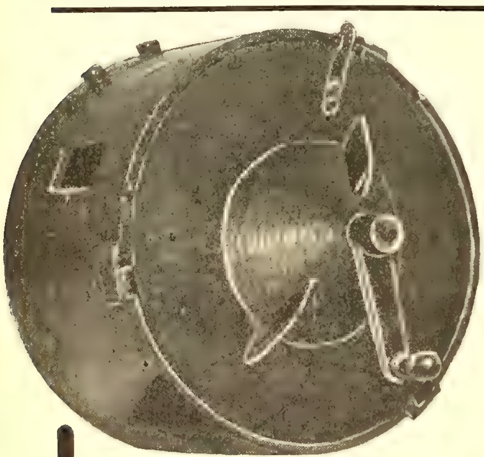
We take pleasure in recommending your trolley wheels wheels to other parties interested.

Yours,
J. W. Miller
Supt.

Need Any Trolley Wheels?

Will ship you quickly any quantity desired.

COLLINS, BOUCHARD & EMERY
41 Main Street, Bradford, Pa., U. S. A.



A Good Trolley Catcher
At an attractive price.

THE superiority of the Simplest Trolley Catcher is founded upon facts that a trial will substantiate. It is the best because simplest—simplest because it consists of only a drum with teeth on one flange, a coil spring to keep the rope taut, and a stationary hook in the case above the drum rack. Because of its fewer parts it works better and wears longer than any other catcher made.

The drum rests by its own weight in the bearings. When the cord is jerked by the trolley wheel leaving the wire the drum, instead of paying out, is lifted in this bearing, and the teeth upon its rim engage the hook above it and prevent the cord from unwinding. Only one-half inch of cord is paid out before the trolley is caught, and it is held below the span wire.

We not only will consent to sending catchers on trial—we are anxious to be permitted to do so. Get a sample machine and our prices.

JOHNSON & MORTON, UTICA, N. Y., U. S. A.

SUPPLIES FOR WINTER
EQUIPMENTS

SNOW SWEEPER RATTAN
TRACK BROOMS
TRACK CLEANERS
SAND BOXES
AIR SANDERS
BRAKE SHOES
VESTIBULE SHADES
KALAMAZOO WHEELS and HARPS
TROLLEY POLES and ROPE
TROLLEY CATCHERS
O. K. SLEET CUTTERS
MOTOR BEARINGS
GEARS and PINIONS
CARBON BRUSHES

PORTER & BERG
309 Dearborn St., CHICAGO

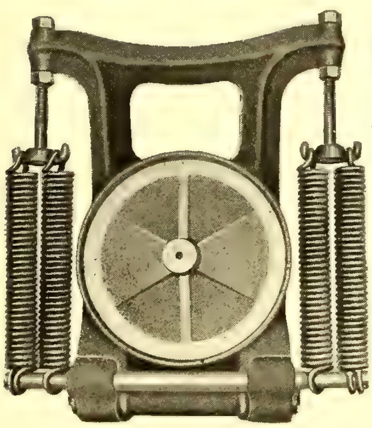
"THEY not only save poles and cord, but prevent delays." There's a man who knows what the Wilson Trolley Catcher is for.

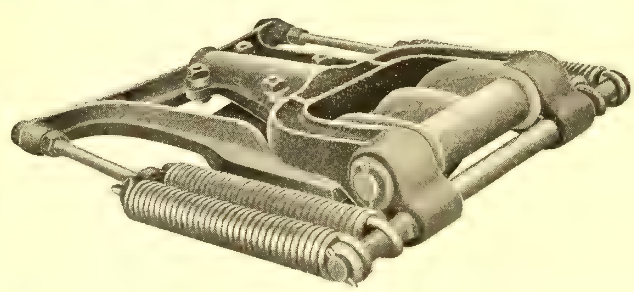
WILSON TROLLEY CATCHER CO., 200 Summer St., Boston, Mass.

THE
"Kalamazoo"
IS THE BEST
FOR ALL CITY and
SUBURBAN LINES.

INVESTIGATE
ITS
MERITS

Milloy Low Trolley Base





In the first place it is only 4 inches high, the lowest base ever made, and weighs 85 lbs.

It is uniform in tension, produces the same tension on every location of the wire.

It requires no oiling or grease of any kind.

It has no fulcrum in its bearings, no friction of any kind

It is very active on curves and switches.

It looks very neat.

It is made of malleable iron.

The standard trolley base is similar to this except that it has a dome in the center. The strength given by this dome is secured in the low trolley base by three ribs with reinforcements of metal.

The cable connection is under cover and all its fastening connections to the roof connections are under cover.

It can be adjusted to any bridge work.

It is a roller bearing base.

All the N. Y., N. H. & H. R. R. trolley cars equipped with it. Will pay for itself in a short time in the saving of current.

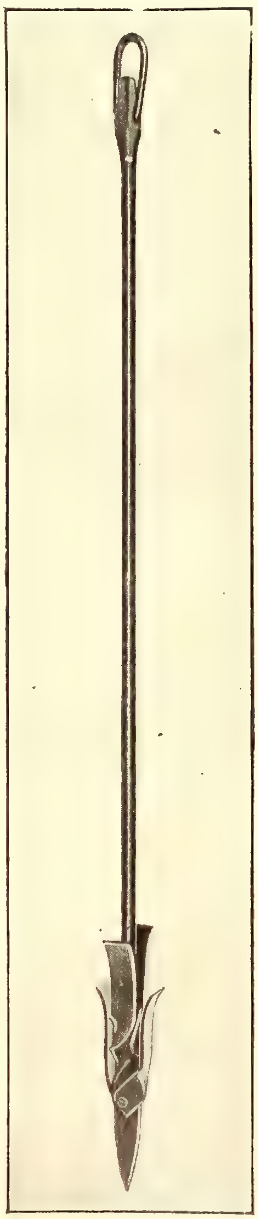
INTERNATIONAL TROLLEY CONTROLLER CO.
BUFFALO, N. Y.

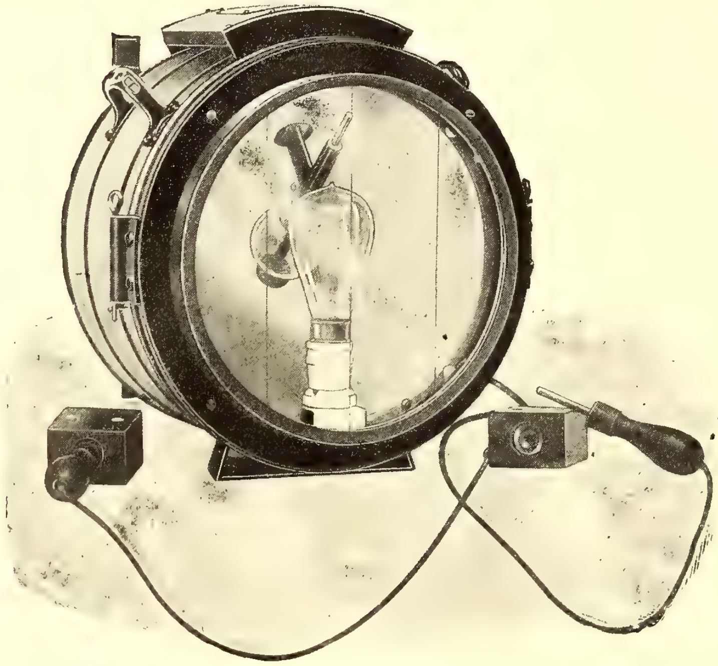
CROUSE-HINDS CO.

SYRACUSE, N. Y., U. S. A.

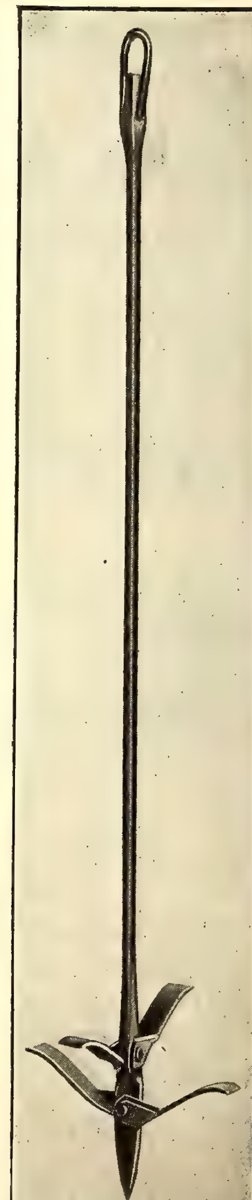
IMPERIAL-ARC-HEADLIGHT

Guy Anchor
closed ready
to install





Guy Anchor
open after
being installed



MANUFACTURERS OF

Railway Switchboards
Imperial-Arc-Headlights
Syracuse Changeable Headlight
Guy Anchors
Norbitt Specialties

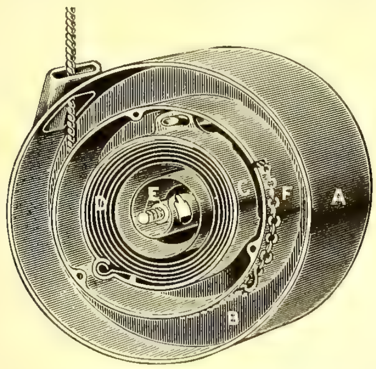
BRANCH OFFICES AND STORES

NEW YORK	23 Dey Street
BOSTON	200 Summer Street
CHICAGO	133 South Clinton Street
CINCINNATI	234 West 4th Street
SAN FRANCISCO	Mills Building

WRITE FOR BULLETINS AND PRICES

Full Stock at All Branch Stores

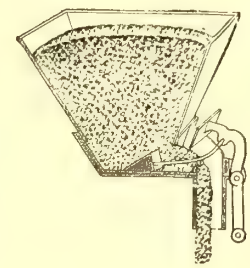
MAY WE SEND YOU ONE FOR TRIAL?



It will then cost you nothing to determine for yourself the truth or falsity of our statement that our

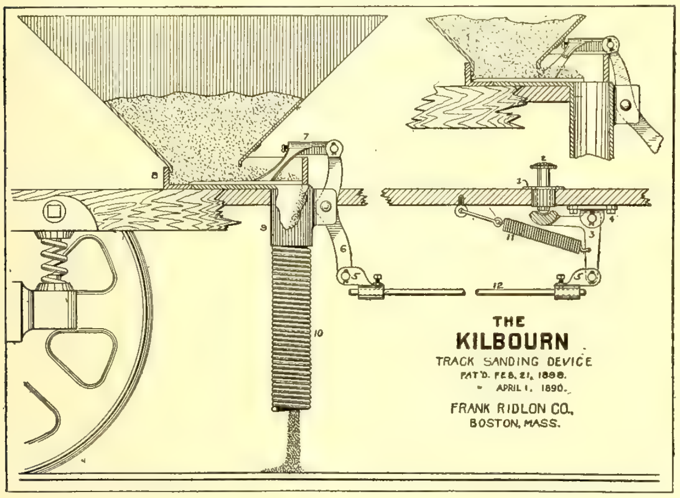
Sand Boxes and Trolley Catchers

are the most simple in construction and the most effective in service. The former has been in universal use for eight years and been adopted as standard by the leading street railways. The latter is rapidly following suit.

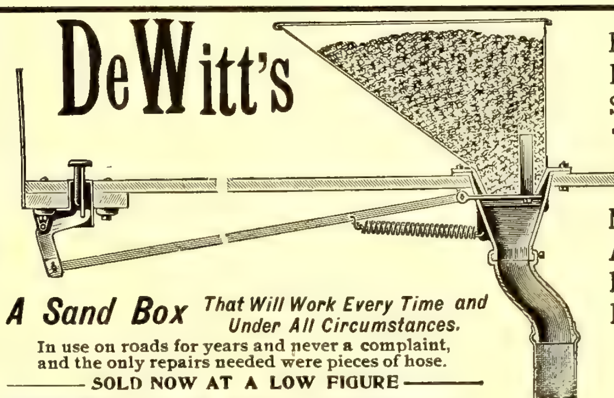


HAM SAND BOX COMPANY

TROY, N. Y., U. S. A.



DeWitt's



BEST MADE

A Sand Box *That Will Work Every Time and Under All Circumstances.*

In use on roads for years and never a complaint, and the only repairs needed were pieces of hose.

SOLD NOW AT A LOW FIGURE

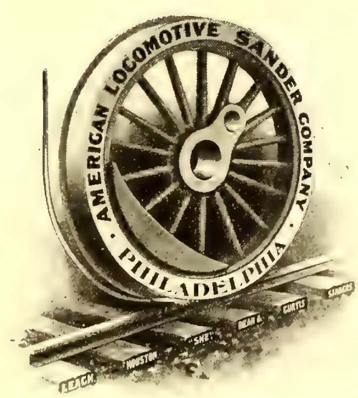
DeWitt Sand Box Company,

523-525 Fifth Ave, Troy, N. Y.

C. J. Harrington, 15 Cortlandt St., New York, Eastern Agent

Pneumatic Track Sanders

Positive
and
Economical



Full Particulars and Prices On Application

American Locomotive Sander Co.

13th and NOBLE STREETS, PHILADELPHIA, PA.

CHICAGO: - - - - - - - - 509 GREAT NORTHERN BUILDING

DAMP SAND

CAN BE

Put on the Track

BY THE USE OF THE

POSITIVE TRACK SANDER

ADDRESS....

THE

Positive Railway Sander Co.
LANCASTER, PA.

SALES AGENCIES

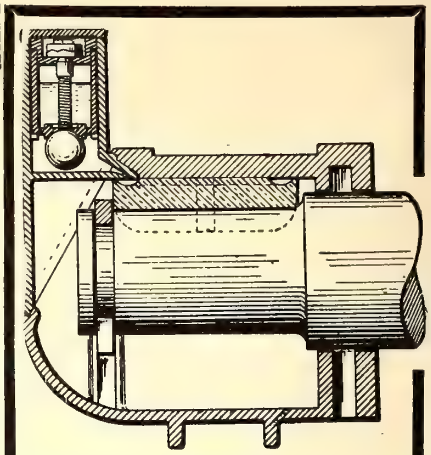
DOUBLEDAY HILL ELECTRIC CO., 919 Liberty St., Pittsburg, Pa.
H. F. SANVILLE, 710 and 711 Girard Trust Building, Philadelphia, Pa.
STANDARD RAILWAY MATERIALS CO., 406 Omaha Building, Chicago, Ill.

No Oil Wasted

No Hot Journals

Life of Bearings Increased THREE Fold

Oil Always Clean



By Our Method of Journal Lubrication

bearings have run over three years in constant service, with the lining still good. Boxes require filling once only in 60 to 90 days. Armature bearings have run over one year before requiring to be relined, thus showing perfect lubrication. No hot boxes have occurred where this system of lubrication is in operation. Defies comparison with any other mode of lubrication as to saving in cost of lubricant, bearings, axles and labor.

Standard Automatic Lubricator Co.

810 Arcade Building, Philadelphia, Pa.

Lieber's Standard Code

ENGLISH. FRENCH. SPANISH.

PRICE, $10.00.

SELECTED CODE WORDS — The Ciphers are selected from the "OFFICIAL VOCABULARY," care having been taken to omit such DANGEROUS ciphers as "cheap," "charge," "collect," "bi-monthly," "eleventh," "eighteenth," "cargo," etc., which are found in other codes.

CONTENTS — The Code contains 800 pages of 75,000 Ciphers; 65,000 have sentences, and 10,000 are blank, enabling the addition of private phrases under their proper headings.

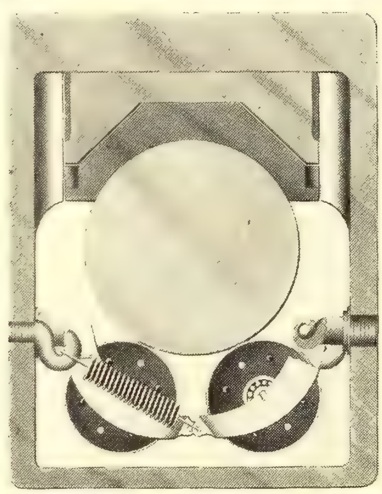
DIRECTORY OF USERS — LIEBER'S MANUAL, published every three months, contains a revised list of those using the code. NO OTHER CODE FURNISHES SUCH A LIST.

BEST EXTANT — That LIEBER'S CODE is recognized as the best ever offered to the public is shown by the following houses, who have unqualifiedly endorsed it in preference to all others:

Albert & J. M. Anderson Mfg. Co.
H. W. Johns Mfg. Co.
Okonite Co.
Bethlehem Iron Co.
Eugene Munsell & Co.
Garton-Daniels Electric Co.
McCardell, West & Co.
Robert W. Blackwell.
Safety Third Rail Electric Co.
Standard Air Brake Co.
Dick, Kerr, & Co.
Risdon Iron Works.
E. H. Cadiot & Co.
Lorain Steel Co.
Westinghouse Electric & Mfg. Co.
General Electric Co.
Jackson & Sharp Co.
Peckham Truck Co.
Baltimore Car Wheel Co.
American Metal Co.
Lewisohn Bros.
Carnegie Steel Co.
John Stephenson Co.
Baldwin Locomotive Works.
Brown Hoisting & Conveying Machine Co.
J. G. Brill Co.
Christensen Engineering Co.
Berlin Iron Bridge Co.
B. F. Sturtevant Co.
Riter-Conley Mfg. Co.
Ball & Wood Co.
A. L. Ide & Sons.
Springfield Mfg. Co.
Edwin Harrington, Son & Co.
J. A. Fay & Egan Co.
Worthington Pump Co.
Babcock & Wilcox Co.
Westinghouse Air-Brake Co.
Manning, Maxwell & Moore.

LIEBER CODE CO.,

2 and 4 STONE STREET NEW YORK.
97 QUEEN VICTORIA ST. LONDON, E. C.



PERFECT LUBRICATION

MECHANICAL not CAPILLARY

Economy Journal Lubricators and Dust Guards

Prevents "Hot Boxes." Applicable to any Standard M. C. B. Box.
Feeds any Oil. Doubles Life of Journal Brasses.
50 PER CENT. SAVING Guaranteed. No Waste Packing Used.

We will demonstrate our device on your road without expense to you.

RAILWAY JOURNAL LUBRICATING COMPANY

MILWAUKEE AND CHICAGO
12th St. and St. Paul Ave. Monadnock Block
ADDRESS CORRESPONDENCE CHICAGO

Steel Wool Journal Packing

NECESSARY FOR HIGH SPEED HEAVY WEIGHT ROLLING STOCK

205 cars on the Wentworth Avenue and Halsted Street Lines packed with Steel Wool Journal Packing, saving the Chicago City Railway $33\frac{1}{3}$ to 50% of expense of lubrication and obviating entirely the hot box evil. Nearly 200 Steam and Street Railways already equipped. Let us send you a trial sample.

Federal Supply Co.

1209-1213 Stock Exchange Bldg., CHICAGO, ILL.

There is no need to run flat wheels, nor to throw them away. Just use the Wheel Truing Brake Shoe in place of the regular shoe until the wheel is true. No need to remove wheels or take the car out of service.

The trouble is less and the cost is less than by any other method.

WHEEL TRUING BRAKE SHOE CO.
DETROIT, MICH.

REG TRADE MARKS "Phosphor-Bronze" DELTA

THE PHOSPHOR BRONZE SMELTING CO. LIMITED,
2200 WASHINGTON AVE., PHILADELPHIA.
"ELEPHANT BRAND PHOSPHOR-BRONZE"
INGOTS, CASTINGS, WIRE RODS, SHEETS, ETC.
—DELTA METAL—
CASTINGS. STAMPINGS AND FORGINGS.
ORIGINAL AND SOLE MAKERS IN THE U.S.

PITTSBURGH WHITE METAL CO.
160 Leroy St., N. Y. 1739 Liberty St., Pittsburgh, Pa.
BABBITT AND ANTI-FRICTION METALS
Linotype, Stereotype, Monotype and Electrotype.
Prices consistent with quality and market
References—Westinghouse Interests

BRAKE SHOES

The Approved Standards of American Railway Practice for Steam and Electric Service

THE AMERICAN BRAKE SHOE & FOUNDRY CO.
NEW YORK 170 BROADWAY
CHICAGO WESTERN UNION BLDG.

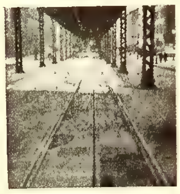
STREETER — LAPPIN
CORNING — DIAMOND "S"
and "U" TYPES

Elevated and High Speed Interurban Equipments require Steel Back Brake Shoes

MISCELLANEOUS IRON AND STEEL CASTINGS

Marginal Protecting Strip

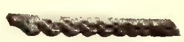
AN ECONOMY IN THE MAINTENANCE OF ASPHALT PAVING



UNPROTECTED PAVING

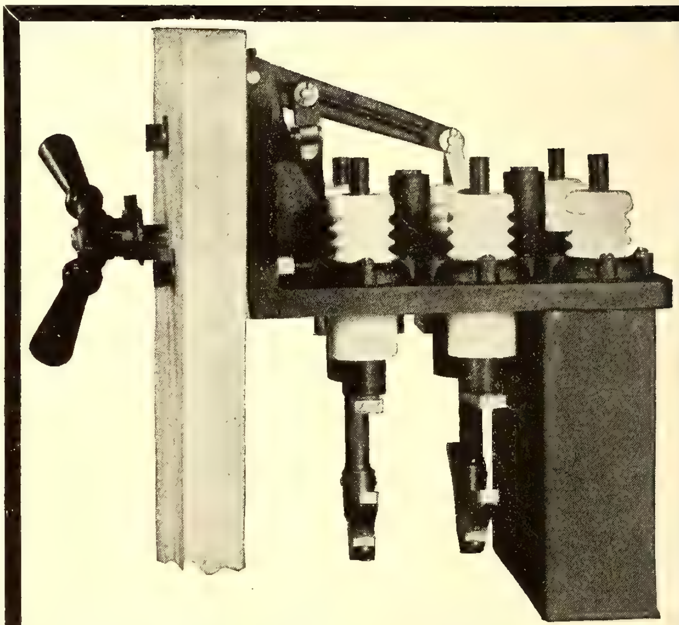
Top View

MARGINAL PROTECTING STRIP



Bottom View

PROTECTED PAVING



HARTMAN HIGH TENSION OIL SWITCHES and CIRCUIT BREAKERS

contain many points of advantage over similar apparatus now in use. They are described in Bulletin "D," which will be mailed on request.

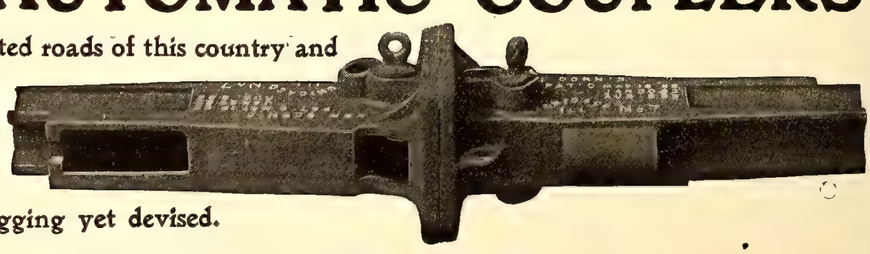
We make a special direct current circuit breaker for the protection of railway feeder circuits. These circuit breakers may be installed on the back of the switchboard in the usual manner or they may be installed at points remote from the station, and can be closed or opened at will by means of our system of remote electrical control.

Send for descriptive matter and prices.

HARTMAN CIRCUIT BREAKER CO.
MANSFIELD, OHIO

VAN DORN AUTOMATIC COUPLERS

Are now a standard on all of the elevated roads of this country and are being made a standard on all the leading surface, street and interurban roads. All couplings are machine fitted and we make sixteen sizes to meet any requirements. ✣ ✣ ✣
We build the most complete draft rigging yet devised.



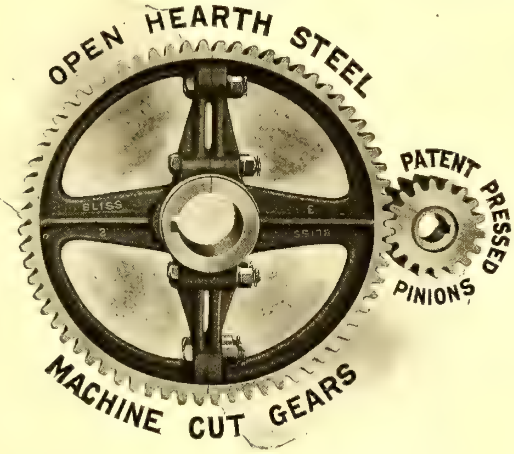
SEND FOR NEW CATALOGUE

W. T. VAN DORN COMPANY, Monadnock Block, CHICAGO.

"PROJECTILE (BLISS) BRAND"

GEARS AND PINIONS

ACCURATE TOUGH DURABLE



MADE OF HIGH-GRADE STEEL BY THE MOST APPROVED AND UP-TO-DATE MACHINERY

CAPACITY 60,000 PINIONS PER ANNUM

NO DELAY—WE SHIP FROM STOCK

E. W. BLISS CO., OWNERS OF THE U. S. PROJECTILE CO.

CABLE ADDRESS "BLISS-BROOKLYN" BROOKLYN, N. Y., U.S.A.

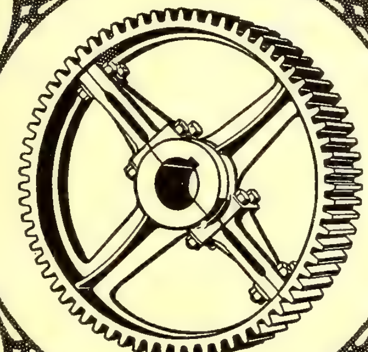
The Very Fact

that the U. S. Sleet Cutter is light, strong, compact—easily attached without tools of any description and designed on practical lines, should commend it to all Street Railway Managers.

SHIPPED FROM STOCK.

R. D. NUTTALL COMPANY

PITTSBURG, PA.

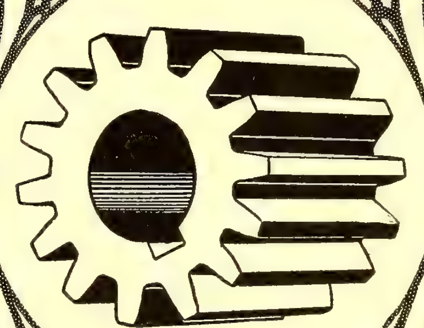


HORSBURGH & SCOTT

MANUFACTURERS OF

GEARS AND PINIONS

CLEVELAND, O.



Ventilating System for Trolley Car Motors

Covered by several broad and basic patents.

By its use motors are kept **cool** and **clean**—all the highly heated air, dust and foreign matter is expelled—armatures, field coils, bearings, etc , are saved from damage. Operating expenses of trolley roads largely reduced in the saving of repairs, labor and power. A well-known consulting engineer has said "that no trolley road could afford to do without it." Is applied at moderate cost without injury to car. In the cut, air collector is on top of car. May be used on dash or under platform as desired.

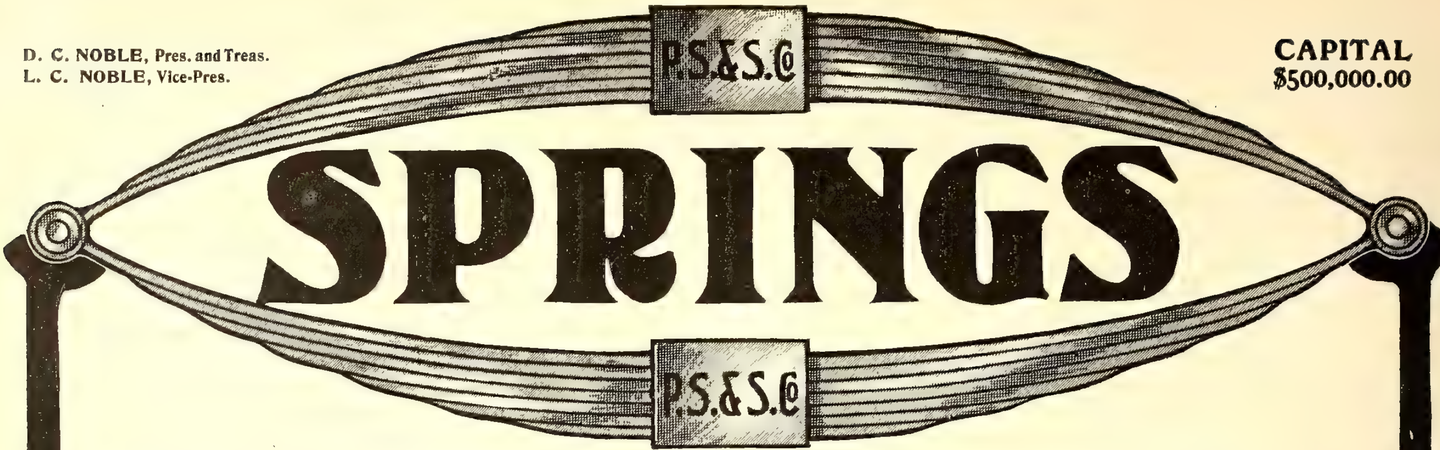
PARTICULARS ON APPLICATION

ELECTRIC MOTOR & GENERATOR VENTILATING CO.

572 DREXEL BUILDING, PHILADELPHIA, PA.

D. C. NOBLE, Pres. and Treas.
L. C. NOBLE, Vice-Pres.

CAPITAL
$500,000.00



SPRINGS

Springs for Traction Cars especially adapted to High Speed Work; also for Locomotives, Freight, Coal and Dump Cars

FOR EVERY PURPOSE

BEST MATERIAL USED.

ALL SPRINGS OIL TEMPERED

Also Governor Machinery Agricultural Implements, Springs of the Highest Grade.

QUALITY AND WORKMANSHIP GUARANTEED

CORRESPONDENCE AND ORDERS SOLICITED

PITTSBURGH SPRING & STEEL CO.

1416=16A=17 FARMERS BANK BLDG., PITTSBURGH, PA.

ARCHIBALD M. McCREA, Pres. L. G. WOODS, Vice-Pres. A. PANCOAST, Sec'y and Treas

Union Spring and Manufacturing Company,

GENERAL SALES OFFICE
310 FRICK BUILDING, PITTSBURG, PENN.

....MANUFACTURERS OF....

Helical and Elliptical Springs

For Locomotives, Tenders, Coach, Freight Car And Street Car Service

Branch Offices

D. L. Markle, Old Colony Building, Chicago, Ill.

Southern Railway Supply and Machinery Co., Savannah, Ga.

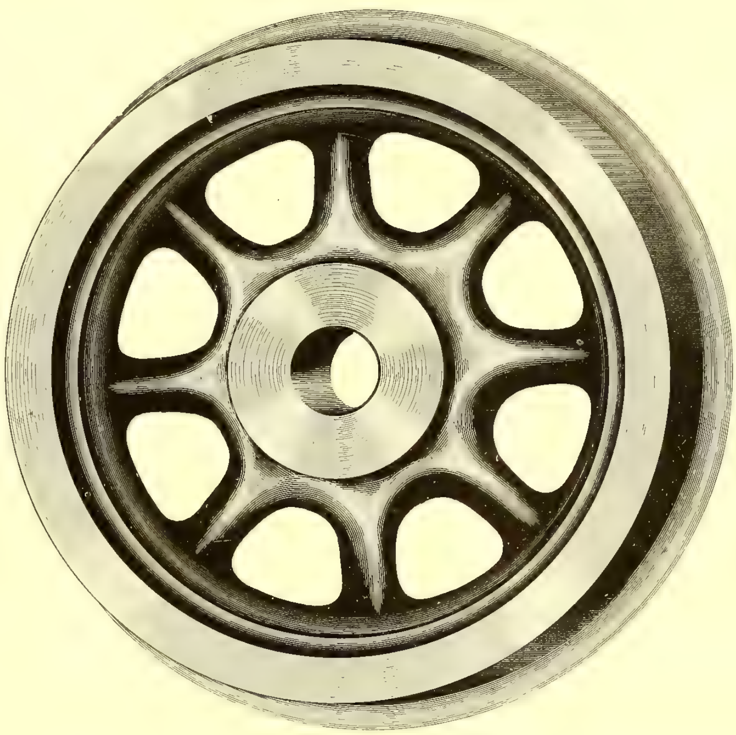
General Offices and Works, at New Kensington, Pa.

CAPACITY OF PLANT, 60 TONS PER DAY

Railway Steel-Spring Co.

STEEL TIRED WHEELS

Adopted as Standard by Principal Electric and Interurban Roads



Safer, More Durable and More Economical Than Cast Iron Wheels

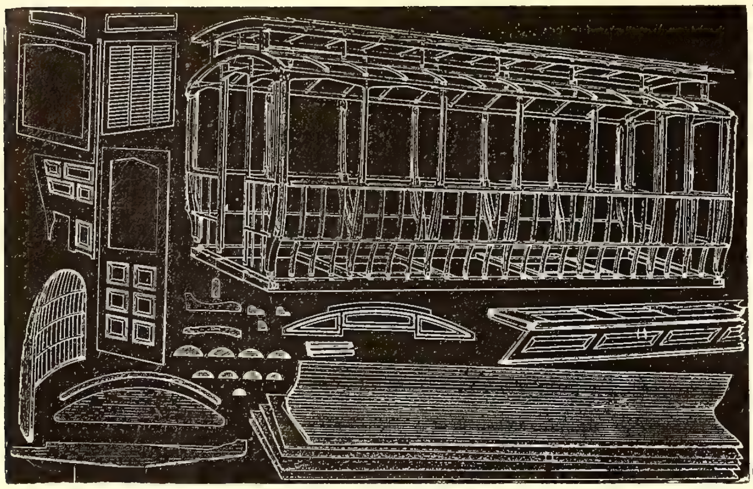
Blue Prints and Prices Furnished on Application

GENERAL OFFICE:

71 BROADWAY, = = = NEW YORK

BRANCH OFFICES:

CHICAGO, - = - -	1380 Old Colony Building
ST. LOUIS, - - - -	Lincoln Trust Building
WASHINGTON, - - - - -	17 Sun Building
ST. PAUL, - - - -	Pioneer Press Building



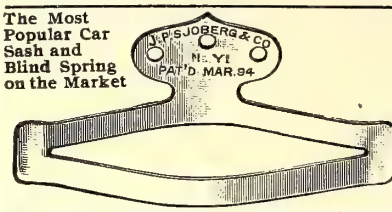
J. P. SJOBERG & CO.

533-539 West 32d Street, NEW YORK,

MANUFACTURERS OF

STREET CAR WOOD WORK

The Most Popular Car Sash and Blind Spring on the Market



For Repairs Rebuilding and Stationary Vestibules

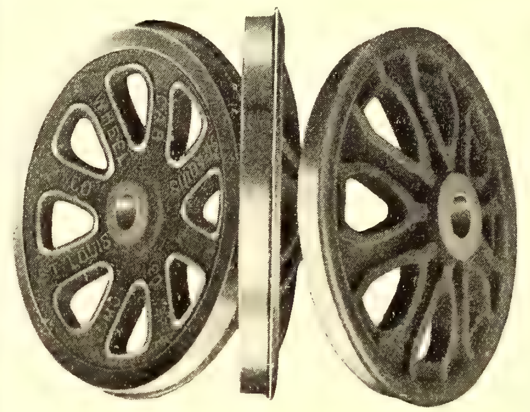
Also Portable Vestibule Fronts Complete

Re-enforced... Spoke Wheels

For City Service

Stronger Spokes. Stronger Flange. **Deep, Even Chill.** Greater Mileage. **Absolute Safety.**
A Sample Order will prove its superiority over the old style Spoke Wheel.

Write for Booklet on Wheels



For Interurban Cars

This Wheel is being substituted in place of the old style Plate Wheel because it does **NOT** rumble and roar when on paved City Streets.

The Only Spoke Wheel for Heavy, High-Speed Service

St. Louis Car Wheel Co.

ST. LOUIS, MO.

NATIONAL CAR WHEEL COMPANY

MANUFACTURERS OF

STREET CAR WHEELS

General Offices:
PITTSBURGH, PA.

Works:
ROCHESTER, N. Y.
SAYRE, PA.
PITTSBURGH, PA.
CLEVELAND, O.
NEW YORK CITY

SUCCESSFUL

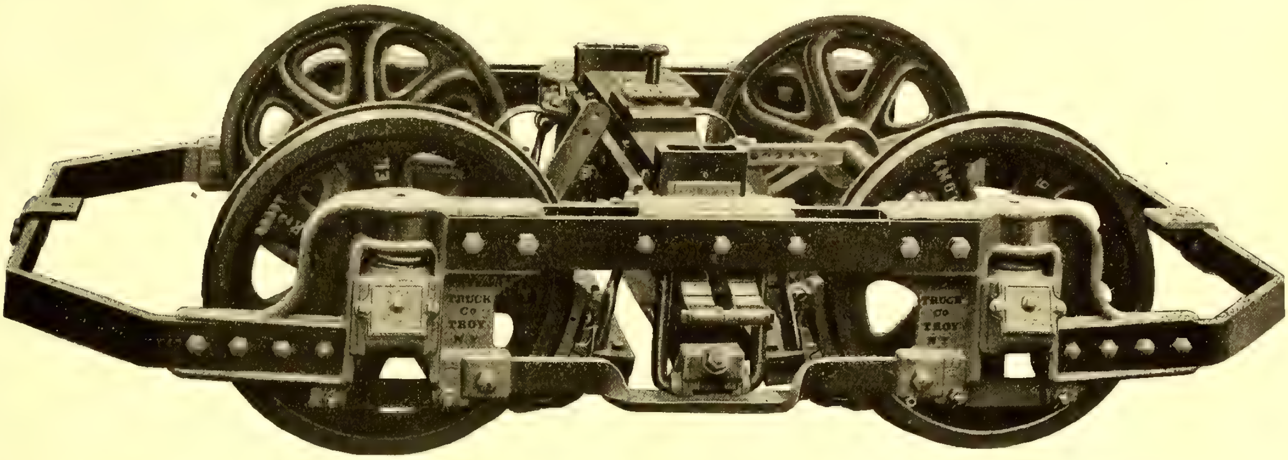
Gasoline Locomotives and Motors

To lessen the cost of Suburban and Interurban Street Car and Railroad Service are being made by the

PROUTY-PIERCE LOCOMOTIVE MFG. CO.

STOCK YARDS STATION. KANSAS CITY, KAN.

For Carrying Long Cars Around Curves of Short Radii, the Taylor Swing Motion Double Truck is Superior to All Others



Constructed to mount a car low down, and to accommodate long cars that are FRAMED NARROW on the sills. The wheel base is 4′ 6″ with 33″ wheels, and 4′ 3″ with 30″ wheels. The only short wheel base Double Truck on the market with swing motion and elliptic springs for the riding of the car body. Constructed on the best principles of Master Car Builders' standard practice. The brakes are of the live and dead lever system, made extra strong, so that air-brakes can be used if desired.

TAYLOR ELECTRIC TRUCK CO., Troy, N. Y., U.S.A.

Agents for Great Britain
ESTLER BROTHERS, 25 Laurence Pountney Lane, Cannon St., London, E. C.

Our Export Trade (outside of Great Britain) is Handled Exclusively by
DUTILH-SMITH, McMILLAN & CO., Broad-Exchange Bldg., New York

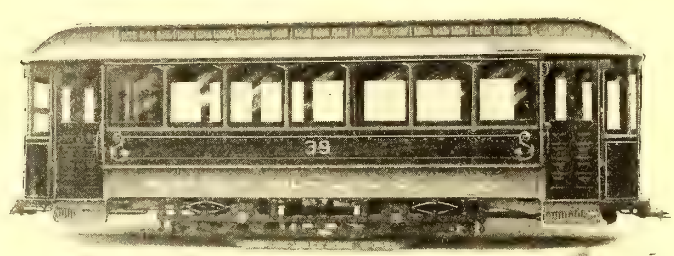
ESTABLISHED 1839

J. M. JONES' SONS

WEST TROY, N. Y.

BUILDERS OF

High Grade Cars for Electric Railways



THE JEWETT CAR CO.

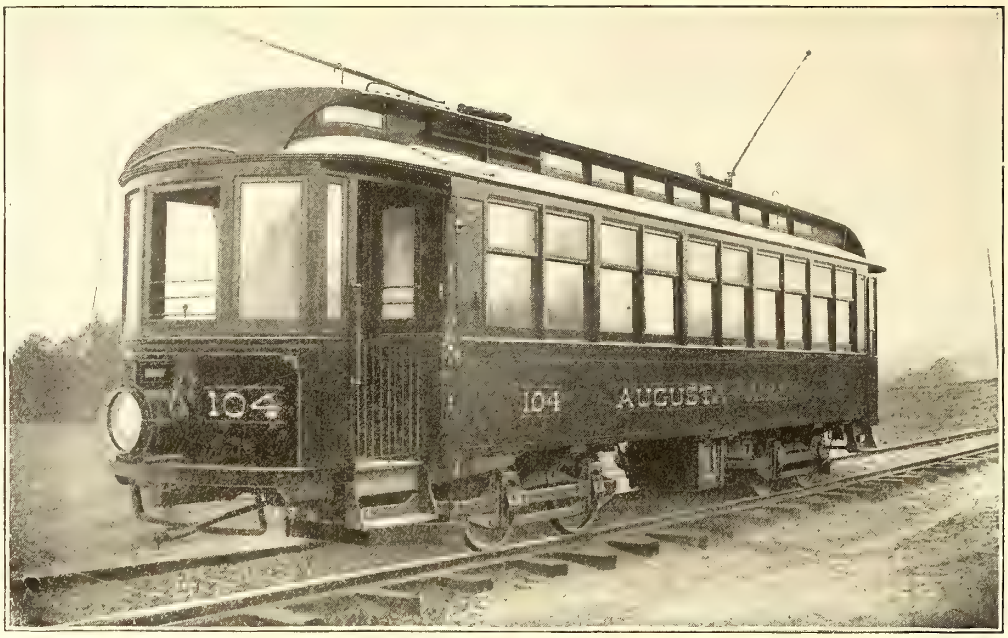
Builders of High Grade Cars for Electric Railways

NEWARK, - OHIO, U. S. A.

The Laconia Car Company Works

P. W. WHITTEMORE, Treas. **BOARD OF TRADE BLDG., 131 STATE ST., BOSTON, MASS.** J. C. SPRING, Vice-Pres.

Works: Laconia, N. H.



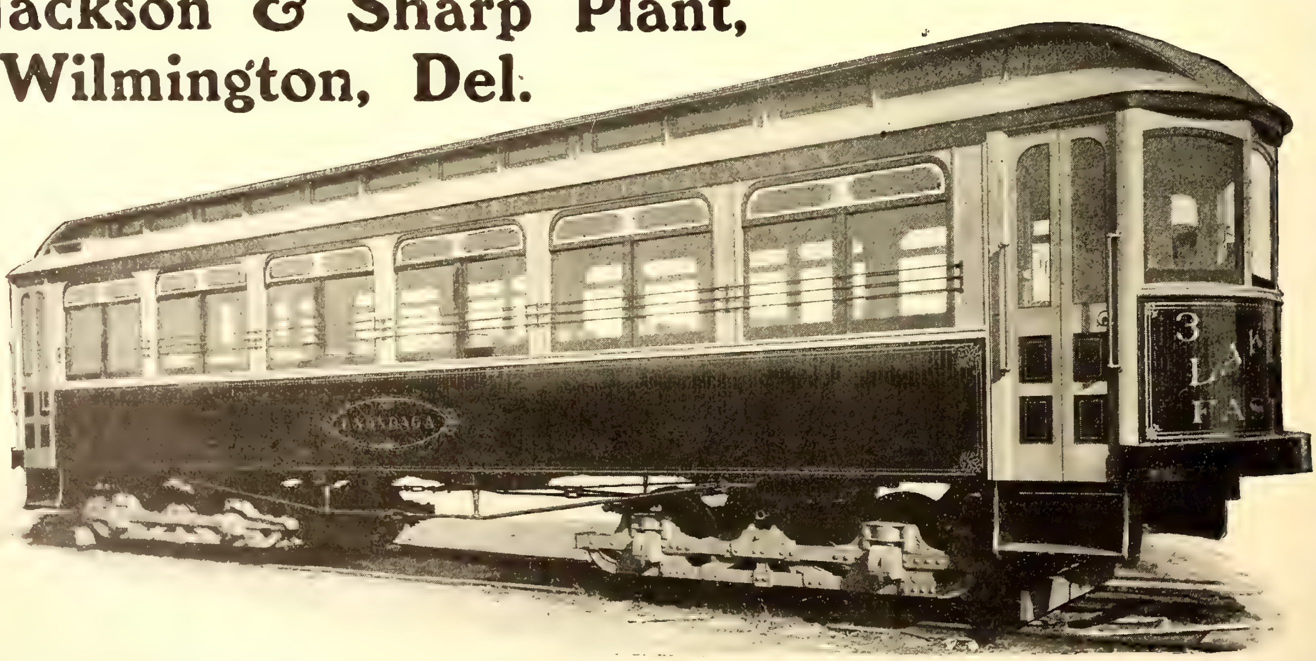
BUILDERS OF ELECTRIC CARS AND TRUCKS

MALLEABLE IRON CASTINGS FOR ELECTRICAL WORK

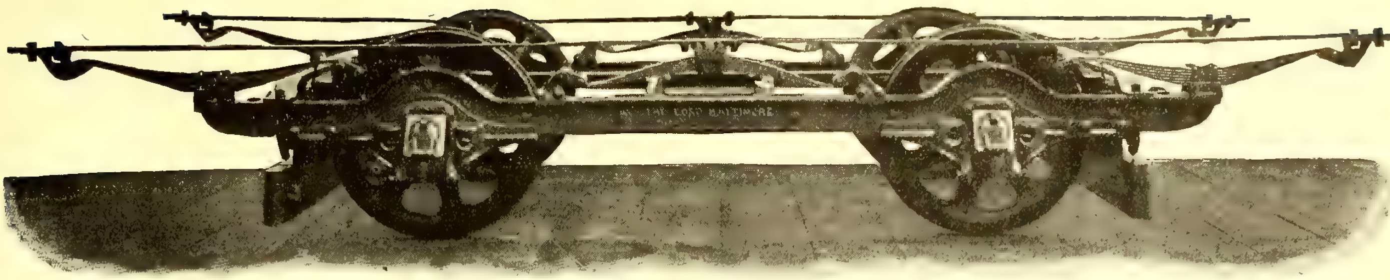
THE

AMERICAN CAR AND FOUNDRY CO.

Jackson & Sharp Plant, Wilmington, Del.



Builders of Any Type of Cars for Steam, Electric or Animal Traction for Either Domestic or Export Trade.



THE BALTIMORE CAR WHEEL COMPANY

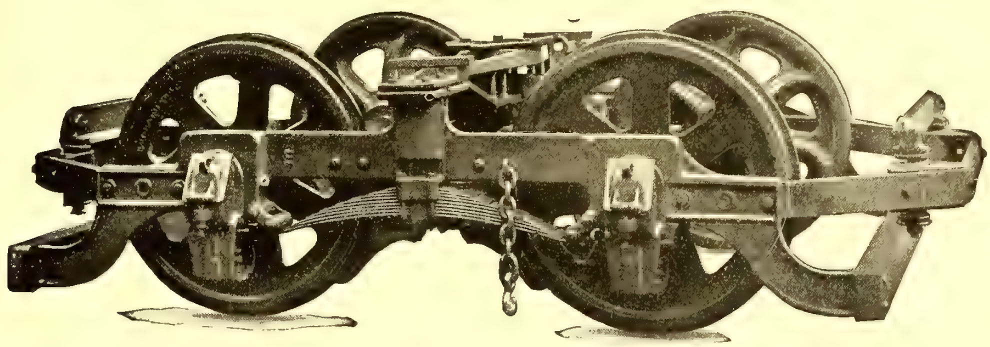
W. S. G. BAKER, *President and Treasurer* BALTIMORE, MD., U. S. A. J. PAUL BAKER, *Secretary*

MANUFACTURERS OF

THE LORD BALTIMORE

4-WHEEL BOGIE AND MAXIMUM TRACTION

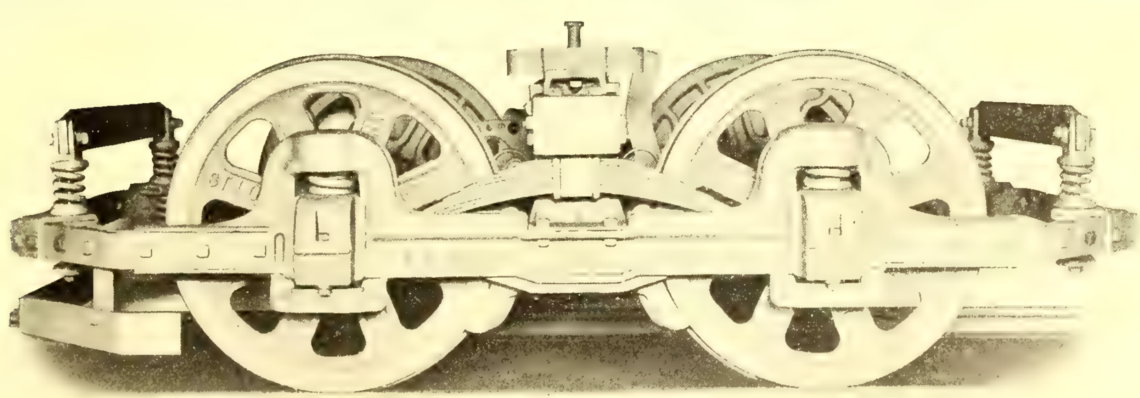
ELECTRIC CAR TRUCKS



CHILLED WHEELS OF ALL PATTERNS AND SIZES FOR EVERY SERVICE, WITH OR WITHOUT AXLES

The well-known Bemis Number 45 Electric Truck.

THIS truck has been adopted as the Standard Truck on some of the leading roads of the country and is especially adapted for City and Interurban Service. All of our Trucks are equipped with either M. C. B. or Bemis Dust-Proof Boxes.



BEMIS CAR TRUCK CO.

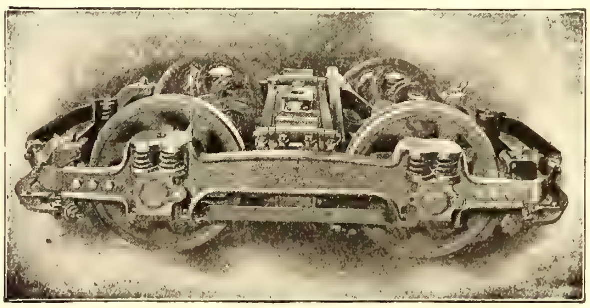
GENERAL OFFICES

120 Liberty Street, New York City

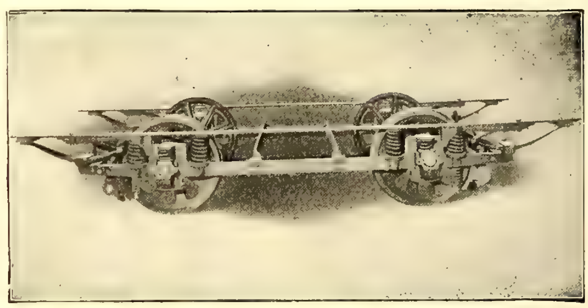
Factory: SPRINGFIELD, MASS. THOS. F. CAREY, 53 State Street, Boston, Mass.
Eastern Agent.

McGuire Manufacturing Co.

Pneumatic Sprinkler in Operation, Spraying Water 45 Feet on Each Side of Track



No. 39 Double Truck



Solid Steel Columbian

Snow Sweeper with Side Wing Plows

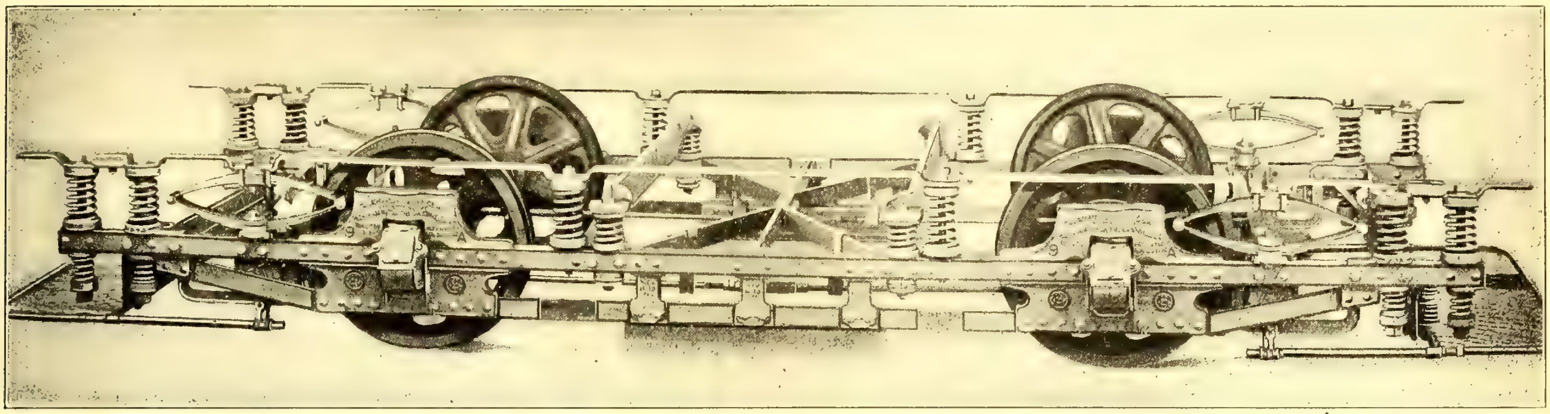
Illustrations, Blue Prints, Specifications and Other Data Cheerfully Furnished

McGuire Manufacturing Co., 122-132 N. SANGAMON ST. CHICAGO

PECKHAM'S system of Single and Double Electric Trucks

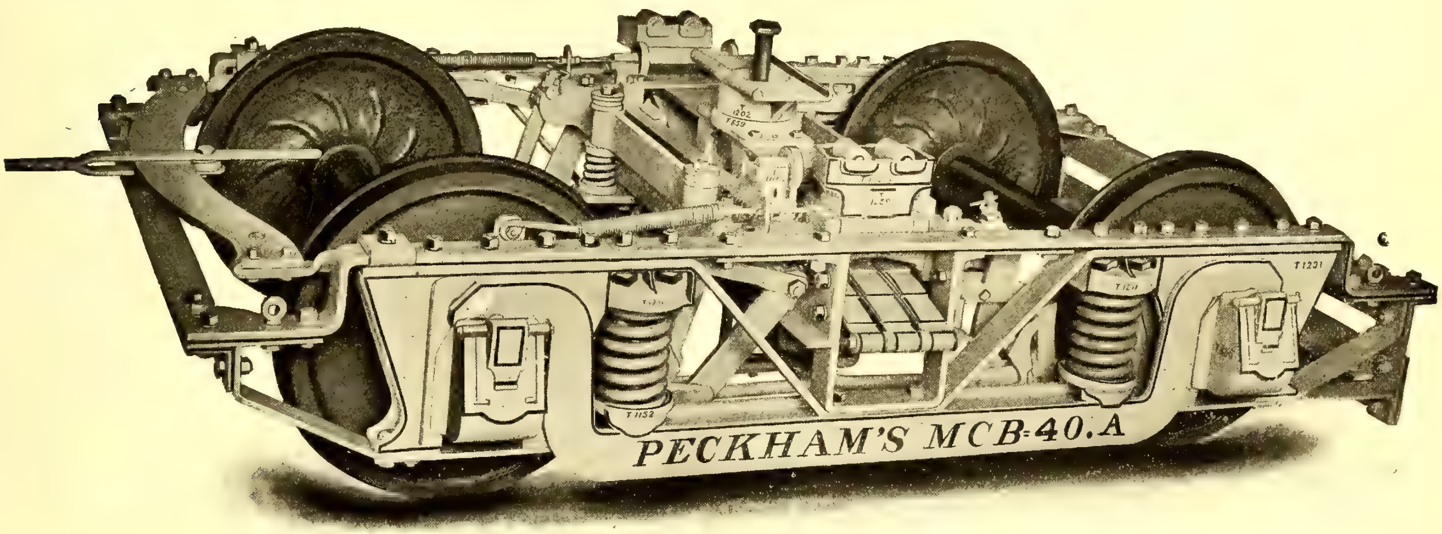
Adapted to any and all conditions of Electric Railway Service. The Largest and Most Complete System in the World.

"METROPOLITAN SPECIAL."



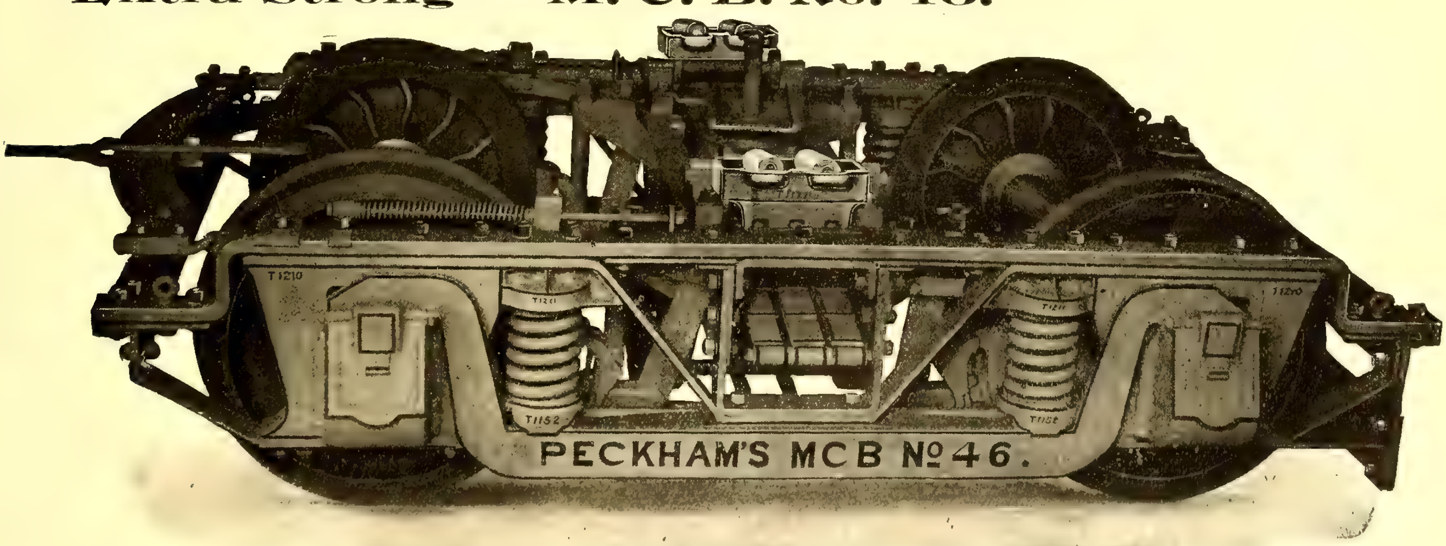
Designed for 20 and 22 ft. Closed and 30 to 32 ft. Open Electric Cars. Guaranteed to make a speed of 20 miles per hour without "Oscillation." Adopted as standard by the "Metropolitan Street Railway Co.," New York.

"Standard" "M. C. B. No. 40-A."



Designed for 50 to 60 ft. "High Speed" Electric Cars. Carrying Capacity 80,000 lbs. per car. "Triple Elliptic Spring Swing Bolster." Double Roller Side Bearings. Taylor Non-Chattering Brake Hangers.

"Extra Strong" "M. C. B. No. 46."



Designed expressly for "High Speed" Electric Railways. Carrying Capacity, 100,000 lbs. per Car. Triple Elliptic Spring all Steel Bolster.

BLUE PRINTS, PRICE LISTS AND CATALOGUES FURNISHED ON APPLICATION.

THE PECKHAM MANUFACTURING CO.

KINGSTON, N. Y.

General Sales Office: 26 CORTLANDT STREET, NEW YORK CITY.

BOSTON, 53 State Street. LONDON, 59 City Road, E. C. CLEVELAND, 312 Electric Building.

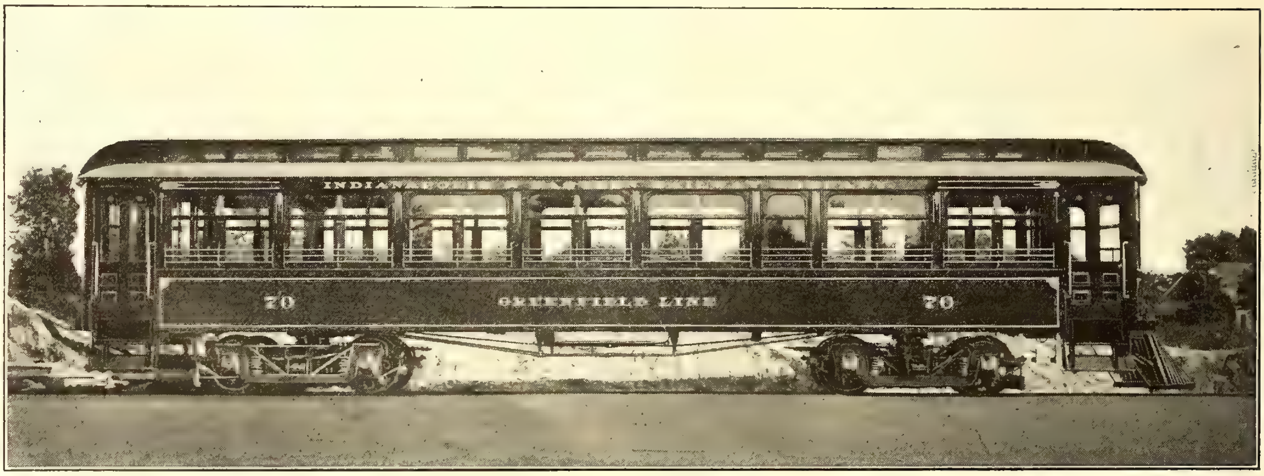
THE G. C. KUHLMAN CAR CO.

Office and Factory:
COLLINWOOD, O.

Car Builders

GEORGE S. HASTINGS & CO.
General Sales Agents
324 Electric Bldg., CLEVELAND, O.

Illustrating Beauty of Design.



WE have illustrated strength of construction by showing one of our cars that was thrown from the track, turned a somersault, and came out intact. We also illustrated durability by showing one of our cars that has run for six years without repairs and without sagging.

We wish now to call your attention to our claim of beauty in design on a car that was built by us for the Indianapolis & Eastern Railway Co., Indianapolis, Ind. We suggest, if you are in the market for a modern interurban coach, that you let us build you some like these. Write for specifications and photographs if you are in the market.

THE G. C. KUHLMAN CAR CO., CLEVELAND, O.

The Romünder "Comfort" Passenger Car

Patented and patents pending in the United States and foreign countries.

The Ideal Observation Car for Local, Interurban and Steam Roads

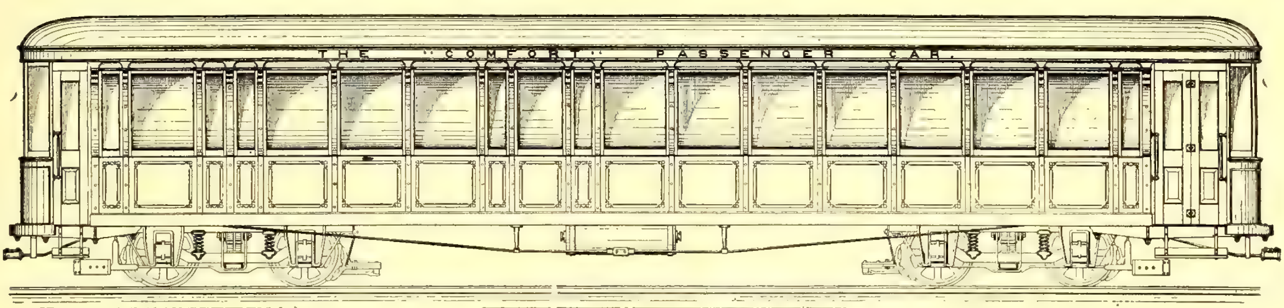
Covers every requirement sought for both in comfort and attractiveness, combined with greatest strength and wearing power at a price not exceeding the best production of a closed car as now built.

IN WINTER

"Copyrighted 1903 by Hermann Romünder"

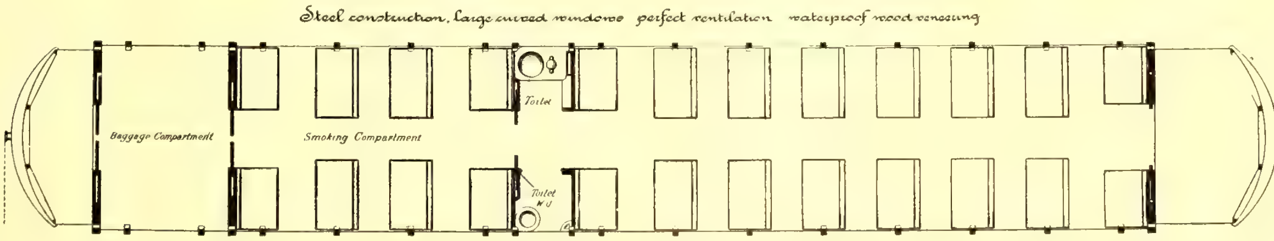
One continuous roof, extending from side to side and from end to end, overhanging the body of the car, producing a high and roomy interior of the car at a reduced total outside height, and obviating the monitor roof.

System of perfect ventilation through outer ventilators between the side posts, above the side windows and under the eaves of the overhanging roof, and inner ventilators in the ceiling of the car.



Interurban Combination Type of the "COMFORT" Passenger Car.

Steel construction, Large curved windows perfect ventilation waterproof wood veneering



Patented & Patents applied for

COMPANIES DESIRING THIS TYPE OF CAR CAN BUILD SAME OR HAVE SAME BUILT ON A REASONABLE ROYALTY SPECIFICATIONS AND CONSTRUCTION DRAWINGS WILL BE FURNISHED IN EACH CASE AT COST

For catalogue and further particulars, address

HERMANN ROMÜNDER, Patentee and Owner
315 Garfield Ave., Milwaukee, Wis.

Representative for the Continent of Europe: **Ferd. Romünder, Gladbacher Str., 20, Cologne, Germany**

Six Great Types

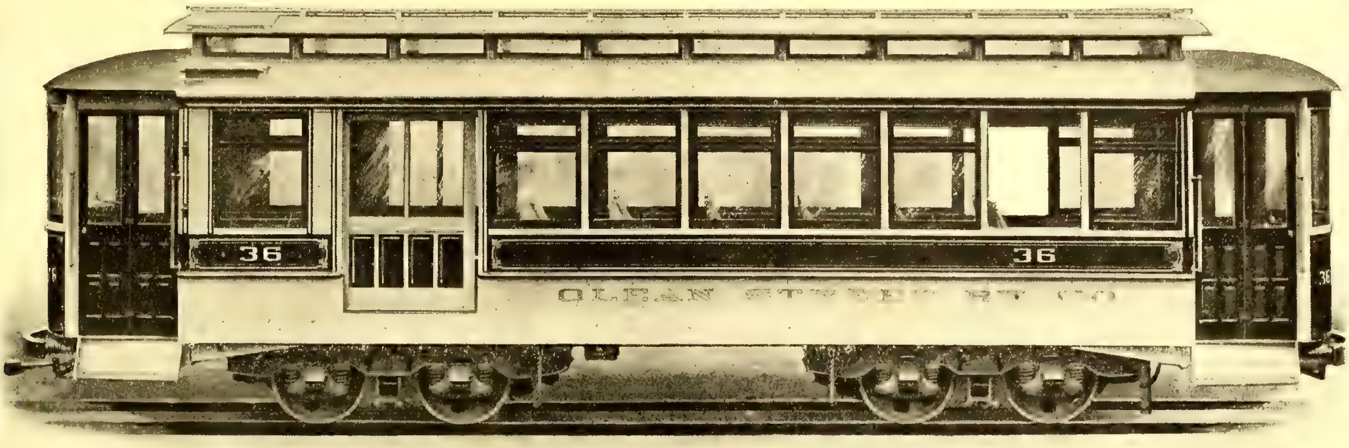
There are six patented types which have won their way into the large systems and have proved their entire suitability in such an unmistakable manner as to have a definite place in the car world of to-day, and these are the Convertible, Semi-Convertible, Narragansett and California types of the J. G. Brill Company, and the Accelerator and Semi-Accelerator types of the Brownell Patents Company. We feel particularly fortunate in having the right to build these cars, because each type meets all the most highly developed conditions of its special field and is being ordered and re-ordered by same companies, and the general demand

CONVERTIBLE CAR (Brill Patented) CLOSED

for each is increasing rapidly. Each type has all the good features of the standard car, or cars, it supersedes, avoiding the short-comings that have been revealed in general practice and including certain additional features which promote the greatest economy, comfort and safety. We of course build open and closed cars of all sizes in the standard styles, and also design cars to suit special conditions. Our supply department is ready to meet the requirements of Purchasing Agents regarding material and equipment of every kind for electric rolling stock.

AMERICAN CAR COMPANY

ST. LOUIS, MO.



Your passengers deserve first consideration—but your express and freight service should be properly handled also.

Perhaps some combination passenger and baggage cars such as illustrated on this page will meet your requirements. Or maybe you need special cars for express and freight service exclusively.

In either case, we are prepared to design a car that will meet your conditions, or to submit estimates on cars of your own design.

After you have given us the order you needn't worry about the workmanship. We won't take the contract unless we can build the cars in a manner that will sustain the Stephenson reputation.

JOHN STEPHENSON COMPANY

Works: Elizabeth, New Jersey

PETER M. KLING, General Manager
E. J. LAWLESS, Agent

New York Office: 16 Exchange Pl.

JOSEPH C. WILLETTS, President
LEANDER M. DELAMATER, Treasurer
JOHN G ROOT, Secretary

The largest individual

Electric Car Plant

in the World.

THE ST. LOUIS CAR COMPANY

wishes the Street Railway industry in general and its patrons in particular

A Happy and Prosperous New Year

GEO. J. KOBUSCH, President.
H. F. VOGEL, V. P. and G. M. GEO. A. H. MILLS, Secretary and Treasurer.
E. I. ROBINSON, V. P. and G. M. Laclede Plant.
W. S. McCALL, General Sales Agent, St. Louis, Mo.

F. E. HUNTRESS, General Eastern Agent, New York and Boston.
GUS KOCH, Pacific Coast Agent, San Francisco, Cal.
CHAS. G. ETTE, Secretary, St. Louis Malleable Casting Co.

ST. LOUIS CAR COMPANY

ST. LOUIS, MO.

The largest individual Electric Car Plant in the World.

QUICK AND EFFECTIVE

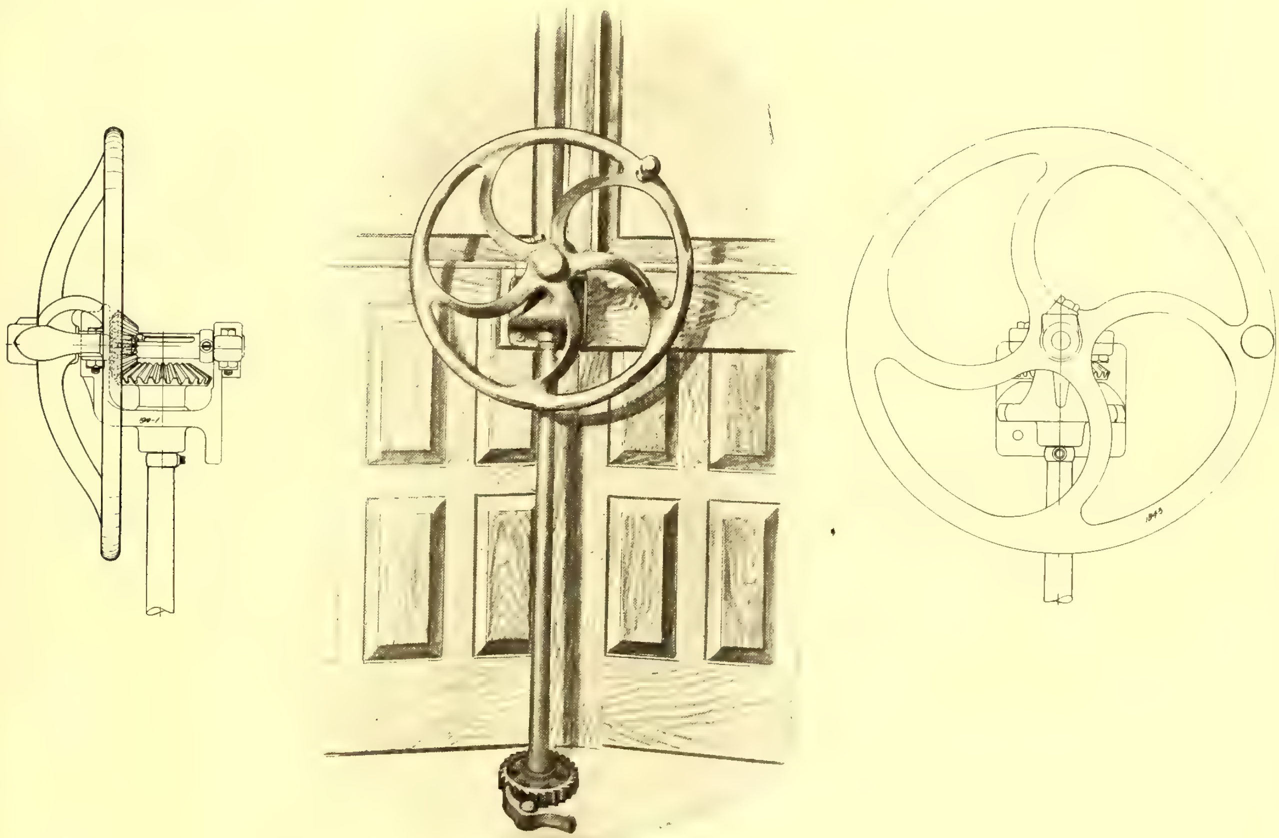
Our Patented Vertical Wheel Brake has many strong points — we submit the following for your consideration:

It is *easier* to operate than the handle, as motormen can use both hands in operation.

It is simple in construction, yet it is strong.

It saves platform space, and removes the danger of injuring passengers by flying brake-handle — a frequent occurrence.

It gives *quicker* and more *effective* action on the brakes than can possibly be obtained by the use of the brake-handle.



This wheel brake is fitted up against the dash. Dished wheel brake is geared to work staff perpendicular to dished wheel. Leverage of 20-inch wheel is equivalent to 14-inch handle.

It will pay you to investigate.

ST. LOUIS CAR COMPANY

ST. LOUIS, MO.

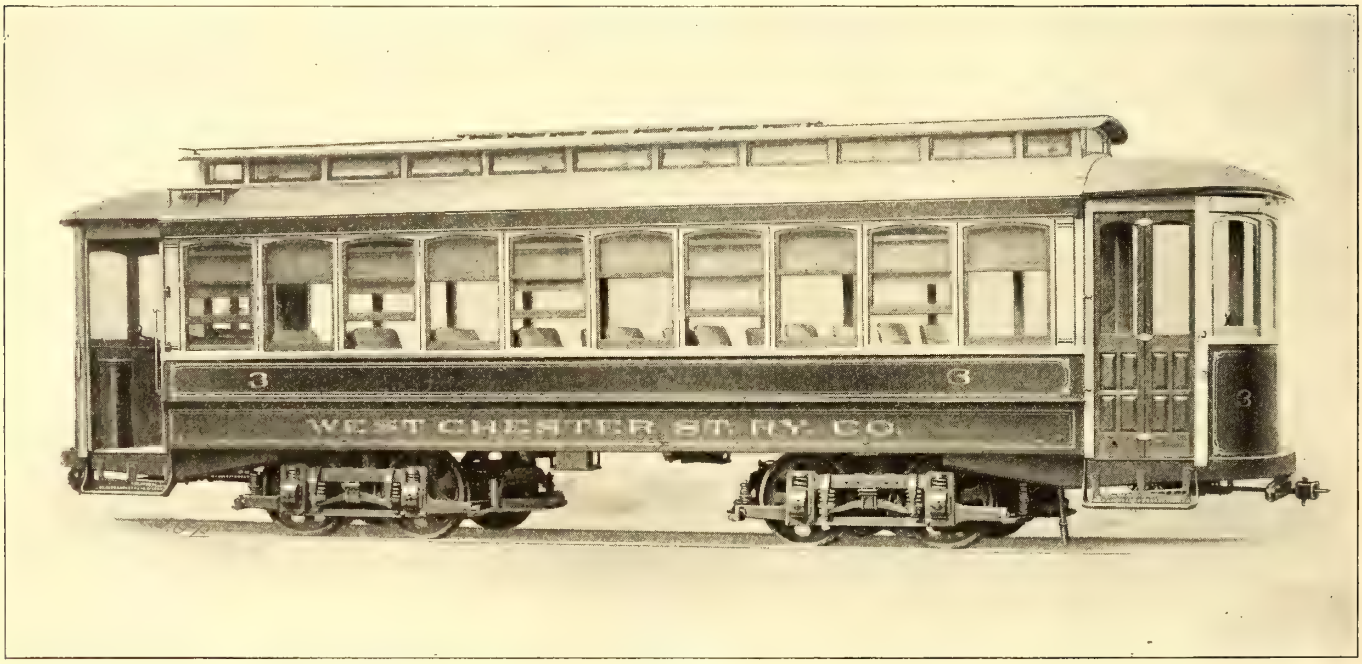
PHILADELPHIA, U.S.A.
Cablegrams
"Brill," Philadelphia
Telegrams
"Axles," London

J. G. BRILL COMPANY
CARS AND TRUCKS

110 CANNON STREET
London, E.C. England
NOYES BROTHERS.
109 Pitt St., Sydney
Agents for Australasia

The Three Semi-Convertibles

What is there to be said in favor of the removable-window semi-convertible? It has no wall window pockets, and so the ends of the seats are brought between the posts and against the side lining, allowing the seats to be longer and the aisle wider. It costs something, however, to remove and replace the windows, and it is no easy matter to determine just when it should be done. When the windows are out the car must depend upon its curtains for protection. What can be said in favor of the wall window pocket semi-convertible? It is a self-contained car—that is about all that can be said in its favor, for the window pockets are in the wrong place. They take up much valuable space, and careless passengers use them as cuspidors and rubbish receptacles. The Brill Semi-



SEMI-CONVERTIBLE CAR (Patented)

Convertible has the good features of both these cars, and avoids the objectionable ones by having the window pockets in the side roofs. The manner in which the details have been carried out is singularly complete, and the operation is simply perfect. The lower sash is raised alone at first, and when the tops of both sashes are abreast the upper sash hooks itself on and is carried into the roof pocket. Only one runway in each post is required, and that is entirely of metal. There can be no sticking, as the trunnions at the corners of the sash, which move in the metal runways, are also metal. The ease with which the windows are operated is always astonishing to passengers. The system is of course just as applicable to straight-sided cars as curved. Another thing in favor of not having wall window pockets is that the window sills can be as low as desired.

PHILADELPHIA, U.S.A.
Cablegrams
"Brill," Philadelphia
Telegrams
"Axles," London

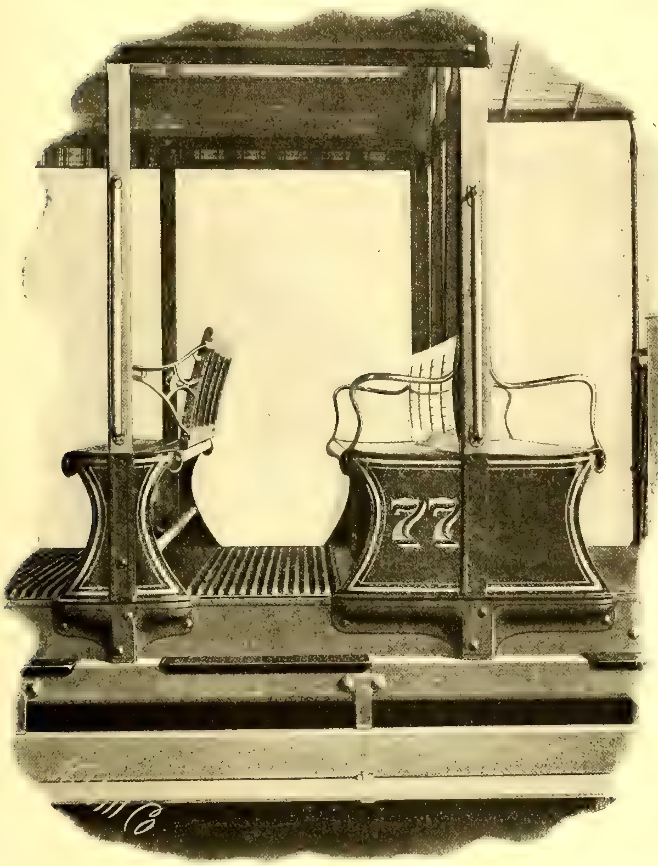
J. G. BRILL COMPANY

CARS AND TRUCKS

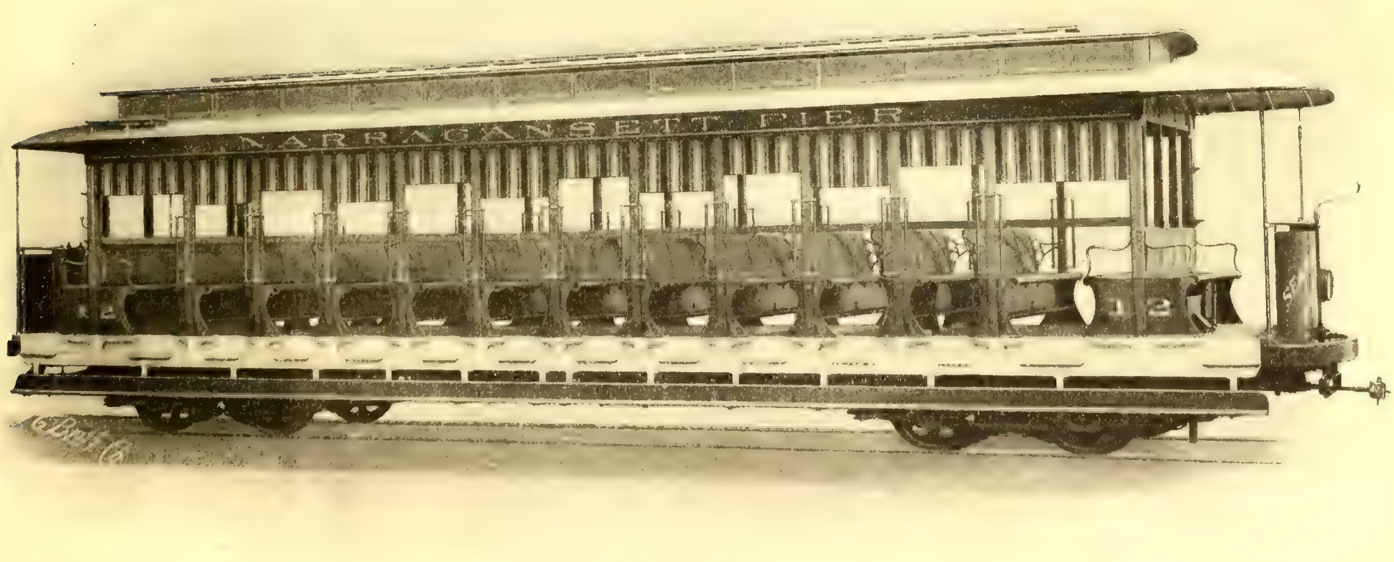
110 CANNON STREET
London, E.C. England
NOYES BROTHERS
109 Pitt St., Sydney
Agents for Australasia

Long, Open Cars, with Easy Steps

The 19½ inches from the rail-head to the step, or running-board, of a single-step double-truck car is much too high for women and children, and even awkward and unsafe for men, and the 17 inches from the step to the car floor is worse still, for the passenger must pull himself between the posts, a more difficult operation than drawing himself up in front of it as he does to reach the first step. Now it is impossible to have the car floor lower than 36½ inches, and the height of the single step mentioned is probably the best under the circumstances. The double step is therefore a genuine necessity, and we have it in the Narragansett without exceeding the width over all of the single-step car, for the upper step is on the lower flange of Z-bar sills, and the step heights respectively 16, 13 and 7½ inches. Z-bar sills are much stronger than timber, in fact the Narragansett is the strongest open car ever built. The posts have a deep setting in brackets bolted to the sills. The lower part of the posts are enclosed in Brill Patented Round-Corner Seat-End Panels, as the illustration shows. The seats are full standard length, and in every way the car has all the good features of standard construction, with the advantages of easier ingress and egress and greater strength. For summer excursion service it has no equal, and is the only practical open car for mounting on double trucks having equal-sized wheels.



SECTION OF "NARRAGANSETT" CAR



BRILL "NARRAGANSETT" CAR (Patented)

PHILADELPHIA, U.S.A.
Cablegrams
"Brill," Philadelphia
Telegrams
"Axles," London

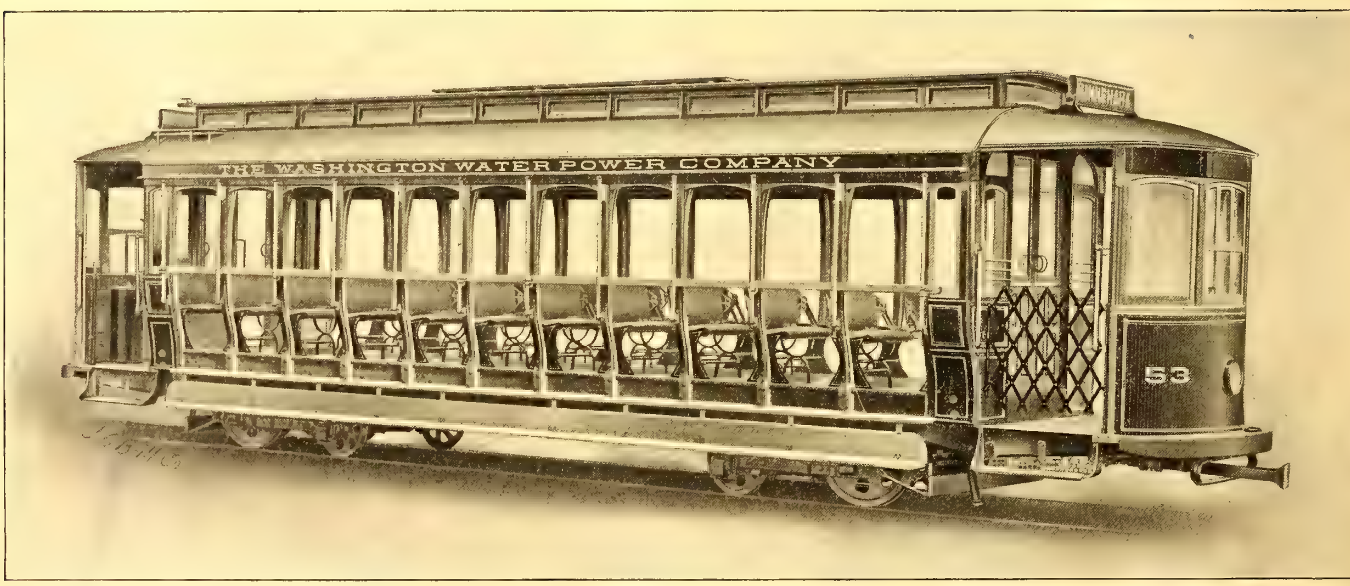
J. G. BRILL COMPANY

CARS AND TRUCKS

110 CANNON STREET
London, E.C. England
NOYES BROTHERS
109 Pitt St., Sydney
Agents for Australasia

The Car that Leads A Double Life

The Convertible not only does the work of two cars, but does it better, for it is always ready to meet any change of temperature. The large class of people who do not use street cars for business purposes want comfort and protection, and if it is not given them will not go out on threatening or stormy weather. Where ordinary cars are used many fares are lost because people who have but a short distance to go prefer to walk rather than suffer the discomforts of closed cars in warm weather or open cars on stormy or chilly days. It is little to be wondered at that the Convertible is a remarkably popular car, and one that people will wait for in preference to others, for the choice is with them whether it shall be open or closed. Managers are usually glad enough to be rid of the "weather-prophet" business. The sashes and panels are light enough for any one with moderate strength to raise into the roof-pockets, and the operation is simple enough for any one with ordinary



CONVERTIBLE CAR (Patented), Windows and Panels in Roof Pockets. "Narragansett" Sill Steps.

intelligence. A pair of sashes weigh fifteen pounds, and a panel eighteen pounds. The flexible double-sheet metal panels are thoroughly water-proof, and the air spaces in them enable the car to retain heat. The width of the monitor deck is not materially reduced by the pockets in the side roofs. In a car measuring eight feet over the posts, the clear interior width of the deck is forty-six inches. The cars of the Washington Water Power Company, shown above, include in their construction the Brill "Narragansett" type of double steps. This arrangement comprises Z-bar sills, with the upper sill on the outward-extending lower flange of the Z-bar, thereby utilizing the space ordinarily occupied by a timber sill. These cars are mounted on Brill "Eureka" Maximum-Traction trucks, which carry them low, but it will be readily seen that with this arrangement double trucks having equal-sized wheels may be used.

PHILADELPHIA, U.S.A.
Cablegrams
"Brill," Philadelphia
Telegrams
"Axles," London

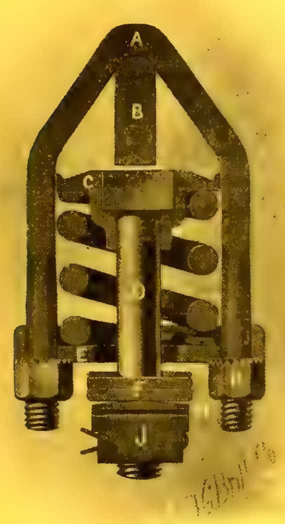
J. G. BRILL COMPANY

CARS AND TRUCKS

110 CANNON STREET
London, E. C. England
NOYES BROTHERS
109 Pitt St., Sydney
Agents for Australasia

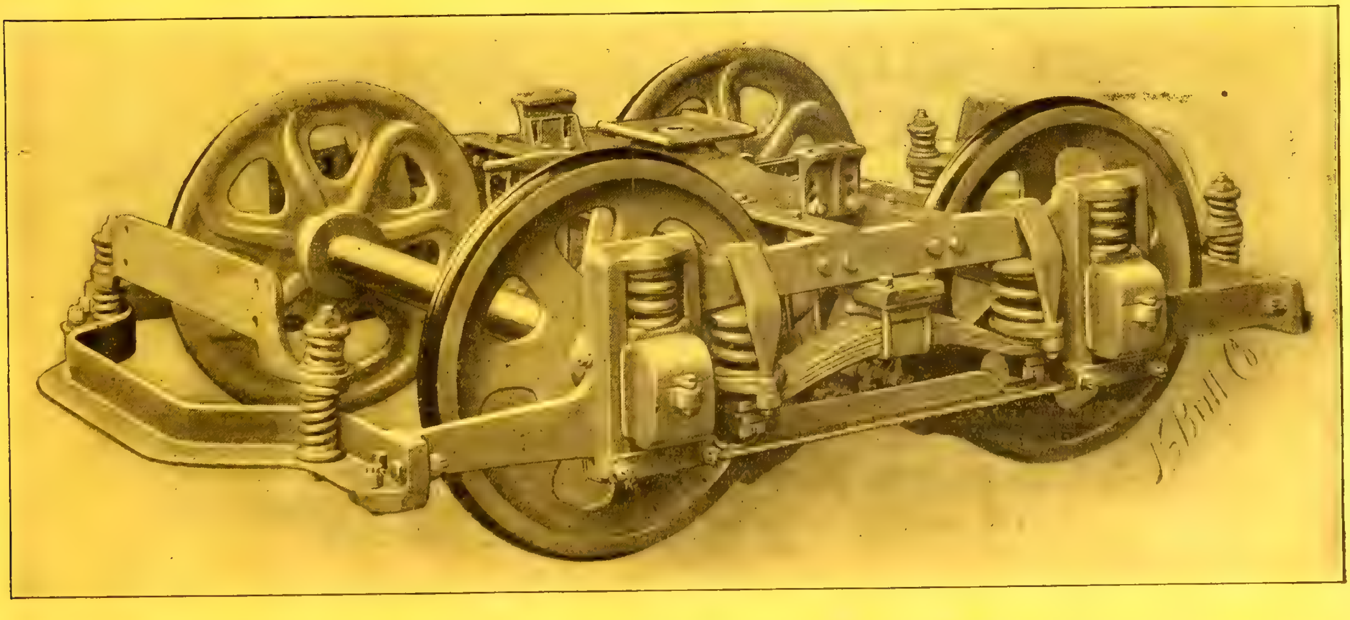
Traits of Character

One of the finest traits of the No. 27-G truck is shown when it rounds a curve—there is no lurch nor jar to the car body, nor grinding of the wheel flanges against the rail heads, no matter what the speed is. That is because the Brill patented system of equalization includes spring-links which perfectly cushion the side-swing of bolster. A good proof that the frame does not tilt is that the brakes retain their adjustment longer than with other trucks, and a non-tilting frame is extremely important in a truck having outside-hung motors, for the tendency is for the motors to bounce and cause the frame to oscillate. Our truck is good for thirty to thirty-five miles an hour without oscillation. The side frames of the truck are cast or solid forged in a single piece. We never use riveted or built-up work, as it is literally impossible for such frames to keep square. The solid forged frame is vastly better than the cast, because it cannot be crystallized by shocks or vibration. Solid forging, as we do it, is using metal with a fibre to it and toughening it by shaping it under 2,000 ton hydraulic presses. We are the only makers of solid forged frames for trucks—frames that are safe and sound for all time.



Sectional View of Equalizing Spring Link and Relative Parts

A—Equalizing Spring Link.
B—Truck Side Frame.
C—Equalizing Spring Cap.
D—Equalizing Spring Bolt.
E—Equalizing Spring Seat.
F—Ends of Elliptical Springs.
H—Rocker Casting.
I—Equalizing Spring Bolt Nut. (Top of Nut is shaped like top of Rocker Casting, to which it is set at right angles).
K—Equalizing Spring Link Nut.



Brill Truck 27-G (Patented). For City and Suburban Service

THE SPRAGUE-GENERAL ELECTRIC

SYSTEM OF

MULTIPLE UNIT CONTROL

FOR ELECTRIC TRAINS

Has been adopted exclusively by The New York Underground Railway (Interborough Rapid Transit Company), after exhaustive and impartial tests, on account of its

1—Safety to Passengers and Employees
2—Reliability of Service
3—Comfort to Passengers
4—Economy of Power
5—Low Cost of Maintenance
6—Simplicity

GENERAL ELECTRIC COMPANY

GENERAL OFFICE

Schenectady, N. Y.

New York Office: 44 Broad Street

SALES OFFICES IN ALL LARGE CITIES

FOR GREAT BRITAIN AND IRELAND:

The British Thomson-Houston Co., Ltd.
Rugby and 83 Cannon St., London, E. C.

THE FOLLOWING ELECTRIC RAILWAY COMPANIES ARE OPERATING OR HAVE ORDERED THIS FORM OF EQUIPMENT:

Athens & Piræus Railway, Athens, Greece.
Aurora, Elgin & Chicago Railway, Chicago, Ill.
Baltimore & Ohio Railroad, Baltimore, Md.
Boston & Albany Railroad, Boston, Mass.
Boston Elevated Ry., Boston, Mass.
Boston & Maine R. R., Concord, N. H.
Boston & Worcester Street Ry. Co., Boston, Mass.
Boston & Worcester Electric Railway, Worcester, Mass.
Brooklyn Rapid Transit Co., Brooklyn, N. Y.
Butte Electric Railway, Butte, Mont.
Canton & Akron Railway, Canton, Ohio.
Central London Railway, London, England.
Chemin de Fer de L'Ouest, France.
Chesapeake Transit Co., Chesapeake, Md.
Chicago, Burlington & Quincy R. R., Deadwood, S. D.
Columbus, Buckeye Lake & Newark Railway, Columbus, Ohio.
Columbus, London & Springfield Railway, Columbus, Ohio.
Columbus, Delaware & Marion Railway, Columbus, Ohio.
Dayton, Lebanon & Cincinnati Railway, Dayton, Ohio.
Denver & Northwestern Railway, Denver, Col.
Detroit & Chicago Railway, Detroit, Mich.
Henry A. Everett, Cleveland, Ohio.
Fonda, Johnstown & Gloversville Railway, Gloversville, . Y.
Great Northern & City Railway, London, England.
Houghton County Railway Co., Hancock, Mich.
Indianapolis & Northwestern Traction Co., Indianapolis, Ind.
International Railway Co., Buffalo, N. Y.
Interborough Rapid Transit Co., New York, N. Y.
Kobu Railway, Kobu, Japan.
Lake Shore Electric Railway, Toledo, Ohio.
Louisiana Purchase Exposition, St. Louis, Mo.
Manhattan Railway Co., New York City.
Mediterranean Railway Co., Italy.
Milwaukee Electric Railway Co., Milwaukee, Wis.
National Railway Construction Co., Boston, Mass.
New Albany Railway, New Albany, Ind.
Newark & Zanesville Railway Co., Newark, Ohio.
N. Y., N. H. & Hartford Railway, New Haven, Conn.
Northeastern Railway, England.
North Shore Railway Co., San Salito, Cal.
Northwestern Elevated Railway, Chicago, Ill.
Oakland Transit Consolidated Ry., Oakland, Cal.
Paris Metropolitan Tramway Co., Paris.
Paris-Orleans Railway, Paris, France.
Prussian Government Railway, Berlin, Germany.
Rochester & Eastern Railway, Rochester, N. Y.
Saginaw Valley Traction Company, Saginaw, Mich.
Schenectady Railway Co., Schenectady, N. Y.
Scioto Valley Pool Co., Columbus, Ohio.
Seattle & Tacoma Interurban Railway, Seattle, Wash.
South Side Elevated Railway Co., Chicago, Ill.
Underground Electric Railways Ltd., London, England.
Union & Glens Sps. Railway, Union, S. C.
Wilkes-Barre & Hazelton Railway, Wilkes-Barre, Pa.

This makes a total of Fifty-four roads with 2,470 equipments up to December Fifteenth, nineteen hundred and three.

INDEXED

DIGEST IN GERMAN AND FRENCH

OF THE ISSUES OF

JAN. 9, JAN. 16, JAN. 23, JAN. 30 and FEB. 6.

INHALTS - VERKÜRZUNG.

Ausgabe vom 9. Januar.

Editorielle Notizen. . . . . [Seite 53.]

Die erste editorielle Notiz spricht sich gegen die Eile aus, mit welcher die erste Vermessung elektrischer Linien vorgenommen wird. Die nächste bezieht sich auf das überall wachgerufene Interesse an Einphasenmotoren und bespricht die Thatsache, dass noch ein bedeutender Fabrikant von elektrischen Apparaten bald einen kommerziellen Einphasenmotor ankündigen wird. Sodann folgt eine kurze Bezugnahme auf die Thatsache, dass Ueberlandbahnen ihren Fahrplan bei sehr kaltem Wetter besser als Dampfbahnen einzuhalten im Stande sind. Daran schliesst sich ein langer Leitartikel über die Gründe, welche die Inhaber der New York Central Railroad bewogen, auf ihrem New Yorker Terminus Gleichstrom- anstatt Wechselstrom-Lokomotiven einzuführen. Einer der Hauptgründe besteht darin, dass die Schnellverkehrslinien der Stadt New York jetzt mit Leitungsschienen-Gleichstrom ausgerüstet sind und die New York Central einen ergänzenden Teil dieser Bahnnetze bilden sollte. Ob dies in der That der Fall sein wird, ist eine Frage, welche die finanziellen Interessen entscheiden müssen, indessen wünschten die Ingenieure kein unüberwindliches Hindernis für den wechselseitigen Verkehr von Motorzügen zu schaffen. Einen weiteren Grund bildete der Umstand, dass die Aenderung bezüglich bewegender Kraft schnell vor sich gehen musste, da diese Stammlinie, welche die einzige ist, die innerhalb der Stadt New York einen Bahnhof besitzt, eine lange Verzögerung, welche die eventuelle Unvollständigkeit des Einphasensystems nach sich ziehen konnte, nicht wagen durfte. Dies enthält keine Kritik des Wechselstromsystems, sondern bildet die notwendige Folge der Thatsache, dass mit dem Wechselstromsystem noch kein Versuch in grossem Massstabe angestellt worden ist. Ebenso wenig involviert das oben Gesagte einen Präcedenzfall für andere Strecken des Bahnnetzes. Auch scheinen sich aus Konstruktionsgründen grosse Schwierigkeiten bei Installierung einer oberirdischen Leitung im Tunnel geltend zu machen. Sonstige technischen Gründe, welche bei dem Entschlusse der New York Central ins Gewicht fielen, waren das grössere Gewicht von Wechselstrom-Lokomotiven, die ausgedehntere Instandhaltung, besonders beim Triebwerk, indem die Gleichstrommotoren keine Uebersetzung besitzen, und ferner die grössere Entwertung, wenn die Apparate mechanischer Aenderungen wegen abgeschafft werden. Jeder dieser Punkte erfährt eine eingehende Besprechung.

Elektrische Ausrüstung der North-Shore Bahn in der Nähe von San Francisco. II. . . . . . . [Seite 56.]

Die Gesellschaft besitzt für den Notfall eine Dampfkraftstation nebst Reserve- und Hülfsdienst und erhält ausserdem Energie zu 40000 Volt von einer 240 km entfernten Wasserkraftanlage. Dies ist die längste regelrechte Uebertragung elektrischer Energie in Amerika. Das Dampfkraftwerk erfährt eine nähere Beschreibung. Als Brennmaterial verwendet man Petroleum, und ist bei den benutzten Brennern als neu hervorzuheben, dass sie ihre Flamme von der Rückseite nach der Vorderseite des Kessels hin — anstatt in umgekehrter Richtung — abgeben, was verschiedene Vorteile mit sich bringt. Das für das Oel eingeführte Rohrleitungssystem wird eingehend beschrieben, ebenso auch die Wirkung der Benutzung von Oel anstatt von Kohlen auf die Höhe und den Durchmesser des verwendeten Schornsteins. Bei einer der Dampfmaschinen kommt Seilbetrieb zur Anwendung. Das Diagramm der Drahtleitung für die Unterstation ist auf S. 60 wiedergegeben. Motordynamos gelangen zur Verwendung und werden zu 60 Perioden betrieben. Die Art und Weise der Kontrolle des 40000 Volt starken Stromes, welcher in die Station geleitet wird, erfährt eine eingehende Beschreibung. Man verwendet eine geschützte Leitungsschiene sowie eine für diesen Schienentyp geeignete Kontaktvorrichtung. Die Bahnwagen sind mit der Parallelschaltungskontrolle Typ M ausgerüstet. Gewöhnlich besteht der Zug aus zwei Motorwagen und drei Anhängewagen, und beläuft sich das Gewicht jedes Bahnwagens auf ca. 300 t. Das Blocksignalsystem ist vollständig neuartig und gleicht beinahe demjenigen, welches man bei der New Yorker Tunnelbahn einführen will. Im Prinzip ähnelt es dem auf der Bostoner Hochbahn benutzten, wobei eine Laufschiene in Sektionen geteilt ist und wobei diese Sektionen durch die Achsen des Zuges kurzgeschlossen werden. Bei der Bostoner Hochbahn war die Möglichkeit vorhanden, für den lokalen Signaldienst Gleichstrom zu verwenden, und zwar in Folge der verhältnismässig kurzen Strecke der Linie und des Vorhandenseins der stählernen Hochbahnstruktur. Bei der in Rede stehenden kalifornischen Linie war dies nicht möglich, so dass man zum Bethätigen der Signale Wechselstrom benutzt. Die Spannung beträgt 9 bis 15 Volt, und bethätigt ein Kurzschluss zwischen der in Sektionen geteilten Laufschiene und der ununterbrochenen Laufschiene ein am Fusse des Signalturmes befindliches Wechselstromrelais; dieses Relais ist so gestellt, dass es bei 0,1 Amp. arbeitet und den Momentausschalter eines kleinen achtvoltigen Gleichstrommotors, der die optischen Telegraphensignale bethätigt, öffnet oder schliesst. Der betreffende Motor wird mittelst Akkumulatorenbatterien betrieben. Ausser den optischen Telegraphensignalen kommen auch noch Lichter zur Verwendung.

Die Beaufsichtigung von Schaffnern wegen des Unterlassens der Registrierung von Fahrgeldern. . . . . [Seite 68]

Die hauptsächlichsten Kniffe, welche Schaffner beim Betrügen der Gesellschaft durch Nichtregistrierung von Fahrgeldern anwenden, ausserdem auch die besten Mittel, diesen Betrügereien auf die Spur zu kommen, werden beschrieben.

Eine Explosion in St. Louis. . . . . . . [Seite 69.]

In dem Kraftwerk der St. Louis Transit Co. fand am 1. Dezember eine Kesselexplosion statt, bei welcher sechs Leute ums Leben kamen und mehrere andere verletzt wurden.

Die Wirkung häufigen Anhaltens bei Ueberlandbetrieb. Von A. H. Armstrong. . . . . . . [Seite 70.]

Zunächst taxiert der Verfasser die PS, die erforderlich ist, um einen 35 t schweren Bahnwagen bei einer fahrplanmässigen Fahrgeschwindigkeit von 40 km die Stunde mit verschiedenmaligem Anhalten pro 1,609 km von 0 bis 1,2 zu betreiben. Sodann giebt er eine Veranschlagung der Kwstunden sowie der Kosten für dieses verschiedenmalige Anhalten. Weiter nimmt er für denselben Bahnwagen den Fall an, wenn derselbe für eine maximale Fahrgeschwindigkeit von 72 km die Stunde mit Uebersetzung sowie mit einer Ausrüstung von 300pferdigen Motoren versehen ist, und zeigt, was die fahrplanmässige Fahrgeschwindigkeit sein wird und wie viel die Kwstunden pro Tonnenmeile für das verschiedene Anhalten pro 1,609 km betragen werden. Dies weist auf die Notwendigkeit einer Verringerung des Anhaltens hin, und kann Letzteres auch durch Bauen einer Linie, wobei man Kurven vermeidet, verbessert werden.

Meilenbücher auf Ueberlandbahnen. . . . . [Seite 71.]

In Ohio gelangen von Seiten mehrerer Ueberlandbahnen auswechselbare Meilenbücher zur Ausgabe, die auch auf anderen Linien, die eine Vereinbahrung unter sich getroffen haben, gültig sind. Diese Bücher besitzen für 800 km Gültigkeit und werden ungefähr zu 3,2 Pf. pro km abgegeben.

Speiseleitungsröhren-Konstruktion in Brooklyn. . [Seite 72.]

Illustrationen veranschaulichen ein Verfahren zur Herstellung von Verbindungen zwischen Untergrund-Speiseleitungen und der Hochbahn- sowie Brückenstruktur in Brooklyn.

Westinghouse-Parsons-Turbinensätze von 5000 kw Leistung. [Seite 73.]

Kontrakte für diese Maschinengrösse sind von zwei amerikanischen und einer englischen Bahngesellschaft eingelaufen. Die Turbine, welche einen Flächenraum von 8,43 bei 4 m einnimmt und eine Höhe von 3,66 m besitzt, läuft zu 750 U. i. d. M. Sie lagert auf einer einzelnen Lagerplatte mit zwei Sektionen. Die Welle ist hohl geschmiedet, und wird Energie auf den Dynamo durch eine biegsame Kuppelung übertragen. Der Durchmesser der Welle am Lager beläuft sich auf 381 mm. Zur Erhöhung der Leistung der Turbine kann man der zweiten Stufe der Turbine Hochdruckdampf zuführen. Der für die Turbine verwendete Dynamo besitzt ein aus einem soliden Stahlcylinder hergestelltes Feld, und können diese Dynamos nach Belieben für irgend eine Spannung bis zu 15000 Volt gebaut werden.

Selbstverfertigte Blitzschutzvorrichtungen. . . [Seite 75.]

Es ist dies eine Magazin-Blitzschutzvorrichtung, bei welcher, wenn die eine Abschmelzsicherung ausbrennt, der Arm auf eine zweite Abschmelzsicherung fällt. Indessen hat man eine Vervollkommnung eingeführt, mittelst deren die Bewegung des Armes durch eine in Oel arbeitende Stossbremse kontrolliert wird, in Folge dessen der Arm langsam nach unten fällt.

Durch den New Yorker Tunnel auf Draisinen. . [Seite 75.]

Die Abbildung zeigt den Bürgermeister von New York, den Kontraktor McDonald und andere prominente Gäste, wie sie am 1. Januar auf Draisinen die erste Fahrt durch den New Yorker Tunnel unternehmen.

Kombinierter Schneeflug und Güterwagen. . . [Seite 76.]

Der betreffende Wagen wiegt ohne Motoren ca. 1100 kg. Im Sommer können die Schneepflüge abgenommen und der Kasten zum Befördern von Frachtgut verwendet werden.

Eine Kombination von Rad- und Gleisbremse. . [Seite 76.]

Dieser Schuh fällt vorn am Rade nach unten und bildet so eine kombinierte Schuh- und Gleisbremse.

Sichtbare Bahnwagenschilder. . . . . . . [Seite 77.]

Derartige Schilder sind aus Holz hergestellt, wobei man die Buchstaben und die so entstandenen Lücken hinten mit einem durchsichtigem Material bedeckt hat, welches das Licut ohne blendenden Glanz durchscheinen lässt. Ausserdem sind sie schwarz angestrichen, und da die Buchstaben sämtlich weiss sind, kann man die Schilder sowohl am Tage als auch zur Nachtzeit deutlich lesen.

Kommutator-Abschleifapparat. . . . . . [Seite 77.]

Diese Maschine kann an einem Dynamo befestigt und in irgend welche Stellung gebracht werden.

Senkrechtes Bremshandrad. . . . . . . [Seite 78.]

Dasselbe soll, wie geltend gemacht wird, wünschenswerter als der gewöhnliche Griff sein, nimmt ausserdem auch nur einen sehr kleinen Raum ein.

Neue Bahnvorschriften für New York. . . . [Seite 82.]

Die betreffenden Vorschriften bilden einen Teil der soeben in der Stadt New York angenommenen Ordinanzen und beziehen sich auf die Bewegung aller auf den Strassen verkehrenden Fahrzeuge. Paragraph 1 bis 13 beziehen sich auf gewöhnliche Fahrzeuge; Paragraph 14 verlangt, dass Strassenbahnwagen auf der nahen Seite der Strasse — anstatt wie früher auf der entfernteren Seite — anhalten, um Fahrgäste aus- und einsteigen zu lassen; die übrigen Paragraphen betreffen die Benutzung der Strassen seitens anderer Fahrzeuge.

Ausgabe vom 16. Januar.

Editorielle Notizen. . . . . [Seite 87.]

Die erste editorielle Notiz behandelt das Thema über übliche Werkstattverfahren, ein Thema, welches auf der nächsten Jahresversammlung der Master Mechanics' Association zur Erörterung gelangen soll; obgleich in gewissem Sinne ein Gegenstand für Rechnungsführer, steht es doch mit der Thätigkeit des Werkführers in naher Verbindung und sollte nach Ansicht der Redakteure zuerst von jener Körperschaft zur Debatte herangezogen werden. Die folgende editorielle Notiz betrifft das Gesuch der Bahnmeister behufs Aufnahme in den Verein der Werkmeister. Letztere jedoch erklären, dass die ihnen zur Verfügung stehende Zeit es ihnen nicht gestattet, dieser Angelegenheit näher zu treten. Eine weitere editorielle Notiz befasst sich mit der Verminderung des Verkehrsandrangs in Chicago, woran sich ein Leitartikel über halb verwandelbare Bahnwagen anschliesst, denen das höchste Lob gezollt wird; doch sollte man dieselben nicht als vollständigen Ersatz für den offenen Bahnwagen ansehen. Die letzte editorielle Notiz betont die Wichtigkeit der Verminderung des oftmaligen Anhaltens- und langsamen Bergabfahrens, wenn Eilfahrgeschwindigkeit verlangt wird, und liefert einen Kommentar zu dem von Herrn A. H. Armstrong gehaltenen Vortrage, der in der Nummer vom 9. Januar veröffentlicht worden ist.

Elektrische Ueberlandbahn im westlichen New York. [Seite 90.]

Beschrieben wird in diesem Artikel eine neue Ueberlandbahn von Rochester nach Geneva, wovon ungefähr zwei Drittel fertiggestellt und bereits im Betrieb sind. Das Unternehmen ist vor Allem deshalb interessant, weil die Bahn mit einer bereits vorhandenen Dampfbahn, auf welcher täglich 22 Züge zwischen den Endpunkten der elektrischen Bahn für Lokaldienst verkehren, in direkten Mitbewerb tritt. Indessen gewährt die neue Bahn viele Vorteile und zwar in der Form eines häufigen Dienstes, einer kürzeren Zeit und eines niedrigeren Tarifs. Ausserdem hat die Gesellschaft der elektrischen Bahn mit der lokalen Bahngesellschaft von Rochester eine Vereinbarung getreffen, welche jener erlaubt, den Mittelpunkt des Geschäftsviertels zu befahren, wogegen Fahrgäste der Dampfbahnlinie in beträchtlicher Entfernung von dem Mittelpunkte der Stadt abgesetzt werden. Die elektrische Bahn läuft zum grössten Teil über eigenes Wegerecht, und sowohl Linienkonstruktion wie auch Oberbau bilden ein vortreffliches Beispiel eines modernen Ueberlandbaues. Auf der Bahnlinie sind 16 Stahlbrücken und fünf Bahnkreuzungen mit einer Absperrung von den Steigungen vorhanden. Die Uebertragungslinie besteht aus gedrehten Aluminiumdrähten, die auf Locke'schen 40000Volt-Glasisolatoren geleitet sind, während die Speiseleitungslinie, ebenfalls aus gedrehtem Aluminiumdraht bestehend, 500000 Kreismils Kupfer gleichkommen. Die Kraftanlage enthält zwei direkt gekuppelte Wechselstrommaschinen von je 650 kw Leistung sowie zwei rotierende Umformer und vier Transformatoren von je 500 kw Leistung. Auch sind an der Linie drei Unterstationen vorhanden, von denen jede zwei rotierende Umwandler von je 300 kw und drei gewöhnliche Transformatoren von je 200 kw Leistung nebst den üblichen Hülfsapparaten enthält. Die anfängliche Ausrüstung umfasst sechs grosse Personenwaggons für Ueberland-Eildienst, einen Ruggles-Eilschneepflug mit Doppelwirkung, zwei Eilgutwaggons sowie einen Konstruktions- und Reparaturwagen. Zu dem Ganzen sollen noch acht weitere Personenwaggons, die jetzt im Bau begriffen sind, hinzukommen. Die Gesellschaft hat bereits eine vortreffliche Bahnwagenremise sowie Reparaturwerkstätte mit den notwendigen Werkzeugmaschinen nebst Fazilitäten zum Nachsehen und zur Vornahme von Reparaturen vorgesehen und geht mit dem Gedanken um, sich auch mit der Beförderung von Eilgut zu befassen, sobald die östliche Strecke der Linie fertiggestellt ist.

Ordinanz betreffs des Haltens an der nahen Ecke der Strassenseite in New York. . . . . . . [Seite 99.]

Seit die Vorschrift, welche das Anhalten der Bahnwagen in New York auf der nahen Seite der Strassenecke verfügt, in Kraft getreten ist, war das Wetter äusserst unfreundlich, in Folge dessen sich eine grosse Unzufriedenheit seitens des Publikums über diese Verordnung kundgab.

Vervollkommnungen in Belfast, Irland. . . [Seite 100.]

Eine Karte des Trambahnnetzes von Belfast, welches jetzt noch mit animalischer Kraft betrieben wird, gelangt zur Veröffentlichung; ausserdem wird die geplante Ausrüstung beschrieben, deren Kosten sich auf ca. Mk. 4000000 belaufen werden.

Aufzeichnungskarten, wie sie in den Reparaturwerkstätten zu Rochester zur Verwendung gelangen. . [Seite 100.]

Die Form einer Aufzeichnungskarte für die Handwerker-Abteilungen ist abgebildet. Diese Karten werden ausgefüllt, von dem Vormann der Werkstätte unterzeichnet und von dem Werkmeister in regelmässiger Ordnung aufbewahrt, wodurch es ihm ermöglicht wird, sich über die Anzahl der Reparaturen sowie über die Art der Arbeit, wie sie an jedem Bahnwagen, welcher durch die Werkstätten geht, vorgenommen ist, auf dem Laufenden zu halten.

Eventuelle Verwendung der Einphasenbahn. Von A. H. Armstrong. . . . . [Seite 102.]

Der Verfasser, einer der Ingenieure der General Electric Co., zieht den Einphasenmotor für schweren Betrieb in Betracht, für welchen Zweck er denselben als sehr geeignet empfiehlt. Fig. 1 giebt Zugfrictionsbelastungen für Züge verschiedenen Gewichts bei verschiedener Fahrgeschwindigkeit. Er vergleicht die Kosten des Dampfbetriebs mit denen des Elektromotors und zwar mit Kohlen zu verschiedenen Preisen, führt auch ein Beispiel an, welches auf 160 km Gleis mit einem einfachen Kraftwerk mit Niederspannungs-Umformer-Stationen, die 20 km von einander entfernt liegen, und mit 3000 Volt Spannung am Fahrdraht basiert ist.

Die Kosten für Dampfbetrieb erhellen aus Fig. 2 und solche für elektrischen Betrieb aus Fig. 5. Wo der Fahrplan nicht sehr viele Züge d. h. fünf Züge oder weniger pro Tag aufweist, ist Elektrizität nicht zu empfehlen.

Zum Betreiben der Bahnwagen erforderliche Energie. [Seite 106.]

Statistiken aus einem kürzlich erschienenen Bericht der Bahnkommission werden angeführt und lassen die durchschnittlichen kw pro Bahnwagen der Niveaubahnen New Yorks sowie der Niveau- und Hochbahnen Brooklyns ersehen.

Neue Bahnwagenwerkstätten im Süden. . . [Seite 107.]

Zur Beschreibung gelangen einige Bahnwagenwerkstätten in Nord-Carolina.

Gasproduktion für Gasmaschinen. . . . . [Seite 108.]

Der Artikel enthält die Beschreibung eines Verfahrens zum Erzeugen von Gas, welches sich für Gasmaschinen und anderen Betrieb eignet. Jeder Satz besteht aus zwei Dynamos und einem Röhrenkessel. Bei den Dynamos kann man Brennmaterial beliebiger Art verwenden, und sind dieselben so eingerichtet, dass sie Generatorgas abgeben, wenn man dasselbe sich mit Luft, die mittelst des nach unten gehenden Zugs durch das Brennmaterial gepresst wird, vermischen lässt. Das erzeugte Gas strömt durch ein besonderes Ventil, den Kessel und Reinigungsapparat und wird von da nach einem Gasbehälter geleitet. Sobald das Brennmaterial den Punkt der Glühhitze erreicht hat, wird Dampf zu den Dynamos hinzugelassen, dessen Zersetzung die Bildung von Wassergas bewirkt, welches einem anderen Gasbehälter zugeführt wird. Mit Hülfe eines Mischungsventils kann man die erzeugten Gase in jedem beliebigen Verhältnis mischen.

Verwandelbare Bahnwagen für Austin, Texas. . [Seite 109.]

Artikel und Abbildung beziehen sich auf verwandelbare Bahnwagen, die besonders interessant sind, weil sie mit abnehmbaren Vorräumen, die zugleich Doppelschiebethüren besitzen, versehen sind. Wenn man die Vorräume abnimmt, so wird ein Scheerenverschluss, der — falls man es wünscht — den Zugang absperrt, an dem Wagenkasten befestigt.

Ein neuer Metall-Schmelzofen. . . . . [Seite 109.]

Artikel und Illustrationen beziehen sich auf einen Schmelzofen für Metall, der aus einer Stahlblech-Trommel, die gusseiserne Verschlüsse besitzt, hergestellt ist. Das Innere ist mit feuerfesten Ziegeln gefüttert, und befinden sich an den entgegengesetzten Seiten der Trommel zwei Oeffnungen, von denen jedesmal nur die eine benutzt wird, während man die andere durch eine Ausfüllung von feuerfestem Thon verschlossen hält. Der Vorzug eines derartigen Ofens besteht darin, dass man, wenn das eine Füllloch unbrauchbar geworden ist, dasselbe durch Ausfüllen mit feuerfestem Thon sowie einer Platte verschliessen, den Ofen umdrehen und die andere Oeffnung verwenden kann. Ein Oelbrenner liefert die erforderliche Hitze.

Bahnschwellen aus Zement. . . . . . [Seite 110.]

Die betreffende Schwelle ist aus einer stählernen, in Zement gebetteten Winkelstange hergestellt und bei einer Dampfbahn probeweise in Benutzung, wo täglich 20 Lokomotiven darüberfahren müssen. Zwischen Schiene und Schwelle legt man einen Holzstreifen.

Aus acht Wagen bestehender Schnellzug für den New Yorker Tunnel. . . . . [Seite 110.]

Diese Bahnwagen haben je eine Länge von 15,25 m, so dass ein kompletter Zug 142 m Länge besitzt. Ein derartiger Zug würde 461 Fahrgästen Sitzplätze gewähren. Die Schnellzüge sollen aus je 8 Bahnwagen und die gewöhnlichen Züge aus 5 Bahnwagen bestehen.

Jahresbericht der Bostoner Hochbahngesellschaft. . [Seite 112.]

Die genannte Gesellschaft betreibt fast sämtliche Niveau- und Hochbahnwagen in Boston. Der Bericht bezieht sich auf das am 30. September 1903 zu Ende gegangene Jahr.

Ausgabe vom 23. Januar.

Editorielle Notizen. . . . . [Seite 123.]

Die ersten beiden editoriellen Notizen handeln über die Konkurrenz zwischen Dampfbahnen und elektrischen Ueberlandbahnen, woran sich dann eine editorielle Notiz über die Wegschaffung von Schnee schliesst; hierbei wird hervorgehoben, dass ein häufiger und prompter Dienst mit Schneeflügen und Kratzeisen notwendig ist. Die letzte editorielle Notiz erörtert die Frage betreffs mechanischer Beschickung, und wird die Ansicht ausgesprochen, dass mechanische Beschickungsapparate nicht besser als erster Klasse Handbeschickungsapparate sind, indessen einen gleichmässigeren Dienst als die durchschnittlichen Handbeschickungsapparate gewähren.

Von Indianapolis nach Nordwesten sich erstreckendes Bahnnetz. [Seite 126.]

Es ist dies eine der bedeutendsten Ueberlandbahnlinien in Indiana, welche nach ihrer Fertigstellung in Bezug auf Meilenzahl die zweitgrösste von allen denen, die jetzt ausserhalb von Indianapolis im Betrieb sind, sein wird. Die Bahnlinie berührt eine Anzahl wichtiger Punkte, zieht sich auch durch eine blühende landwirtschaftliche Gegend hin und wird von den Landleuten stark benutzt. Die Luftleitungsanlage und der Oberbau gehören dem üblichen Normaltyp an. Die Zentrale umfasst zwei Cross Compound-Maschinen mit Kondensation, welche Dreiphasendynamos von je 800 kw Leistung treiben. Energie wird zu 370 bis 400 Volt an das Wechselstromende der in dem Kraftwerk befindlichen rotierenden Umwandler abgegeben, welche zur Speisung der in der Nähe des Kraftwerks gelegenen Trolleylinien verwendet werden. Die übrige Energie wird von drei spannungserhöhenden Transformatoren von je 300 kw Leistung entnommen, welche die Spannung auf 2600 Volt bringen, zu welcher Spannung die Energie auf die Unterstationen behufs Verteilung übertragen wird. Die gewöhnlichen Personenwaggons, die zur Verwendung gelangen, sind ungewöhnlich gross, indem sie 20 m lang, 3 m breit sind und Sitzplätze für 60 Fahrgäste aufweisen.

Ueberlandbahn-Entwickelung in Indiana i. J. 1903. [Seite 131.]

Die Meilenanzahl der Ueberlandlinien, die von Indianapolis ausgehen, hat im Laufe des vorigen Jahres beinahe um 100 Prozent zugenommen, ohne dass dabei mehrere grosse Projekte, deren Ausführung jetzt ins Werk gesetzt ist, in Betracht gezogen werden. Wenn diese im Bau begriffenen Linien fertiggestellt sind, hat sich die Länge der Bahnlinie seit dem 1. Januar 1902 verdoppelt. Gegenwärtig fahren täglich 153 Personenwaggons in Indianapolis ein; dieselbe Anzahl Bahnwagen verlässt auch die Stadt, und dazu kommen noch 20 regelmässig verkehrende Güterwagen. Im vergangenen Jahre wurden 2250000 Fahrgäste nach der Stadt befördert, und betrugen die Betriebskosten 45 Prozent der Einnahmen. Dann folgen noch Statistiken über andere von Indianapolis ausgehende Ueberlandbahnen.

Bericht der Techniker-Kommission über die Pariser Untergrundbahn-Katastrophe. . . . . . . [Seite 132.]

Der Befund der Kommission, welche die Bahnkatastrophe auf der Stadt Untergrundbahn im letzten August in der Absicht, einer Wiederholung einer derartigen Katastrophe vorzubeugen, untersuchte, ist in neun Paragraphen zusammengefasst.

Mechanische Beschickungsapparate vs. Handfeuerung. [Seite 132.]

Dies ist eine Besprechung der relativen Vorzüge und Ersparnisse der beiden Beschickungssysteme beim Feuern und wurde dieselbe durch eine im STREET RAILWAY JOURNAL vom 24. Okt. erschienene editorielle Notiz über Beschickungsapparate veranlasst. Der Verfasser ist der Ansicht, dass die besonderen Vorzüge mechanischer Beschickungsapparate in grossen Kraftwerken zu Tage treten, wo sich die Arbeit von Handbeschickungsapparaten nicht so gut wie in kleinen Anlagen überwachen lässt und wo demnach ein unwirksamerer Dienst die Folge sein würde.

Jahresbericht der Bahnkommission des Staates New York. [Seite 134.]

Statistiken, das verschiedene Eigentum im Staate New York betreffend, werden angeführt. Der Bericht besagt, dass das Eigentum, was Oberbau und rollendes Material anbelangt, sich in besserer Verfassung als je zuvor befindet, und enthält der Bericht auch eine Reihe Empfehlungen zur Verhütung von Unfällen.

Jahresbericht der Bahnkommission von Massachusetts. [Seite 135.]

Statistiken sowie Empfehlungen werden mitgeteilt. Bei den Letzteren bemerkt die Kommission, dass elektrische Ueberlandbahnen das Recht über eine sehr grosse Domaine besitzen sollten.

Kraftwerk der Interborough Rapid Transit Co. von New York. [Seite 137.]

Dieses Kraftwerk wird eine Leistung von 130000 PS besitzen, und werden nähere Einzelheiten über Konstruktion der Fundamente sowie des Gebäudes mitgeteilt. Es sind dort fünf Schornsteine und neun Dampfmaschinen von 8000 bis 10000 PS Leistung vorhanden, von denen jede mit einer Wechselstrommaschine von 5000 kw gekuppelt ist. Die Dampfmaschinen besitzen horizontale Hochdruckcylinder und vertikale Niederdruckcylinder. Weiter befinden sich dort vier 2000PS-Dynamos für Beleuchtungszwecke.

Weitere Ausdehnung des Packetbeförderungs-Geschäfts in Cleveland. . . . . [Seite 140.]

Das Packetbeförderungs-Geschäft, welches man in Cleveland mittelst elektrischer Bahnwagen ins Werk gesetzt hat, hat sich als äusserst erfolgreich erwiesen und will man nunmehr binnen kurzer Zeit einen Waarenspeicher errichten.

Gleis und Schutzschiene in Zossen. . . . [Seite 140.]
Die auf der Zossener Eilbahn verwendete Schutzschiene, welche sich über die ganze Linie hin erstreckt, ist im Profil wiedergegeben

Einphasen-Bahnwagen im Osten Pittsburgs. . [Seite 141.]
Die betreffende Linie befindet sich in den Werken der Westinghouse Co., und sind Diagramme des Kontrollers sowie der Motorkupplungen dem Artikel beigegeben; ausserdem enthält der Artikel auch eine kurze Beschreibung des Motors.

Das Betriebs-Kraftwerk auf der St. Louis'er Ausstellung. [Seite 143.]
Ausser den Dampfmaschinen, die in St. Louis ausgestellt werden und zugleich im Betrieb sein sollen, haben die Behörden behufs Verwendung während der Ausstellung vier 2000kw-Einheiten zu 25 Perioden, Dreiphasen-6600 Volt, installiert. Die elektrotechnische Ausstellung in St. Louis wird auch mehrere 2000PS-Induktionsmotoren für Pumpendienst in sich begreifen.

Der Zonenplan für Cleveland. . . . . [Seite 145.]
Auf Anregung der städtischen Behörden haben sich die Bahnen in Cleveland thatsächlich entschlossen, den einheitlichen Tarif in einen Zonentarif umzuändern, wonach das Fahrgeld 3c. (12 Pf.), 5 c. (20 Pf.) und 7 c. (28 Pf.) betragen soll. Die längste mögliche Fahrt für 3 c. (12 Pf.) wird 14 km betragen. In Anbetracht der Herabsetzung des Tarifs hat sich die Stadt zur Aufhebung gewisser Steuern verpflichtet. Mehrere beigefügte Berechnungen lassen die Einnahmen an Fahrgeldern, die man eventuell erwarten kann, ersehen.

Wagenschuppen, durch Feuer zerstört. . . [Seite 147.]
Es war dies eine alte Wagenremise in Brooklyn, die früher für Pferdebahnwagen und später dann zu Magazinzwecken benutzt wurde.

Bahnwagen mit Vorräumen in Buffalo. . . [Seite 147.]
Die betreffenden Bahnwagen besitzen je eine Kastenlänge von 7,93 m.

Bahnwagen-Ventilierung. . . . . . . [Seite 147.]
In Camden, N. J., hat man mit einem Bahnwagen-Ventilationssystem Versuche angestellt, bei dem sich der Luftwechsel ohne Zug vollzieht.

Automatische Weiche. . . . . [Seite 148.]
Unter dem Bahnwagen befindet sich ein Räderpaar, welches die Weiche auf mechanischem Wege in Thätigkeit setzt.

Selbstfahrerzug in Paris. . . . . . . [Seite 149.]
Ein derartiger Zug wird mit Hülfe einer Gasolinlokomotive, welche die Räder sämtlicher Anhängewagen treibt, fortbewegt. In Folge eines gewissen Kuppelungssystems müssen alle Bahnwagen genau der Spur der Lokomotive folgen. Eine Versuchsfahrt damit hat am 24. Dezember stattgefunden.

Halb verwandelbare Bahnwagen für Burlington, N. J. [Seite 149.]
Die betreffenden Bahnwagen haben je einen 8,54 m langen Wagenkasten.

Ausgabe vom 30. Januar.

Editorielle Notizen. . . . . [Seite 159.]
Der erste Leitartikel enthält einen Kommentar zu zwei in der betreffenden Nummer veröffentlichten Briefen, deren Inhalt sich auf die geplante Organisierung eines Vereins der Gleisingenieure bezieht; die nächste editorielle Notiz handelt über den Verkehr auf der Manhattan Hochbahn, welche vor Kurzem an mehreren Tagen mehr als 1000000 Fahrgäste beförderte. In den Tagen des grössten Verkehrs, als man noch Dampfkraft verwendete, ist hier niemals diese Zahl erreicht worden. Bei Verwendung der Dampfkraft betrug die höchste Anzahl der Züge, die an einer Station anhielten, ungefähr 40; in Folge der Einführung von Elektrizität vermag man 60 Züge die Stunde an einem gegebenen Punkte vorbeipassieren zu lassen. Eine weitere editorielle Notiz betrifft die Ordinanz, welche verlangt, dass Strassenbahnwagen an der nächst liegenden Ecke anhalten sollen; dieselbe ist jetzt in Kraft und hat zu vielfachen Klagen seitens des Publikums Anlass gegeben. Sodann folgen zwei kurze editorielle Notizen, von denen die eine über Kuhfänger für Ueberlandbahnwagen und die andere über munizipales Eigentumsrecht handelt. Die letzte editorielle Notiz bezieht sich auf Schlafwaggons auf elektrischen Bahnen.

Vervollkommnung in der Ausrüstung des Kraftwerks des Cleveland- und Südwest-Bahnnetzes. . . . [Seite 162.]
Diese Anlage ist deshalb von besonderem Interesse, weil die neuen Maschineneinheiten, wovon jetzt eine mit Erfolg im Betrieb ist, eine der ersten Dampfturbinen-Installierungen für elektrischen Bahnbetrieb in diesem Lande repräsentieren. Eine grosse Strecke dieses Bahnnetzes ist für das Starkspannungs-Wechselstromsystem vorgesehen und will man eventuell die gesamte Bahn nach diesem System betreiben; gegenwärtig indessen verwendet man auf einem Teil des Bahnnetzes noch Gleichstromübertragung. In der Zentrale nehmen die Gleichstrom-Maschinensätze von annähernd 1000 kw Leistung zweimal so viel Raum ein, wie ihn die dort befindliche Turbinenausrüstung erfordert, obgleich letztere die doppelte Leistung, nämlich 2000 kw, besitzt. Die Turbinen gehören dem Vielfach-Expansions-Parallelflusstyp, System Westinghouse-Parson, an. Jedes System besteht aus drei selbstständigen Sektionen, nämlich dem Hochdruckcylinder, Niederdruckcylinder und dem Dynamo. Die Konstruktion dieser Maschineneinheit erfährt eine ausführliche Beschreibung, und werden von einer Reihe stattgehabter Versuche die Resultate mitgeteilt, aus denen sich die Oekonomie der Turbine in der Praxis deutlich ergiebt. Besondere Aufmerksamkeit ist den Röhrenwerkplänen und dem Kondensationsystem gewidmet. Die Kessel kann man mit oder ohne Ueberhitzer arbeiten lassen. Ausser den Unterstationen, die längs der Linie verteilt sind, besitzt die Gesellschaft auch eine transportable Unterstation, die sich zur Verringerung der übermässigen Belastung an einzelnen Punkten, wo zeitweilig ungewöhnliche Anforderungen an die Energie gestellt werden, als sehr zweckdienlich erwiesen hat.

Elektrische Ausrüstung der Bahn Lancashire-Yorkshire. [Seite 172.]
Dies ist eine der Stamm-Dampfbahnlinien in England, und hat die Strecke, die eine elektrische Ausrüstung erhalten soll, eine Länge von 38 km. An der Leitungschiene verwendet man 600 Volt mit Mehrphasenverteilung zu 7500 Volt, ausserdem auch rotierende Umwandler von je 600 kw Leistung. Der Zug besteht aus zwei Motorwagen und zwei Anhängewagen, und hat jeder Motorwagen vier Motoren von je 150 PS Leistung. Die Bahnwagen sind nach amerikanischer Art mit Gängen und Vorräumen eingerichtet. Die Motorabteile sind aus feuerfestem Material hergestellt.

Union Traction Bahnwagen in Chicago. . . [Seite 174.]
Dies sind halb verwandelbare Bahnwagen, deren Sitzplätze an jedem Ende der Länge nach angeordnet sind.

System zum Kontrollieren der Bahnwagen in Brooklyn. [Seite 175.]
Der Abstand der auf den verschiedenen Strecken verkehrenden Bahnwagen, die zwei verschiedene Punkte passieren, wird verzeichnet. Die Aufzeichnungen erfolgt auf elektrischem Wege auf einem beweglichen Zifferblatt, und sobald die Bahnwagen den Punkt passieren, drückt der Inspektor auf mehrere Knöpfe, welche wie Tasten einer Schreibmaschine bethätigt werden und eine Nadel in Thätigkeit setzen, welche den Bogen durchlöchert. Man wendet dieses System an, um bestimmen zu können, wie genau die Fahrpläne eingehalten werden.

Die Stellung der Gleisingenieure. . . . [Seite 176.]
Zwei Briefe erörtern die Frage, ob die Gleisingenieure eine Vereinigung organisieren sollen.

Halb verwandelbare Bahnwagen für Bloomington, Ill. [Seite 178.]
Der betreffende Bahnwagen besitzt eine Gesamtlänge von 12 m.

Stromabnehmer für Einphasen-Bahnwagen. . [Seite 178.]
Derselbe wird von einer Firma in der Schweiz hergestellt und besteht aus einer gekrümmten Stange, deren konvexe Fläche mit dem Energiedraht in Kontakt gebracht wird. Der Stromabnehmer vermag einen Bogen von 180° zu passieren, so dass demnach der Energiedraht sich in fast jeder beliebigen Stellung befinden kann. Zwei Diagramme sind beigefügt, welche die allgemeine Verwendung des Stromabnehmers ersehen lassen.

Halb verwandelbare Bahnwagen für Indiana. . . [Seite 179.]
Die Länge dieser Bahnwagen, von Buffer zu Buffer gemessen, beträgt 12,5 m.

Neue elektrische Untergrundbahn in Paris. . [Seite 180.]
Diese geplante Linie läuft nord- und südwärts, und ist soeben die Konzession für dieselbe bewilligt worden.

Ratschhebelwinde mit Zahnradübersetzung. . . [Seite 180.]
Mit diesem Hebebock lassen sich Gegenstände nach oben und unten winden, und wenn man das Gehäuse entfernt, sind sämtliche Teile des Apparats leicht zugänglich.

Ausgabe vom 6. Februar.

Editorielle Notizen. . . . . . . [Seite 189.]

Die erste editorielle Notiz nimmt auf den Organisations-wechsel der Public Service Corporation von New Jersey Bezug und giebt einen Kommentar zu der von der Gesellschaft eingeschlagenen Politik. Die nächste editorielle Notiz behandelt das Thema über die für Extradienst eingestellten Bahnwagen und Fahrpläne in St. Louis, wo das Verfahren von dem, welches man in jeder anderen Stadt einschlägt, vollständig verschieden ist. Während der verkehrsreichsten Stunden wird die Anzahl der im Betrieb befindlichen Bahnwagen — in Vergleich zu dem regulären Fahrplan in der Mitte des Tages — um 144 Prozent erhöht und zu jeder Zeit eine verhältnismässig grosse Fahrgeschwindigkeit aufrecht erhalten. Der Abstossungs-Bahnmotor bildet das Thema einer kritischen Beleuchtung der von den Herren Slichter and Steinmetz gehaltenen Vorträge, welche diese Woche veröffentlicht sind. Der Verfasser spricht sein Bedauern darüber aus, dass von diesem wichtigen Gegenstande so wenige Thatsachen zur Verfügung stehen. Eine weitere editorielle Notiz ist dem Heizen von Bahnwagen gewidmet und hebt die Schwierigkeiten hervor, die sich geltend machen, wenn man einen zufriedenstellenden Dienst nach dieser Richtung hin erzielen will. Ein anderes Thema, das zur Besprechung gelangt, bildet die Bewegung für die Organisierung einer Vereinigung des Gleisingenieure, und wird der Vorschlag, die Meinungen der in dieser Abteilung thätigen Leute behufs Zustandebringens einer Organisation einzuholen, kommentiert. Die letzte editorielle Notiz befasst sich mit dem Thema über Entfernung des Schnees und Verkehrsstockungen und schildert die Schwierigkeiten, auf welche Stadt- and Ueberlandlinien stossen, wenn sie den ungewöhnlichen Anforderungen, wie sie die äusserst ungünstige Witterung während des vorigen Monats an sie stellte, nachkommen wollen.

Das Ueberlandbahnnetz Conneaut-Erie. . . [Seite 192.]

Die genannte Bahnlinie hat eine Länge von 56 km und bildet das Verbindungsglied zwischen Buffalo, Toledo und Detroit. Die Einwohnerzahl der Städte an den Endpunkten sowie der dazwischen liegenden Ortschaften wird angegeben, und entfallen auf 1 km Gleis ungefähr 2000 Bewohner. Mehrere lange Viadukte und Brücken, die auf der Strecke gebaut wurden, sind abgebildet. Diese Gegend wird gewöhnlich von starkem Schneefall heimgesucht, und besitzt die Gesellschaft den zweitgrössten Schneepflug in den Vereinigten Staaten; derselbe ist vierachsig, mit vier G. E.-1000-Motoren auf den Trucks und einem 200pferdigen Motor zum Treiben der Schaufeln ausgerüstet. Die Bahnwagen besitzen Wagenkasten von 13,73 m Länge, wiegen aber nur 9000 kg, da die Betriebsleitung leichte Bahnwagen haben will; dieselben sind je mit vier Motoren ausgerüstet. Das Kraftwerk enthält zwei Dynamos von je 400 kw Leistung, und besitzen dieselben eine Reihe besonderer Vorzüge; das Schmieren der Dampfmaschinen erfolgt auf automatischem Wege. Ausserdem befindet sich dort eine Zusatzmaschine für 375 Volt and 300 Amp. Mehrphasen-Uebertragung kommt nicht zur Verwendung. Nähere Einzelheiten werden noch über die Bahnwagenremise mitgeteilt.

Elektrisches Bahnnetz in Wien. . . . . . [Seite 201.]

Dieses Bahnnetz ist nunmehr Eigentum der Stadt, und wenn die geplanten Bahnen fertiggestellt sind, wird das gesamte Bahnnetz ungefähr aus 350 km Gleis bestehen. Ueberall gelangt das Bügelkontaktsystem zur Verwendung, ausgenommen im Herzen der Stadt, wo man das System mit unterirdischer Stromzuführung, wie oben auf S. 202 veranschaulicht ist, in Anwendung bringt. Die Schienen wiegen 50,51 kg pro l. m. Als die Bahn dem Verkehr übergeben wurde, waren 895 zweiachsige und 50 vierachsige Bahnwagen vorhanden, und am Anfang des Jahres 1904 besass die Gesellschaft 700 Anhängewagen. Die grösste erlaubte Fahrgeschwindigkeit beträgt 15, 18 und 30 km. Die Bahnwagen, welche im Mittelpunkte der Stadt verkehren, besitzen auf jeder Seite eine Kontaktvorrichtung mit Flügeln, die sich nach oben klappen lassen, so dass man sie in die unterirdische Leitung hinablassen kann. Das Kraftwerk zerfällt in zwei Teile; der eine war ursprünglich für Beleuchtungszwecke und der andere für Bahnbetrieb bestimmt, jedoch werden jetzt beide gemeinschaftlich betrieben. Ihre Herstellung nahm 19½ Monate in Anspruch. Der Kohlenverbrauch im Oktober 1902 belief sich 1,117 kg pro Kwstunde. Die Anzahl der Dampfmaschinen in dem grösseren Kraftwerke beträgt fünf; diese Maschinen, welche eine Normalleistung von 3400 PS und eine Maximalleistung von 4200 PS besitzen, bethätigen Dreiphasen-Wechselstrommaschinen. Eine beigegebene Tabelle lässt die Resultate mehrerer mit den Maschinen angestellten Versuche ersehen. Mit Kohlen zu 18 Kronen die Tonne betrugen die Erzeugungskosten in der Kraftanlage 1,8 Heller pro Kwstunde, während sich dieselben in der Unterstation auf 2 Heller stellten.

Neuartige Leitungsschienen-Kontaktvorrichtung bei der Bostoner Hochbahn. . . . . [Seite 204.]

Der betreffende Kontaktschuh ist von allen anderen, die bei Leitungsschienenbetrieb zur Verwendung gelangen, gänzlich verschieden und auf der Bostoner Hochbahn eingeführt worden. Er besteht aus einer Weichstahlstange, 584 mm bei 88 mm bei 13 mm, und wiegt ungefähr 5 kg. Diese Stange, welche den Teil zur Bewerkstelligung des Kontaktes mit der Leitungsschiene bildet, ruht an jedem Ende in einem Halter und wird durch ihr Eigengewicht sowie auch durch eine leichte stählerne Feder, die so konstruiert ist, dass sie einen Druck von ca. 23 kg nach unten ausübt, nach unten gehalten, und beträgt auf diese Weise der Gesamtdruck zwischen Schuh und Schiene 28 kg und zwar ohne Rücksicht auf die Bewegung des Schuhs längs der Schiene. Sobald sich indessen der Bahnwagen in Bewegung setzt, zeigt er das Bestreben, den Schuh nach oben hin zusammenzuziehen, und zwingt ihn an dem einen Ende zu einem stärkeren Kontakt mit der Leitungsschiene, je nach der Richtung, in welcher sich der Bahnwagen fortbewegt. Die Lebensdauer des Schuhs beträgt ungefähr 21600 km. Einen besonderen Vorzug des Schuhs bildet der Umstand, dass er an Verbindungen nicht in die Höhe springt.

Bremssystem mit aufgespeicherter Luft in St. Louis. [Seite 208.]

Die St. Louis Transit Co. hat 1500 Luftbremsungs-Ausrüstungen des Aufspeicherungssystems in Bestellung gegeben. Bei diesem System sind — wie auf Fig 1 veranschaulicht — auf den Bahnwagen zwei Behälter vorhanden, die Druck zu 20 Atmosphären enthalten; diese Behälter sind durch ein Reduzierungsventil mit einem weiteren kleineren Behälter, worin der Druck ungefähr 3 Atmosphären beträgt, verbunden. Die übrigen Teile des Bremswerks gleichen fast ganz denen einer gewöhnlichen Luftbremse. Die Aufspeicherungsbehälter werden in besonderen Komprimier-Anlagen geladen, von denen sich eine an jedem Endpunkte und andere an verschiedenen Punkten längs der Linie befinden. Auch besitzt die Gesellschaft mehrere transportable Stationen, welche aus Kompressoren, die auf Bahnwagen montiert sind, bestehen und welche man an den Endpunkten der nur im Sommer betriebenen Linien, ausserdem noch im Notfall verwenden kann; zu gleicher Zeit dienen sie als Ersatz eines stationären Kompressors, wenn derselbe Reparaturen unterzogen wird. Die Luftkompressoren, wovon 40 bestellt sind, werden durch Elektrizität getrieben, und erfolgt das Anlaufen und Anhalten des Motors durch eine sinnreiche automatische Kontrollvorrichtung, welche den Motor zum Anlaufen bringt, wenn der Lufttruck in dem stationären Behälter unter einen gewissen Betrag sinkt, und den Kompressor anhält, wenn der Druck eine vorherbestimmte Maximalhöhe erreicht hat. Die Anlaufvorrichtung ist besonders dafür eingerichtet, dass die Motoren ohne Belastung anlaufen und dass die Anlaufvorrichtung selbst von der Spannung thatsächlich unabhängig ist. Letzteres ist von sehr grosser Wichtigkeit und zwar angesichts der Thatsache, dass die Kompressoren sich an den Endpunkten der Linien, wo die Spannung zu Schwankungen geneigt ist, befinden müssen.

Ueberlandbahn-Fahrkarten. Von P. H. White. . [Seite 211.]

Die Fahrkarten, die auf der Bahn des Verfassers zur Ausgabe gelangen, gleichen den auf der Abbildung veranschaulichten; die Fahrkarte ist nur für einen Weg bestimmt und mit der Rückfahrkarte zusammengedruckt. Man faltet die Karte und teilt sie so in zwei Teile. Wenn ein Fahrgast eine Karte für einfache Fahrt wünscht, markiert der Schaffner mit der Lochzange die Bestimmungspunkte sowie das bezahlte Fahrgeld und reist die einfache Karte halb ab. Diese Durchlöcherungen markieren auch die Rückfahrkarte, welche als Nachweis an den Rechnungsrevisor abgeliefert wird. Falls der Fahrgast eine Rückfahrkarte fordert, dreht der Schaffner das Packet Fahrkarten herum, markiert die Rückfahrkarte halb und reist wie oben die Hälfte ab. Die zurückbehaltenen Hälften geben, wenn sie an den Rechnungsrevisor abgeliefert, ein vollständiges Verzeichnis aller verkauften Fahrkarten sowie der dafür erhaltenen Beträge.

Werkstätteverfahren in Joliet. Von C. S. Patterson. [Seite 212.]

Fig. 1 veranschaulicht einen Handwagen zum Befördern der Anker in die Reparaturwerkstätte; derselbe zeichnet sich hauptsächlich dadurch aus, dass die Haken, welche den Anker halten, mittelst abnehmbarer Stifte am Rahmen gehalten werden. Sodann beschreibt der Verfasser ein Verfahren, wie man die Abnutzung an Bremsbacken gleichmässig bewerkstelligt.

Kohlenbeförderungs-Maschinerie. Von F. V. Hetzel. [Seite 212.]

Der Verfasser macht geltend, dass einige der Vorzüge der von Herrn Little in der Nummer vom 2. Jan. geschilderten Kohlenkonveyors keineswegs neu sind. Ausserdem kritisiert er die Einrichtung, die zum Beschicken dient und in einer der Anlagen, welche in dem bzgl. Artikel beschrieben sind, zur Verwendung kommt.

Strassenbahngesellschaften und Parkbetrieb. Von C. E. Flynn. [Seite 213.]

Der Verfasser ist der Ansicht, dass, wenn Parks sich als wünschenswert erweisen, es besser sei, den Betrieb zu verpachten als dass die Gesellschaft selbst sich diesem Werke unterzieht.

Charakteristisches bezüglich der Geschwindigkeits-Drehkraft des Einphasen-Abstossungsmotors. Von Walter I. Slichter. [Seite 213.]

Diese Abhandlung enthält eine kurze Zusammenfassung der von dem Verfasser geleiteten Versuche an verschiedenen Typen Wechselstrom-Kommutatormotoren mit einer besonderen Hinweisung auf die Entwickelung des Abstossungsmotors für Bahnbetrieb. Der betreffende Motor besitzt dieselben charakteristischen Eigen-

schaften wie der Gleichstrom-Hauptschlussmotor. Der Kraftfaktor beim Anlauf ist niedrig und zwar in Folge der Reaktanz der Motorstromkreise, doch tritt mit dem niedrigsten Kraftfaktor die maximale Drehkraft ein. Beigegeben sind mehrere Kurven, wovon drei die Resultate angestellter Versuche ersehen lassen, während die vierte zum Teil durch Berechnung hergestellt ist. Die charakteristischen Eigenschaften machen den Abstossungsmotor für Beschleunigungsdienst trefflich geeignet, da die Beschleunigungsleistung grösser als bei Gleichstromdienst ist, und die Erlangung von gebrochenen Elektrizität leitenden Potenzen nach Einführung der toten Widerstandsverluste des Gleichstrom-Kontrollsystems möglich wird. Weiterhin zeigt er seine Leistungsfähigkeit beim Laufen zu leichten Belastungen, und da er bei langsamen Geschwindigkeiten gute Konstanten aufweist, eignet er sich in vortrefflicher Weise für Güterzugdienst.

Der Wechselstrom-Bahnmotor. Von Charles P. Steinmetz. [Seite 215.]

Der betreffende Artikel handelt über die Theorie des Abstossungsmotors und giebt in genauer Ausführung die Versuchsforschungen von Rudolph Eickemeyer und Anderer, welche diesem Gegenstande schon früher ihre Aufmerksamkeit zugewendet haben. Der Entwurf des Motors, wie er sich in Folge dieser Forschung entwickelt hat, wird beschrieben, ebenso werden auch die Uebergangsstufen mitgeteilt, welche allmälig zur Annahme der gegenwärtigen Form führten.

Automatisches elektrisches Trambahn-Signalsystem. [Seite 218.]

Es ist dies ein elektromagnetisches Signalsystem, bei welchem zwei Solenoiden zur Bethätigung der optischen Telegraphen zur Anwendung gelangen. Sobald der Bahnwagen an einen Block einfährt, kommt er mit einer am Fahrdraht befindlichen Platte in Berührung, und in Folge dieses Kontakts schliesst sich ein Stromkreis, welcher das Hauptsolenoid bethätigt. Das von Energie durchflossene Solenoid zieht den optischen Telegraphen in die Höhe, welcher dann durch eine Sperrung in seiner Stellung gehalten wird. Wenn der Bahnwagen das Ende des Blocks erreicht, findet wiederum ein Kontakt mit einer zweiten Platte statt, wodurch bewirkt wird, dass das zweite Solenoid von Energie durchflossen wird Letzteres zieht den Sperrhaken zurück und bewerkstelligt auf diese Weise, dass der optische Telegraph in seine anfängliche Lage zurückfällt.

Wasserröhrenkessel in englischen Trambahn-Kraftwerken. [Seite 219.]

Eingehend beschrieben werden die Einzelheiten der Konstruktion eines Wasserrohrkessels, der in Grossbritannien in ausgedehntem Masse Verwendung gefunden hat. Der Kessel hat oben drei und unten zwei Trommeln, die durch vier Lagen auswechselbarer Röhren verbunden sind. Die oben befindlichen Trommeln werden von einem Balkenrahmenwerk gehalten, und da die unten befindlichen Trommeln an den Enden frei gebaut sind, können sie sich bei jedem Ausdehnen und Zusammenziehen der Röhren frei bewegen. Die drei Dampftrommeln sind sämtlich über dem Niveau des Wassers verbunden. Die Hauptröhren sind überall gerade, nur neigt sich der grössere Teil ihrer Länge mit leichten Biegungen gegen einander hin, damit sie radial in die Trommel einmünden können. Jedes Rohr besitzt an den Enden einen ungehinderten Abzugsweg nach den Trommeln, so dass der ganze Dampf, der sich bildet, die volle Fläche des Rohrs für seinen Weg nach dem Dampfraum zur Verfügung hat und nicht auf enge Verbindungs- oder sonstige Röhren beschränkt ist.

Ein wirksamer Apparat zum Zerschneiden des gefrorenen Regens un Schnees. . . . . [Seite 219.]

Die Abbildungen stellen einen Apparat zum Zerschneiden des Eises, welches sich aus Schnee und Regen zusammen gebildet hat, dar; derselbe ist aus einem Gussstück von hämmerbarem Eisen hergestellt, dessen Stiel in den Trolleyhalter eingepasst ist. Der Teil, welcher den Kontakt bewerkstelligt, ist aus Messing angefertigt und weich genug, um der Abnutzung entgegen zu arbeiten und auf diese Weise den Fahrdraht zu schonen. Wenn dieser Teil sich abgenutzt hat, kann man ihn leicht auswechseln.

Pneumatischer Schienen-Sandstreuapparat. . . [Seite 222.]

Die Illustration veranschaulicht einen Sandstreuapparat, welcher eine Vorrichtung besitzt, um die Klumpenbildung des Sandes auf dem Boden des Kastens zu verhüten.

Bahnfernsprecher. . . . .

Illustrationen und Beschreibung betreffen Fernsprecher zur Verwendung auf Bahnlinien. Es sind zwei Arten derselben abgebildet: die eine Abbildung stellt ein in einem eisernen Kasten befindliches Telephon dar, welches an den längs der Linie stehenden Masten angebracht wird, und die andere Illustration veranschaulicht ein transportables Bahnwagentelephon, das in einem Holzkasten eingeschlossen und mit einem ledernen Tragriemen versehen ist. Dieses Instrument ist mit einer langen Schnur versehen, an deren Ende ein Stöpsel behufs Einführung in Verbindungskästen befestigt ist. Letztere kann man eventuell an Masten längs der Bahnlinie installieren und eine Verbindung mit dem Zentralbureau dadurch herstellen, dass man an diesen Punkten den Stöpsel einschaltet. Die Schnur ist lang genug, dass der Wagenführer den Apparat auf dem Bahnwagen stehen lassen kann.

Bahnwagen für die neue Bahnlinie Coeur d'Alene-Spokane. [Seite 223.]

Illustrationen und Beschreibung beziehen sich auf zwei Typen eines halb verwandelbaren Ueberlandbahnwagens, wovon der eine nur für Personendienst und der andere für Personen- und Gepäckdienst dienen soll. Die Personenwaggons, die je 38 Sitzplätze aufweisen, haben am einen Ende Doppelthüren und am anderen Ende eine einfache Thür, um Platz für einen Toilettenraum zu schaffen.

Die Nürnberger Gasmaschine. . . . . [Seite 224.]

Angekündigt werden die Vorkehrungen, die in diesem Lande zum Bauen von Nürnberger Gasmaschinen von 130 bis 6000 PS Leistung getroffen werden. Mehrere Einzelheiten, die sich auf besondere Vorzüge dieser Maschinen beziehen, werden mitgeteilt.

RÉSUMÉ DES MATIÈRES.

Numéro du 9 Janvier.

Articles de fond. . . . . [Page 53.]

Le premier article met en garde contre la hâte en faisant la première levée de plans de lignes électriques. L'article suivant réfère au grand intérêt qu'excitent les moteurs à phase unique et commente sur le fait qu'un autre grand manufacturier d'appareils électriques mettra bientôt en vente un moteur commercial à phase unique. On réfère ensuite brièvement à la plus grande faculté qu'ont les lignes électriques interurbaines de suivre leur horaire pendant les grands froids que les chemin de fer à vapeur. Suit un long article sur les raisons qui ont décidé les propriétaires du New York Central Railroad à installer des locomotives à courant continu au lieu de courant alternatif sur leur système terminus de New York. L'une des raisons principales est que les lignes de transit rapide de la Ville de New York sont équipées maintenant avec un troisième rail à courant direct et que le New York Central doit être une partie intégrale de ces systèmes. Les intérêts financiers auront à déterminer si celà sera mais les ingénieurs n'ont pas voulu introduire une objection insurmontable à l'entre-échange de trains-moteurs. Une autre raison a été que le changement de la force motrice devrait se faire promptement car cette ligne qui est la seule à avoir une gare dans la ville même de New York ne pouvait pas risquer le délai que pouvait occasionner l'état peut-être un peu incomplet du système à phase unique. Ceci ne doit pas être pris comme une critique du système à courant alternatif mais découle nécessairement du fait que ce système n'a pas encore été essayé sur une aussi grande échelle. Celà n'aura pas non plus force de précédent pour d'autres parties du réseau. Des raisons de construction font aussi qu'il y aurait eu une grande difficulté à installer un conducteur aérien dans le tunnel. D'autres raisons techniques qui ont influencé la décision du New York Central sont le plus grand poids des locomotives à courant alternatif, les plus grands frais d'entretien surtout en engrenages, car le moteur à courant direct sera sans engrenage et la plus grande dépréciation en valeur des appareils lorsque les changements de l'art forceront à les remplacer. Chacune de ces raisons est discutée en détail.

Equipement électrique du Northshore Railroad près de San Francisco. II. . . . . [Page 56.]

La compagnie a une usine à vapeur en cas de besoin et pour le service auxiliaire et reçoit aussi de la force motrice à 40.000 volts d'une usine hydraulique située à 240 km. C'est le circuit régulier de transmission de force électrique le plus long d'Amérique. On décrit l'usine à vapeur. On se sert de pétrole comme combustible et parmi les particularités nouvelles que présentent les becs employés on note qu'ils lancent la flamme de l'arrière à l'avant des chaudières au lieu de l'autre direction. Ceci a plusieurs avantages. Le système de tuyautage pour le pétrole est discuté en détail ainsi que l'effet de l'emploi du pétrole au lieu de charbon sur le diamètre et la hauteur de la cheminée employée. On voit à la page 60 le diagramme de la pose des fils pour la sous-station. Les générateurs de moteurs employés sont opérés à 60 cycles. On décrit entièrement la méthode employée pour contrôler le courant à 40.000 volts qui entre dans l'usine. On se sert d'un troisième rail protégé avec le sabot de contact étalon pour ce type de rail. Les voitures sont équipées avec le contrôle d'unité multiple type M. Le train consiste généralement de deux voitures automotrices et de trois voitures de remorque, chaque voiture pesant environ 30 tonnes. Le système de signal de bloc est tout neuf et est presque entièrement pareil à celui qu'on installera dans le Souterrain de New York. En principe il ressemble beaucoup à celui qui est employé sur le Boston Elevated

Railway et dans lequel un rail de roulage est divisé en sections et ces sections sont court circuitées au moyen de l'autre rail de roulage par les essieux du train. Sur l'Elevé de Boston il est possible d'employer le courant direct pour le service local de signaux à cause du peu de longueur relative de la ligne et de la présence de la structure élevée en acier, mais ceci n'était pas possible sur la ligne californienne de sorte qu'il a fallu recourir au courant alternatif pour opérer les signaux. Le potentiel est de 9 à 15 volts et un court circuit entre le rail de roulage sectionné et l'autre rail de roulage continu opère un relai de courant alternatif dans la base de la tour à signaux. Ce relai est ajusté de manière à opérer à 0,1 ampère et à ouvrir ou fermer l'interrupteur de circuit d'un petit moteur à courant direct de 8 volts qui opère les bras du sémaphore. Ce moteur est actionné par des batteries d'accumulateurs. On se sert de lampes en plus des bras du sémaphore.

Surveillance des receveurs au point de vue de l'enregistrement des places. . . . . [Page 68.]

On décrit les principaux trucs qu'ont les receveurs pour frauder la compagnie en ne pas enregistrant les places perçues et on donne les meilleurs moyens de découvrir ces fraudes.

Une explosion à St. Louis. . . . . . . [Page 69.]

Une explosion de chaudières a eu lieu dans l'usine centrale de la St. Louis Transit Company le 1er. Décembre. Il y a eu 6 hommes tués et un nombre de blessés.

L'effet des arrêts fréquents sur les lignes de tramways à grande vitesse. Par A. H. Armstrong. . . . [Page 70.]

L'auteur commence par estimer la force en chevaux requise pour opérer une voiture de 35 tonnnes à une vitesse prévue de 25 miles (40 km) par heure avec un nombre d'arrêts par mile variant de 0 à 1,2. Il estime ensuite les kilowatts-heures et le coût de ces arrêts. Il aborde ensuite le cas de la même voiture engrenée pour une vitesse maxima de 72 km à l'heure avec un équipement de moteurs de 300 chevaux et montre ce que la vitesse prévue et les kilowatts-heures par tonne-mile seront pour différents nombres d'arrêts par mile. Ceci fait ressortir la nécessité de réduire le nombre d'arrêts: ces arrêts peuvent d'autre part être réduits en nombre par éliminant les courbes lorsqu'on construit la ligne.

Cahiers de billets pour les lignes interurbaines. . [Page 71.]

Dans l'Ohio un nombre de tramways interurbains émettent des cahiers de billets interchangeables sur les autres lignes qui appartiennent à l'association. Ces cahiers contiennent des billets pour parcourir 500 miles (800 km) et se vendent au taux d'à peu près 4 centimes le kilomètre.

Construction de conduits pour feeders à Brooklyn. [Page 72.]

On présente des illustrations d'une méthode pour opérer les connexions entre les feeders souterrains et les structures élevées ou les ponts à Brooklyn.

Turbo-unités Westinghouse-Parsons de 5000 kw. . [Page 73.]

Des contrats pour des machines de cette dimension ont été reçus de deux compagnies de tramways américaines et d'une compagnie anglaise. La turbine occupe une surface de 8,43 x 4 m et a une hauteur de 3,66 m. Elle marche à 750 révolutions par minute. Elle repose sur une seule plaque de couche en deux sections. L'arbre est forgé creux et l'énergie est transmise au générateur au moyen d'un couplage flexible. Le diamètre de l'arbre au journal est de 381 mm. On peut admettre de la vapeur à haute pression au second étage de la turbine afin d'augmenter sa capacité. Le générateur employé pour la turbine a un champ construit d'un cylindre solide d'acier, et on peut construire ces générateurs, si on le désire pour n'importe quel voltage jusqu'à 15.000.

Paratonnerres faits sur place. . . . . . . [Page 75.]

C'est un paratonnerre à magasin dans lequel, lorsqu'un plomb a fusé le bras tombe sur un autre plomb. On a cependant amélioré l'appareil en y faisant contrôler le mouvement du bras par une tige portant dans l'huile de manière à ce que le bras tombe lentement.

A travers le Souterrain de New York sur des wagonnets à bras. [Page 75.]

L'illustration montre le maire de New York, l'entrepreneur M. McDonald, et d'autres invités officiels faisant le premier voyage dans le Souterrain de New York le 1er. Janvier sur des wagonnets opérés à bras.

Charrue à neige et voiture à marchandise combinée. [Page 76.]

Ce véhicule pèse sans moteurs près de 1100 kgs. On peut enlever les socs de charrue en été et utiliser le caisson pour le transport des marchandises.

Frein combiné pour roue et voie. . . . . . [Page 76.]

Le sabot tombe en avant de la roue pour freiner à la fois sur la voie et la roue.

Ecriteaux de voitures visibles. . . . . . . [Page 77.]

Ces écriteaux sont en bois avec les lettres découpées et les espaces vides couverts d'une matière transparente qui laisse passer la lumière sans éblouissements. Ces écriteaux sont noirs avec les lettres blanches de sorte qu'on peut les lire le jour aussi bien que la nuit.

Appareil pour régler le commutateur. . . . . [Page 77.]

On peut attacher cette machine à une dynamo et l'ajuster à n'importe quelle position.

Roue à main verticale pour frein. . . . . . [Page 78.]

On prétend que cette roue est préférable à la poignée ordinaire et elle tient très peu de place.

Nouveau règlement pour la circulation à New York. [Page 82.]

Ce règlement est une partie d'une ordonnance qui vient d'être adoptée pour la Ville de New York et couvre la circulation de tous les véhicules dans les rues. Les sections de 1 à 13 ont trait aux véhicules ordinaires; la section 14 requiert les voitures de tramways de s'arrêter avant d'avoir franchi les rues transversales pour laisser descendre et monter les voyageurs au lieu de s'arrêter après le carrefour comme précédemment; les autres sections ont trait à la circulation des autres véhicules dans les rues.

Numéro du 16 Janvier.

Articles de fond. . . . . [Page 87.]

Le premier article a trait au sujet de la pratique d'ateliers qui sera discuté à la prochaine convention de l'Association des Maîtres Mécaniciens. Bien que jusqu'à un certain point ce soit un sujet de comptabilité il se rattache de très près aux devoirs des Maîtres Mécaniciens et, d'après l'opinion des rédacteurs, devrait être discuté d'abord par leur association. Le second article réfère à la demande des Maîtres-Voyers d'être inclus dans l'Association des Maîtres Mécaniciens. Ceux-ci expliquent, cependant, que le temps dont ils disposent n'est pas suffisant pour aborder le sujet. L'article suivant traite de la réduction dans la congestion du trafic à Chicago. Vient ensuite un article sur le sujet des voitures semi-convertibles, dont on parle dans les meilleurs termes, bien qu'il ne faille pas les considérer comme pouvant remplacer complètement les voitures ouvertes. Le dernier article réfère à l'importance de réduire le nombre d'arrêts et de relentissements, si on veut obtenir de grandes vitesses et passe en revue l'article de M. A. H. Armstrong sur le sujet publié dans le numéro du 9 Janvier.

Tramway électrique interurbain dans l'Ouest de New York. [Page 90.]

Cet arricle décrit une nouvelle ligne interurbaine entre Rochester et Geneva dont les deux tiers environ sont complétés et en exploitation. L'entreprise est surtout intéressante parceque la ligne sera opérée en concurrence directe avec une ligne de chemin de fer déjà existante sur laquelle circulent 22 trains de voyageurs par jour comme service local entre les points terminus de la ligne électrique. Le nouveau réseau offre cependant plusieurs avantages tels qu'un service plus fréquent, un temps de parcours réduit et un prix de places meilleur marché. De plus la compagnie électrique a un arrangement avec la compagnie urbaine de Rochester qui lui permettra de pénétrer au coeur de la ville tandis que les voyageurs de chemin de fer sont débarqués à une distance considérable du centre de la ville. La ligne est construite pour la plus grande partie sur chemin privé et elle est, ainsi que la voie, un exemple excellent de construction moderne interurbaine. Il y a seize ponts d'acier sur la voie et cinq passages de voies de chemin de fer supérieurs ou inférieurs. La ligne de construction est faite de conducteurs d'aluminium en torrons supportés par des isolateurs en verre Locke de 40000 volts, tandis que la ligne des feeders est composée aussi de torrons d'aluminium, équivalant à 500.000 circ. mils de cuivre. L'usine de force comprend deux alternateurs à connexion directe de 650 kw chacun et deux convertisseurs rotatifs avec quatre transformateurs de 500 kw. Il y a aussi sur la ligne trois sous-statison qui contiennent chacune deux convertisseurs rotatifs de 300 kw et trois transformateurs statiques de 200 kw avec les appareils auxiliaires ordinaires. Le matériel roulant primitif comprend six grandes voitures à voyageurs pour service interurbain à grande vitesse, une charrue à neige Ruggles à double action et grande vitesse, deux voitures de messageries et un fourgon de construction

et de réparation. On y ajoutera trois voitures à voyageurs qui sont déjà en construction. La compagnie a déjà fait construire un excellent dépôt avec atelier de réparation pourvu des outils et des facilités nécessaires pour l'inspection et les réparations. La compagnie transportera des marchandises et des messageries aussitôt que la section Est de sa ligne sera terminée.

Ordonnance du coin le plus près à New York. . [Page 99.]

Le temps a été très inclément à New York depuis qu'a été passée l'ordonnance requérant les voitures de tramways de s'arrêter au coin de rue le plus près, et le public a en conséquence exprimé hautement son mécontentement de cette ordonnance.

Améliorations à Belfast, Irlande. . . . . [Page 100.]

On donne une carte du réseau de tramways de Belfast qui sont opérés encore maintenant par des chevaux et on décrit l'équipement projeté qui coûtera environ cinq millions de francs.

Cartes d'enregistrement employées dans les ateliers de réparation de Rochester. . . . . [Page 100.]

On montre la forme d'une carte d'enregistrement employée dans les divisions mécaniques. Ces cartes sont remplies et signées par le contre-maître de l'atelier et classées à leur place chez le maître-mécanicien, ce qui lui permet de garder trace de la quantité des réparations et de la nature des travaux exécutés sur chaque voiture qui passe par l'atelier.

Possibilités des tramways à phase unique. Par A. H. Armstrong. [Page 102.]

L'auteur qui est l'un des ingénieurs de la General Electric Company, considère le moteur à phase unique au point de vue du fort travail de traction pour lequel il le recommande. La Fig. 1 donne les charges de friction de train pour des trains de différents poids à différentes vitesses. Il compare les coûts d'exploitation de moteurs à vapeur et électriques avec différents prix pour le charbon et donne un exemple basé sur une voie de 160 km de longueur avec une seule usine de force, des stations de transformateur de diminution espacées de 20 km et 3000 volts sur le fil de trolley. Le coût de l'opération à vapeur se voit dans la Fig. 2 et celui de l'opération électrique dans la Fig. 5. Lorsque il y a peu de convois par jour, c'est-à-dire cinq ou moins, l'électricité n'est pas à recommander.

Energie nécessaire à l'opération des voitures. . [Page 106.]

On donne des statistiques tirées d'un rapport récent des Commissaires de Chemins de Fer montrant les kilowatts moyens par voiture sur les lignes de surface à New York et sur les lignes de surface et élevées de Brooklyn.

Nouveaux ateliers de voitures dans le Sud. . [Page 107.]

C'est la description d'ateliers de voitures dans la Caroline du Nord.

La production du gaz pour les machines à gaz. . [Page 108.]

Cet article décrit une méthode pour produire des gaz qui peut-être employée pour les machines à gaz et autres. Chaque unité consiste de deux générateurs et d'une chaudière tubulaire. Les générateurs peuvent brûler n'importe quel combustible et sont arrangés de manière à donner du gaz de produit quand il est mélangé avec de l'air forcé à travers le combustible par un tirage de haut en bas. Le gaz produit passe par une valve spéciale, une chaudière et un purificateur pour aller dans le réservoir à gaz. Lorsque le combustible est devenu incandescent, on admet aux générateurs de la vapeur dont la décomposition resulte en gaz d'eau qui est conduit à un autre réservoir à gaz. On peut mélanger au moyen d'une valve spéciale ces gaz produits dans la proportion que l'on désire.

Voitures convertibles pour Austin, Texas. . . [Page 109.]

L'article et l'illustration qui l'accompagne ont trait à des voiture convertibles qui sont surtout intéressantes parcequ'elles sont pourvues de vestibules portatifs qui contiennent des doubles-portes pliantes. Lorsqu'on enlève les vestibules on fixe si on le veut aux caissons des barrières pliantes pour fermer les entrées.

Nouvelle fournaise à fondre le métal. . . . [Page 109.]

L'article et l'illustration réfèrent à une fournaise à fondre le métal faite d'un tambour de plaques d'acier à têtes de fonte. L'intérieur est garni de tuiles réfractaires avec deux ouvertures sur les côtés oposés du tambour. On ne se sert que d'une ouvertures à la fois, l'autre étant fermée par une couche de terre réfractaire. L'avantage de cette fournaise est que lorsqu'une des ouvertures de remplissage est usée on peut la fermer par une plaque garnie de terre réfractaire, retourner la fournaise et se servir de l'autre ouverture. La chaleur est fournie par un bec à pétrole.

Trains express de huit voitures pour le Souterrain de New York. [Page 110.]

Les voitures employées ont 15,25 m de longueur de sorte qu'un train complet aura 142 m de long. Un train de cette dimension pourra conteuir 416 voyageurs assis. Les trains express consisteront de huit voitures et les trains ordinaires de cinq.

Traverses de chemins de fer en ciment. . . [Page 110.]

Cette traverse est composée d'une barre d'angle en acier posée dans du ciment et est employée à titre d'essai sur un chemin de fer où, dit-on, 20 locomotives par jour passent dessus. Une bande de bois est placée entre le rail et la traverse.

Rapport annuel de la Boston Elevated Railway Company. [Page 112.]

Cette compagnie opère presque toutes les lignes de surface et toutes les lignes élevées de Boston. Le rapport est pour l'année se terminant le 30 Septembre 1903.

Numéro du 23 Janvier.

Articles de fond. . . . . [Page 123.]

Les deux premiers articles discutent la concurrence entre les tramways interurbains à vapeur et à l'électricité. Le troisième article traite de l'enlèvement de la neige et fait ressortir la nécessité d'un service fréquent et prompt de charrues à neige et de balayeuses. L'article final discute la question du passage mécanique du charbon. Les passeurs mécaniques, pense-t-on, ne valent pas mieux que des ouvriers passeurs de premier ordre, mais ils donnent un service plus égal que celui de la moyenne des ouvriers-passeurs.

Réseau de traction Indianapolis & Northwestern. [Page 126.]

C'est l'une des propriétés interurbaines les plus importantes de l'Indiana et lorsqu'elle sera complétée sa longueur kilométrique ne le cédera qu'à celle d'une seule des lignes qui sortent maintenant d'Indianapolis. La ligne traverse un nombre de points importants et un district agricole très prospère de sorte qu'elle est bien patronisée par les paysans. La ligue aérienne, la voie et la chaussée sont de construction ordinaire étalon. L'usine centrale comprend deux machines cross-compound à condenseur actionnant des générateurs trois-phasés de 800 kw de capacité. Le courant est fourni de 370 à 400 volts à l'éxtrémité de courant alternatif des convertisseurs rotatifs de l'usine qui sont employés pour alimenter la ligne de trolley près de l'usine. Le reste du courant est pris par trois transformateurs d'augmentation de 300 kw qui élèvent le voltage à 2600 pour sa transmission aux sous-stations qui le distribuent. Les voitures de voyageurs ordinaires sont d'une grandeur inaccoutumée, soit 20 m de longueur, 3 m de largeur, avec une capacité de 60 voyageurs assis.

Développement interurbain dans l'Indiana en 1903. [Page 131.]

La longueur kilométrique des lignes interurbaines qui rayonnent d'Indianapolis a augmenté pendant l'année de près de 100 pour cent sans tenir compte de plusieurs grandes lignes projetées qui sont en construction. Lorsque celles-ci seront complétées la longueur totale des lignes aura été plus que doublée depuis le 1er. Janvier 1902. Il y a à l'heure actuelle 153 voitures de voyageurs entrant et quittant Indianapolis chaque jour et 20 voitures de marchandises faisant aussi un service régulier. Il y a actuellement 840 km de tramways électriques interur bains rayonnant d'Indianapolis auxquels on ajoutera 160 km durant le printemps prochain. Ces lignes ont amené 2.225.000 voyageurs dans la ville durant l'année dernière et les dépenses d'exploitation ont été 45 pour cent des recettes. On donne quelques statistiques de certaines lignes interurbaines de l'Indiana.

Rapport de la commission technique sur l'accident du Métropolitain de Paris. . . . . [Page 132.]

On résume en 9 chapitres les conclusions de la commission qui a fait une enquête sur l'accident survenu au Métropolitain en Août dernier, en vue de prévenir un second accident semblable. La commission a fait un nombre de recommandations que donne l'article.

Chauffage mécanique et chauffage à bras. . . [Page 132.]

C'est une discussion des mérites relatifs et de l'économie des deux systèmes de chauffage suggérée par un article de fond sur le

passage mécanique paru dans le numéro du 24 Octobre dernier du STREET RAILWAY JOURNAL. L'auteur réfère à un récent article sur ce sujet et croit que l'avantage particulier du passage mécanique apparait dans les grandes usines où le travail des passeurs ne pourrait pas être aussi bien surveillé que dans les petits usines et où un service moins efficace serait par conséquent la règle.

Rapport annuel de la Commission de Chemin de Fer de l'Etat de New York. . . . . . [Page 134.]

On donne des statistiques sur les propriétés dans l'Etat de New York. Le rapport déclare que les propriétés sont dans une meilleure situation que jamais en ce qui concerne la construction des voies et le matériel roulant et il fait un nombre de recommandations pour éviter les accidents.

Rapport annuel de la Commission des Chemins de Fer du Massachussetts. . . . . [Page 135.]

Ce rapport contient des statistiques et des recommandations. Parmi ces dernières la commission est d'avis que les tramways électriques interurbains devraient avoir le droit d'éminent domaine.

Usine de force de l'Interborough Rapid Transit Company de New York. . . . . [Page 137.]

Cette usine aura une capacité de 130.000 chevaux. On donne des détails de la construction des fondations et du bâtiment. Il y a cinq cheminées et neuf machines de 8000 à 10000 chevaux, chacune en connexion directe avec un alternateur de 5000 kw. Les machines ont des cylindres horizontaux de haute pression et des cylindres verticaux de basse pression. Il y a aussi quatre turbo-générateurs de 2000 chevaux pour l'éclairage.

Extension du transport des messageries à Cleveland. [Page 140.]

Le transport des messageries sur les lignes électriques de Cleveland a eu beaucoup de succès et on va construire un magasin à bref délai.

Voie et garde-rail à Zossen. . . . . . . [Page 140.]

On donne une coupe de la construction du garde-rail sur la ligne à grande vitesse de Zossen. Ce garde-rail s'étend sur toute la longueur de la ligne.

Voitures à phase unique à Pittsburg-Est. . . [Page 141.]

Cette ligne se trouve dans les ateliers de la Compagnie Westinghouse. On donne des diagrammes du contrôleur et des connexions des moteurs ainsi qu'une courte description mécanique de ceux-ci.

L'usine de force de service à l'Exposition de St. Louis. [Page 143.]

En plus des machines qui seront exposées pendant leur travail à St. Louis, les autorités ont installé, pour leur emploi pendant l'exposition, quatre unités de 2000 kw, à 25 cycles, 3 phases et 6600 volts. L'équipement électrique à St. Louis comprendra quelques moteurs d'induction de 2000 chevaux pour le service des pompes.

Système de zones à Cleveland. . . . . . [Page 145.]

Grâce à l'insistance des autorités municipales les compagnies de tramways de Cleveland ont pratiquement consenti à changer le système de l'uniformité du prix des places en un système de prix par zone qui sera 15 centimes, 25 centimes et 35 centimes. La distance maxima que l'on pourra parcourir pour 15 centimes sera 14 km. En échange de cette réduction du prix des places la Ville a consenti à abroger certaines taxes. On donne plusieurs évaluations du prix moyen des places auquel on peut s'attendre.

Dépôt de voitures détruit par un incendie. . . [Page 147.]

C'est un vieux dépôt de Brooklyn qui servait autrefois de remise pour les tramways à chevaux et qu'on employait maintenant comme magasin.

Voitures à vestibule à Buffalo. . . . . . [Page 147.]

Ces voitures ont une longueur de caisson de 7,93 m.

Aération des voitures. . . . . [Page 147.]

On essaie à Camden un système de ventilation qui permet de renouveler l'air des voitures sans causer de courants d'air.

Aiguille de voie automatique. , ... [Page 148.]

Une paire de roues placées sous la voiture opèrent l'aiguille automatiquement.

Train automobile à Paris. . . . . . . [Page 149.]

Ce train est actionné par une locomotive à gazoline qui agit sur les roues de toutes les voitures du train. Un système particulier de couplage fait que toutes les voitures suivent exactement le parcours tracé par la locomotive. Un essai a été fait le 24 Décembre.

Voitures semi-convertibles pour Burlington, New Jersey. [Page 149.]

Ces voitures ont une longueur de caisson de 8,54 mètres.

Numéro du 30 Janvier.

Articles de fond. . . . . [Page 159.]

Le premier article est un commentaire sur deux lettres publiées dans le numéro et qui ont trait à un projet d'organisation d'une association des ingénieurs-voyeurs; l'article suivant traite du trafic sur le Manhattan Elevated Railway (Elevé de New York) qui a récemment, plusieurs jours durant, transporté plus d'un million de voyageurs. Pendant les jours où le trafic était le plus fort, du temps de la vapeur, on n'a jamais approché de ce chiffre. Avec la vapeur comme force motrice le nombre maximum de trains s'arrêtant à une gare était de 40, avec l'électricité, on peut faire passer 60 trains par heure à un point donné. L'article suivant réfère à l'ordonnance qui requiert les voitures de tramways de s'arrêter avant le carre-four. Cette ordonnance maintenant en vigueur à New York a causé beaucoup de plaintes de la part du public. Suivent de courts articles sur les pilotes pour voitures interurbaines et la possession municipale. Le dernier article a pour sujet les voitures-lits sur les tramways électriques.

Améliorations dans l'équipement de force du réseau Cleveland & Southwestern. . . . . [Page 162.]

Cette usine est particulièrement intéressante du fait que les nouvelles unités dont l'une est déjà opérée avec succès, représentent l'une des premières installations de turbines à vapeur pour tramways électriques dans ce pays-ci. Une grande portion du réseau est opéré par le système de courant alternatif à haute tension et tout le réseau finira par être opéré de cette manière, mais pour le moment on emploie la transmission à courant continu pour l'autre portion du réseau. Dans l'usine centrale les unités à courant continu, fournissant un total de 1000 kw, occupent deux fois autant de place que le présent équipement à turbine qui à cependant une capacité double soit 2000 kw. Les turbines sont du type Westinghouse-Parsons à expansion et flux parallèles. Chaque système consiste de trois sections indépendantes, savoir: Cylindre à haute pression, cylindre à basse pression et générateur. On explique en détail la construction de ces unités et on donne les résultats de séries d'essais qui montrent l'économie pratique de la turbine. On s'attache particulièrement aux plans du tuyautage et du système de condensation. On peut employer les chaudières avec ou sans les appareils de surchauffe. En plus des sous-stations ordinaires placées le long de la ligne la compagnie a une sous-station portative qu'on a trouvée très commode pour soulager la charge excessive à des points particuliers où il peut se produire une demande temporaire unusuelle de courant.

Equipement électrique du Lancashire & Yorkshire Railway. [Page 172.]

C'est l'un des principaux chemins de fer anglais et la section équipée à l'électricité a environ 38 km de longueur. On emploie 600 volts sur le troisième rail avec distribution polyphasée à 7500 volts et convertisseurs rotatifs de 600 kw. Le train consiste de deux voitures automotrices et deux voitures de remorque, chaque voiture automotrice a quatre moteurs de 150 chevaux chacun. Les voitures sont construites avec des couloirs et des vestibules selon la pratique américaine. Les compartiments à moteur sont construits en matériaux incombustibles.

Voitures pour le Chicago Union Traction. . . [Page 174.]

Ce sont des voitures convertibles avec des sièges longitudinaux à chaque extrémité.

Système d'enregistrement des voitures à Brooklyn. . [Page 175.]

On enregistre sur les différentes divisions le temps qui s'écoule entre le passage des voitures à deux points différents. Cet enregisment se fait électriquement sur un disque mobile et lorsque les voitures passent aux points, l'inspecteur presse un nombre de boutons qui sont opérés comme des clefs de machine à écrire et agissent sur une aiguille qui perfore le disque. On emploie ce systèmes pour à rendre compte de la manière dont les voitures se conformente l'horaire.

Position des ingénieurs-voyers. . . . . [Page 176.]

Deux lettres discutent la question de savoir si les ingénieurs-voyers devraient organiser une association.

Voitures semi-convertibles pour Bloomington, Illinois. [Page 178.]

Cette voiture a environ 12 mètres de longueur totale.

Collecteur pour voitûres à phase unique. . . [Page 178.]

Cet appareil est manufacturé par une compagnie suisse et consiste d'une tige recourbée qui a sa face convexe en contact avec le fil de trolley. Le collecteur peut se mouvoir sur un angle de 180° de sorte que le fil à énergie peut être dans presque n'importe quelle position. On donne deux diagrammes qui montrent l'universalité d'application de ce collecteur.

Voitures semi-convertibles pour l'Indiana. . . [Page 179.]

Ces voitures ont douze mètres et demi de longueur totale.

Nouveau métropolitain pour Paris. . . . [Page 180.]

Cette nouvelle ligne projetée court du Nord au Sud et on vient d'accorder les concessions nécessaires à sa construction.

Cric à levier avec engrenage à cliquet. . . [Page 180.]

Ce cric peut se lever et s'abaisser et toutes ses parties sont facilement accessibles en enlevant le boîtier.

Numéro du 6 Février.

Articles de fond. . . . . [Page 189.]

Le premier article réfère aux changements dans l'organisation de la Public Service Corporation de New Jersey et commente sur la politique de la compagnie. L'article suivant a pour sujet les horaires à St. Louis où la pratique est entièrement différente de celle suivie dans aucune autre ville du pays. Pendant les heures les plus occupées le nombre des voitures en service comparé à celui des voitures pendant le reste du jour est 144 pour cent supérieur et en tout temps la vitesse moyenne est comparativement élevée. Le moteur à répulsion pour tramways fournit l'objet d'une critique des articles par MM. Slichter et Steinmetz publiés dans le numéro de cette semaine. Le rédacteur regrette que si peu de données puissent être fournies sur ce sujet important. Un autre article a pour sujet le chauffage des voitures et les difficultés que l'on éprouve à fournir un service satisfaisant. Le mouvement qui porte les agents-voyers à former un association est un autre sujet discuté et on commente sur la proposition d'obtenir l'opinion des hommes engagés dans ce service en vue de former cette organisation. Le dernier article traite du sujet de l'enlèvement de la neige et des blocades qui en résultent et décrit les difficultés que les lignes urbaines et interurbaines ont eu à surmonter les conditions extraordinaires qu'a produit la température extrême du mois dernier.

Réseau interurbain Conneaut & Erie. . . . [Page 192.]

Cette ligne a 56 km de longueur et forme l'anneau qui rend continue la chaine des tramways entre Buffalo, Toledo et Detroit. On donne la population au terminus et dans les villages traversés, La population moyenne par kilomètre de voie étant d'environ 2000 habitants. On a eu à construire plusieurs longs viaducs et ponts dont on donne des illustrations. Les chutes de neige sont très fortes dans cette région et la compagnie possède la charrue rotative à neige la plus grande, à l'exception d'une seule, qui soit aux Etats Unis. Elle a quatre essieux avec quatre moteurs G. E. 1000 sur les trucks et un moteur de 200 chevaux pour actionner les ailerons rotatifs. Les voitures ont des caissons de 13,73 m de longueur et pèsent seulement 9 tonnes car l'administration insiste pour avoir des voitures légères. Elles sont équipées chacune avec quatre moteurs. L'usine centrale contient deux générateurs de 400 kw qui ont un nombre de particularités spéciales, tandis que les machines se lubrifient automatiquement. Il y a aussi une auxiliaire pour 375 volts et 300 ampères. On n'emploie pas la transmission polyphasée. On donne des détails sur le dépôt des voitures.

Réseau des tramways électriques de Vienne. . [Page 201.]

Ce réseau est maintenant la propriété de la Municipalité, et, lorsque les lignes projetées à présent seront completées, il comprendra environ 350 km de voies. On se sert du système de trolley à arc, excepté dans le centre de la ville où l'on emploie le système à caniveau illustré au haut de la page 202. Les rails pèsent 50,61 kg par mètre. Lorsque la ligne a été ouverte à l'exploitation il y avait 895 voitures à deux essieux et 50 voitures à quatre essieux, et au commencement de 1904 la compagnie possédait 700 voitures de remorque. Les vitesses maxima permises sont de 15, 18 et 30 km à l'heure. Les voitures qui servent au trafic du centre de la ville sont pourvues de deux prises de courant, une de chaque côté, avec des ailerons pliants qui permettent de les descendre dans le caniveau. L'usine de force est en deux parties, l'une construite au début pour l'éclairage et l'autre pour le service des tramways, bien que les deux parties soient maintenant opérées en conjonction. Elles ont été construites en dix-neuf mois et demi. La consommation de charbon en Octobre 1902 a été de 1.117 kg par kw heure. Les machines dans la plus grande usine sont au nombre de cinq avec une force normale de 3400 chevaux et une force maxima de 4200 chevaux.; elles opèrent des alternateurs trois-phasés. On donne une table d'essais des machines. Avec du charbon à 18 kroner par tonne le coût de génération par kw heure était de 1,8 heller dans l'usine et de 2 heller dans la sous-station.

Nouveau sabot à troisième rail sur l'Elevé de Boston. [Page 204.]

Ce sabot diffère radicalement de tout autre sabot en usage sur les lignes à troisième rail et il a été adopté comme étalon sur l'Elevé de Boston. Il consiste en une barre d'acier doux de 584 mm x 88 mm x 13 mm, pesant environ 5 kgs. Cette barre qui est la partie employée pour opérer le contact avec le troisième rail est suspendue à chaque extrémité et est tenue abaissée par son propre poids et un léger ressort d'acier qui est construit de manière à produire une pression de haut en bas d'environ 23 kgs ce qui fait une pression totale d'environ 28 kg entre le sabot et le rail sans tenir compte du mouvement du sabot le long du rail. Lorsque la voiture se meut, cependant, elle tend à rehausser une extrémité du sabot et à presser l'autre extrémité sur le rail ce qui augmente le contact, suivant la direction dans laquelle va la voiture. Le sabot dure environ pendant 21.600 km. Une particularité du sabot est qu'il ne sursaute pas aux joints.

Système de freins à air à magasin à St. Louis. [Page 208.]

La St. Louis Transit Company a commandé 1500 équipements de freins à air du système à magasin. Dans ce système il y a deux réservoirs sur la voiture, contenant de l'air à une pression de 20 atmosphères, comme le montre la Fig. 1. Ces réservoirs communiquent au moyen d'une soupape de réduction avec un autre réservoir plus petit où la pression n'est que de trois atmosphères environ. Le reste de l'appareil de freinage est presque entièrement semblable à l'équipement des freins à air ordinaires. Les deux réservoirs d'emmagasinage sont chargés à des stations spéciales à comprimer l'air, qui sont situées une à chaque terminus et les autres à différents points le long de la ligne. Il y a aussi plusieurs stations portatives, qui consistent en appareils à comprimer montés sur des voitures, que l'on peut employer aux extrémités des lignes qui ne sont exploitées que l'été, dans les cas d'urgence et en lieu et place des stations fixes qui ont besoin de réparations. Les machines à comprimer l'air, dont on a commandé quarante, sont actionnées par l'électricité, et le moteur est mis en marche et arrêté par un appareil de contrôle automatique très ingénieux qui met le moteur en mouvement lorsque la pression de l'air dans le réservoir fixe descend au dessous d'un certain niveau, et arrête son fonctionnement lorsque la pression a atteint un maximum fixé d'avance. Cet appareil de mise en marche a été imaginé spécialement de manière à ce que les moteurs commencent à marcher sans changement, de sorte que cet appareil automatique est pratiquement indépendant du voltage. Cette disposition spéciale a une grande importance en vue du fait que les machines à comprimer sont placées aux extrémités de lignes, où le voltage est exposé à de fortes fluctuations.

Billets interurbains. Par P. H. White. . . [Page 211.]

Les billets employés sur la ligne de l'auteur sont semblables à ce que montre la gravure, un billet d'aller et un billet de retour étant imprimés ensemble. On les plie ensuite et on les relie en paires. Si un voyageur demande un billet d'aller, le receveur poinçonne le lieu de destination et le prix payé puis détache la moitié d'aller. Les trous de poinçon percent aussi le billet de retour qui est envoyé aux archives de l'auditeur. Si le voyageur demande un billet de retour, le receveur retourne son cahier de billets et poinçonne puis détache la moitié de retour de la même manière. Les moitiés qui son ainsi gardées, forment dans les archives de l'auditeur un enregistrement complet des billets vendus et des sommes perçues par eux.

Trucs d'atelier. Par G. S. Patterson. . . . [Page 212.]

La Fig. 1 montre un wagonnet à bras pour le transport des armatures dans l'atelier de réparation dont la particularité principale consiste en ce que les crochets qui supportent l'armature sont retenus au châssis par des clavettes mobiles. L'auteur décrit ensuite une méthode pour obtenir une usure égale sur les sabots de frein.

Machines à passer le charbon. Par F. V. Hetzel. . [Page 212.]

L'auteur prétend que quelques unes des particularités dans les machines à passer le charbon décrites par M. Little dans le numéro du 2 Janvier ne sont pas nouvelles. Il critique aussi l'arrangement pour passer le charbon employé dans l'une des usines décrites dans l'article dont il s'agit.

Compagnies des tramways comme administrant lours parcs. Par C. E. Flynn. . . . . [Page 213.]

L'auteur est de l'opinion que bien que les parcs soient désirables, il est préferable pour les compagnies de tramways de donner à bail leur exploitation plutôt que de les administrer elles-mêmes.

Caractéristiques de rapidité de démarrage du moteur à repulsion à phase unique. Par Walter I. Slichter. . . [Page 213.]

Cet article donne un sommaire des expériences faites par l'auteur sur divers types de moteurs commutateurs de courant alternatif, dans le but principal de développer le moteur à repulsion pour le service des tramways. Ce moteur a les mêmes caractéristiques que le moteur en séries à courant continu. Le facteur d'énergie au départ est faible ce qui est dû à la réactance ou circuits des moteurs, mais c'est avec le facteur d'énergie le plus bas que la force de démarrage maxima se produit. Plusieurs courbes accompagnent l'article; trois d'entre elles montrent les résultats d'essais conduits et la quatrième est établie en partie par des calculs. Les caractéristiques montrent que le moteur à répulsion est admirablement adapté par le travail d'accélération l'efficacité d'accélération étant plus forte que dans le travail à courant direct, ce qui est dû à la possibilité d'obtenir des forces électromotives fractionnelles avec des courants alternatifs après avoir introduit les pertes de résistance inerte du système de contrôle à courant continu. Il est aussi efficace pour marcher sous charges légères, et comme il y a de bonnes constantes aux petites vitesses ilest bien adapté pour le service des marchandises.

Le moteur de tramway à courant alternatif. Par Charles P. Steinmetz. . . . . [Page 215.]

Cet article traite de la théorie du moteur à répulsion et présente en détail les recherches expérimentales de Rudolph Eichemayer et autres qui ont de bonne heure fait des études sur le sujet. Le dessin du moteur qui s'est développé comme résultat de ces recherches est décrit par l'auteur avec les pas successifs qui ont conduit à l'adoption de sa forme présente.

Système de signaux électriques automatiques pour tramways. [Page 218.]

C'est un système de signaux électro-magnétiques dans lequel on emploie deux solénoïdes pour opérer le sémaphore. Lorsque la voiture entre sur un bloc elle produit un contact sur une plaque placée sur le fil de trolley. Ce contact ferme un circuit qui opère le solénoïde principal. Le solénoide qui reçoit l'énergie soulève le sémaphore qui est retenu en place par un ressort. Lorsque la voiture atteint l'autre extrémité du bloc, un autre contact est établi par une seconde plaque et le courant vient fournir de l'énergie au seconde solénoide. Celui-ci relache le ressort qui tient le sémaphore, ce qui laisse retoucher ce dernier à la position de ligne ouverte.

Chaudières tubulaires dans les usines de tramways anglaises. [Page 219.]

C'est la description des détails de construction d'une chaudière tubulaire qui a été beaucoup employée dans la Grande Bretagne. La chaudière a trois tambours de dessus et deux tambours de fond qui communiquent par quatre rangées de tubes renouvelables. Les tambours supérieurs sont supportés par un cadre de traverses et comme les tambours du fond sont construits tout à fait au bout ils sont libres de se déplacer avec la dilatation ou la contraction des tubes. Les trois tambours à vapeur communiquent tous au dessus du niveau de l'eau. Les tubes principaux sont droits sur la plus grande partie de leur longueur mais se recourbent légèrement l'un vers l'autre de manière à pouvoir pénétrer dans le tambour en rayonnant. Chaque tube a une ouverture libre aux tombours à chaque extrémité de sorte que toute la vapeur produite a la surface complète du tube pour son passage au réservoir de vapeur et n'est pas confinée en des têtes étroites.

Un couteau à verglas efficace. . . . . . [Page 219.]

Les illustrations montrent un couteau à verglas fait en fonte malléable dont la tige est boulonnée dans la fourche de trolley. La partie qui assure le contact est en cuivre assez doux pour supporter elle-même la plus grosse partie de l'usure, ce qui économise d'autant le fil de trolley. Lorsque cette partie est usée on peut facilement la changer.

Téléphones pour tramways. . . . . . . [Page 222.]

Les illustrations et la description ont trait à des téléphones pour le service des tramways. On montre deux types différents: l'un est un téléphone à boîte de fer destiné à être fixé aux poteaux le long de la ligne et l'autre est un téléphone de voiture portatif enfermé dans une boîte en bois avec une courroie comme poignée. Cet instrument est pourvu d'une longue corde à l'extrémité de laquelle est attachée une cheville qu'on peut insérer dans les boîtes auxiliaires. Ces boites auxiliaires peuvent être installées sur les poteaux le long de la ligne et on obtient la communication avec le bureau principal en insérant la cheville dans ces boîtes. La corde est assez longue pour permettre au wattman de laisser l'instrument dans la voiture.

Sablier à voie pneumatique. . . . . . . [Page 222.]

L'illustration montre un sablier qui a une étagère pour empêcher le sable de se tasser au fond de la boîte.

Voitures pour la nouvelle ligne Coeur d'Alène-Spokane. [Seite 223.]

Les illustrations et la description ont trait à deux types de voitures interurbaines semi-convertibles, l'un pour le service des voyageurs seulement et l'autre pour le service mixte des voyageurs et des bagages. Les voitures de voyageurs qui ont 38 places assises, ont des portes jumelles à une extrémité et une porte simple à l'autre extrémité de manière à fournir de la place pour un cabinet de toilette.

La machine à gaz Nurnberg. . . . . . [Page 224.]

On annonce que des arrangements ont été faits pour la construction, dans ce pays-ci, de machines à gaz Nurnberg qui auront de 130 à 6000 chevaux de freinage. L'article donne quelques détails sur les particularités spéciales de ces machines.

SMITHSONIAN INSTITUTION LIBRARIES
3 9088 01629 1908